# *DRAFT FINAL*
# DETAILED PROJECT REPORT

## *SAIPAN LAGOON*
## *AQUATIC ECOSYSTEM RESTORATION STUDY*
*Contract No. DACA83-01-D-0014-0002*

*Prepared For:*

U.S. Army Corps of Engineers
Honolulu Engineering District

*Prepared By:*

Environet, Inc.

September 2013

United States Army Corps of Engineers
Honolulu Engineering District
Environmental Engineering

# Draft Final
# Detailed Project Report

## Aquatic Ecosystem Restoration Study
at
## Saipan Lagoon
## Saipan, Commonwealth of Northern Mariana Islands

Prepared for: U.S. Army Corps of Engineers, Honolulu Engineering District

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September 2013

# TABLE OF CONTENTS

## LIST OF TABLES

## LIST OF FIGURES

## APPENDICES

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# EXECUTIVE SUMMARY

The Saipan Lagoon Aquatic Ecosystem Restoration Study is being conducted under the United States Army Corps of Engineers (USACE) Continuing Authorities Program authorized in Section 206 of the Water Resources Development Act of 1986. The cost sharing project proponent, the Commonwealth of the Northern Mariana Islands (CNMI) Coastal Resources Management Office (CRMO) is responsible for providing 35% of the project cost. The statutory limit for Federal participation under Section 206 authority is five million dollars.

The purpose of this study is to identify and evaluate engineering solutions to restore the degraded lagoon aquatic habitat. A number of environmental/biological investigations and studies were conducted in order to adequately establish baseline environmental conditions within the lagoon and to assess the effectiveness of future remedial measures to be implemented in the watershed. The results of these studies indicate that inner lagoon habitats are affected by increased sediment and nutrient load entering the lagoon via stormwater runoff within the study area. Increased sediment and nutrient load has led to a shift in macroalgae-dominant marine system where less seagrass and coral species are able to thrive in. Seagrass and coral reef systems provide habitats for numerous species of fish and invertebrates that compose a healthy marine ecosystem. Urbanization of the inland watershed area that has occurred over the past twenty years has dramatically increased the amount of sediment, nutrient, and contaminants discharged into Saipan Lagoon via stormwater runoff. The probable future increase in urbanization of this area would likely further degrade and have a deleterious impact on the aquatic ecosystem structure of the lagoon.

Detention basins were considered at three locations: near the China House restaurant between Middle Road, across from the Pizza Hut building, and Beach Road (China House site); at the northwestern corner of the intersection of Quartermaster Road and Middle Road (Quartermaster site); and at a site on Middle Road approximately 200 feet north of Commonwealth Road (Cock Fight Arena site) to address the overall project objective of reducing sediment and nutrient loads entering the lagoon. The proposed detention basins are expected to capture runoff from areas located inland or upslope from the sites, allowing sediment and contaminants to settle out, and then discharge the stormwater to the lagoon in a more controlled manner via underground piping. The detention basins would significantly alleviate flooding along Beach Road as well as capture the large volumes of fast-moving sheet flow prior to it reaching or crossing Beach Road, and thereby significantly reduce the transfer of nutrients, sediment, and pollutants associated with the upper watershed from being washed into Saipan Lagoon.

Based on the assumptions that any or all of the three sites could be developed concurrently, at the no-build, two-year, five-year, or 10-year storm design level, 64 different plan combinations were evaluated based on their cost and expected level of benefits. Following an evaluation of all combinations, based on project cost and expected output, CRMO selected a single two-year design level detention basin at the Cock Fight Arena site with an estimated total project cost of $8,451,000. The selected plan will restore an estimated 70.3 acres of lagoon habitat.

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# LIST OF ACRONYMS

| | |
|---|---|
| % | percent |
| °F | degrees Fahrenheit |
| ac-ft | acre-foot |
| APC | Area of Particular Concern |
| ATR | Agency Technical Review |
| BMP | best management practice |
| CE | cost effectiveness |
| CEQ | Council of Environmental Quality |
| CFR | Code of Federal Regulations |
| CNMI | Commonwealth of the Northern Mariana Islands |
| CRMO | CNMI Coastal Resources Management Office |
| CWA | Clean Water Act |
| DEQ | CNMI Division of Environmental Quality |
| DFW | CNMI Division of Fish and Wildlife |
| DO | dissolved oxygen |
| DLNR | CNMI Department of Lands and Natural Resources |
| DPR | Detailed Project Report |
| DPW | CNMI Department of Public Works |
| DQC | District Quality Control |
| EA | Environmental Assessment |
| EPA | Environmental Protection Agency, United States |
| $ft^2$ | square feet |
| GM | geometric mean |
| gpm | gallons per minute |
| ICA | incremental cost analysis |
| IWR | USACE Institute for Water Resources |
| LERRD | land, easements, rights-of-way, relocation, and disposal areas |
| LGHU | lagoon habitat unit |
| m | meter |
| $m^2$ | square meters |
| MMT | CNMI Marine Monitoring Team |
| mg/kg | milligrams per kilogram |
| msl | mean sea level |
| NOAA | National Oceanic and Atmospheric Administration |
| NPDES | National Pollutant Discharge Elimination System |
| PAH | polycyclic aromatic hydrocarbon |
| PCA | potentially contaminating activity |
| PCB | polychlorinated biphenyl |
| PDT | Project Delivery Team |
| pH | hydrogen activity |
| RCP | reinforced concrete pipe |
| RSL | regional screening level |
| SSM | single sample maximum |
| SSO | sanitary sewer overflow |

| | |
|---|---|
| TMDL | total maximum daily load |
| TPCS | Total Project Cost Summary |
| TTPI | Trust Territory of the Pacific Islands |
| US | United States |
| USACE | United States Army Corps of Engineers |
| USGS | United States Geological Survey |
| VOC | volatile organic compound |
| WERI | Water and Environmental Research Institute of the Western Pacific |
| WRC | Water Resources Council |
| WWI | World War I |
| WWII | World War II |

# 1. INTRODUCTION

This Detailed Project Report (DPR) has been prepared for Saipan Lagoon, Saipan, Commonwealth of the Northern Mariana Islands (CNMI). This report includes an assessment of the lagoon based on the compilation of data derived from field studies conducted during the Phase I and II of the Saipan Lagoon Aquatic Ecosystem Restoration Study, ongoing local authority lagoon studies, and review of historical records. An Environmental Assessment (EA) prepared concurrently with this report (Appendix A) includes a detailed analysis of the potential environmental impacts of the preferred alternative selected in this DPR.

## 1.1 STUDY PURPOSE

A combination of increasing population and urbanization of the West Takpochao watershed over the past 70 years has led to degradation of the aquatic ecosystem that makes up Saipan Lagoon. Indicators of this degradation include changes in the density, distribution, and composition of seagrass communities in nearshore waters; high abundance of seasonal macro-algal growth; decrease in nearshore lagoon fish; degraded lagoon corals; and increased frequency of water quality standard violations in nearshore recreational waters. Increased sediment and nutrient load has led to a shift in macroalgae-dominant marine system where less seagrass and coral species are able to thrive in. Seagrass and coral reef systems provide habitats for numerous species of fish and invertebrates that compose a healthy marine ecosystem. The probable future increase in urbanization of this area would likely further degrade and have a deleterious impact on the aquatic ecosystem structure of the lagoon.

Recent manifestations of lagoon degradation are of concern not only because of the deterioration of natural resources supported by the lagoon, but also because degradation has progressed to the point that the aesthetic and recreational utility of the lagoon has been negatively impacted. This is of substantial concern considering that the lagoon is a vital component of the tourism industry that accounts for the majority of the local economy in Saipan.

Indicators of degradation will be discussed in detail in the following sections, together with the desired outcomes of future restoration activities, and the best possible restoration alternative for the study area. The purpose of this study is to: (1) determine current environmental baseline conditions of Saipan Lagoon, (2) to develop restoration alternatives, and (3) to select an environmentally sensitive and economically feasible restoration alternative that would best restore the degraded aquatic ecosystem structure, function, and dynamic processes to a less degraded and more natural condition.

## 1.2 STUDY AUTHORIZATION

The Saipan Lagoon Aquatic Ecosystem Restoration Study is being conducted under the United States (US) Army Corps of Engineers’ (USACE) Continuing Authorities Program authorized in Section 206 of the Water Resources Development Act of 1996. Under this program, the USACE is responsible for 65 percent (%) of the total project cost (planning, design, and construction). As the cost sharing project proponent, the CNMI is responsible for providing 35% of the project cost. The statutory limit for Federal participation under Section 206 authority is five million dollars. In addition to its cost sharing obligation, the CNMI is responsible for providing all land, easements, rights-of-way, relocation, and disposal areas (LEERD) required for project implementation, and operation and maintenance of the completed project. The CNMI may receive credit towards its share of project cost for the value of the LEERD required for the project. Additionally, the CNMI will receive a $200,000 cost sharing waiver for planning and design/construction as allowed by Section 1156 of the Water Resources Development Act of 1986.

## 1.3 STUDY SPONSER

The CNMI Coastal Resources Management Office (CRMO) is the local study sponsor (proponent) and represents the CNMI Government's interest on the Project Delivery Team (PDT).

## 1.4 LOCAL REGULATORY AUTHORITY

The CNMI has promulgated a number of regulations over the past 15 years to protect the environment. Basic environmental rights can be found in the CNMI constitution that states in Article I, Section 9, that each person has the right to a clean and healthful public environment. The CNMI Division of Environmental Quality (DEQ) was formed "to develop and administer programs, including, where appropriate, a system of standards, permits, or prohibitions, to prevent or regulate activities concerning the discharge of pollutants to the air, land, water, wetlands, and submerged lands." The DEQ has set forth regulations governing earthmoving activities in order to prevent soil erosion and to minimize pollution of marine, surface or groundwater resources. Although the National Pollutant Discharge Elimination System (NPDES) program has not been delegated to the CNMI, DEQ issues Section 401 Water Quality Certifications to any project that may affect water quality. Section 401 Water Quality Certifications are issued for all projects involving discharges, dredging, or any activity involving wetlands. This CNMI permitting process is closely linked to the USACE Section 404 permitting program.

The CRMO Program was developed to manage all activities within areas designated as Areas of Particular Concern (APCs), including the shoreline (extending to 150 feet inland), lagoon and reefs, wetlands, and industrial areas surrounding seaports. The Coastal Resources Management Act (outlined in CNMI Public Law 3-47) was established to coordinate island development management and specifies policies and rules that regulate activities with the potential to affect the Saipan's resources. These resources are broadly defined in the Coastal Resources Management Act and include marine water and associated resources, groundwater, wetlands, watersheds, and certain designated APCs. Prior to the initiation of any large development in the CNMI, the developer must obtain a CRMO major siting permit. The CRMO permitting process provides all of the appropriate government agencies an opportunity to inform the developer of the various permitting requirements and general areas of concern for the proposed project. CRMO also has an active monitoring and enforcement section that is responsible for monitoring activities within the APCs.

Any open discharges into waters or wetlands require a NPDES Permit from the US Environmental Protection Agency (EPA) Region 9 Office located in San Francisco, California. For example, the CNMI government holds NPDES permits for the discharge of treated sewage into two locations offshore of Saipan. NPDES permits generally require extensive monitoring and reporting, and a DEQ Water Quality Certification must also be obtained.

The CNMI Marine Monitoring Team (MMT) consists of members from the DEQ, CRMO, and the CNMI Division of Fish and Wildlife (DFW). This interagency MMT was initially established in 1997 to aid in understanding the current conditions of coral reefs and coral reef resources in the CNMI. The first State of the Reef Reports prepared by DEQ for Saipan and Rota Island (Houk, 1999 and 2000) document the baseline conditions of the reef and marine ecosystems, and are used for future assessments and regional management recommendations. It is the goal of the MMT to continue this long-term monitoring program to continually assess reefs and aquatic resources of the CNMI.

## 1.5 ONGOING AND PRIOR STUDIES, REPORTS, PROJECTS

A number of environmental/biological investigations and studies have been conducted, or are ongoing, on Saipan in the general vicinity of Saipan Lagoon and are detailed in this study's Phase I Report (Appendix B). A review of these studies identified a number of additional studies needed to adequately establish baseline environmental conditions within the lagoon. These additional studies included the following and were conducted in order to fill the data gaps for the study area so that the effectiveness of future remedial measures to be implemented in the watershed and/or the lagoon can be accurately evaluated:

- stormwater quality investigation;
- lagoon sediment physical and chemical parameter characterization;
- historical assessment of lagoon from aerial photographs;
- inshore lagoon seagrass and associated fauna survey;
- inventory of potentially contaminating activities (PCAs) in the watershed;
- groundwater investigation;
- hydrologic study of runoff processes in the watershed;
- sediment delta surveys; and
- lagoon water quality investigation.

The results of these baseline monitoring studies are included in Appendix C and summarized in Section 4 of this report.

DEQ and the MMT have initiated two large-scale bio-criteria monitoring programs. Both of these are very different from EPA funded bio-criteria monitoring programs in the US mainland. Tropical marine systems are much more dynamic and harbor very different organisms than terrestrial fresh water systems or even marine water systems in cold environments. Bio-criteria programs set forth in the US mainland fail to provide useful techniques for application in the CNMI. The first monitoring effort is the Saipan Lagoon Monitoring Program (DEQ and CRMO only), and the other is the CNMI Nearshore Reef Monitoring Program (DEQ, CRMO, and DFW). The goal of these programs is to gather continuous data from marine systems that are affected by water quality concerns (e.g., watershed drainages, sewage pump failures and outfalls, and other sources of point and nonpoint source pollution). Currently, the Saipan Lagoon monitoring effort has completed an inventory of one region of the lagoon: the study area (extending from Quartermaster Road to Garapan Fishing Base).

DEQ has also recently completed a Section 305(b) Water Quality Assessment Report for the CNMI (DEQ, 2010). This report was written following guidance detailed in Section 305(b) of the Clean Water Act (CWA) and allowed determination of the following issues: (1) whether US waters meet water quality standards, (2) the progress made in maintaining and restoring water quality, and (3) the extent of remaining problems in the CNMI. On shore, the Safe Drinking Water program began implementing the volatile organic compound (VOC) monitoring requirement, as outlined in the CNMI Drinking Water Regulations in January 2000. Public water systems within the CNMI will be required to perform VOC testing in order to come into compliance with these regulations.

# 2. STUDY AREA DESCRIPTION

This section provides a description of the study area location as well as site history, including a historical comparison of population growth in the study area. A more detailed description of characteristics and components of the study area is included in the Phase I Report (Appendix B).

## 2.1 STUDY AREA LOCATION

The study area encompasses the southern portion of the West Takpochao watershed and extends from Quartermaster Road to the northern boundary of the Hafa Adai Hotel in the village of Garapan (Figure 1). The study area includes the entire inland watershed that contributes groundwater and surface water runoff to the approximately two-mile length of shoreline, as well as the adjacent offshore lagoon area extending out approximately 0.3 miles.

## 2.2 STUDY AREA DESCRIPTION

The shoreline within the study area consists of a narrow sand beach. The beach mainly consists of loose limesand with some gravel, shell, and coral rubble, over calcareous gravel and beach rock. These sediments are primarily medium to coarse-grained and well-sorted. The beach is topped at the high water mark by a strip of grasses, vines, and trees, followed by a concrete pedestrian pathway further inland. The 2.8-mile, concrete pedestrian walking pathway meanders between the narrow sandy shoreline and Beach Road. Picnic facilities, numerous trees, vehicle turnout areas, a memorial to fishermen lost at sea (13 Fishermen Monument), a Japanese tank monument, and concrete defensive bunkers built by the Japanese during World War II (WWII) are also found along this section of shoreline. The northern boundary of the study area contains an earthen pier that was built by the Japanese during their occupation during WWII on the island. A dilapidated barge that was formerly used as a restaurant rests firmly aground just to the south of this earthen pier. The southern boundary of the study area is where Quartermaster Road intersects with Beach Road. The area to the east of Beach Road contains numerous businesses built on private land, including restaurants, hardware and stationary stores, car lots, and several strip malls.

Beach Road is a two lane, undivided, signaled, asphalt highway that was improved by the US military following WWII, but was not completely paved along its length until about 1985. Middle Road runs parallel to and about a half-mile inland of Beach Road, and was improved to a paved, four-lane, undivided, signaled asphalt highway in about 1990. Two paved roads link these two highways, Island Power Road to the north and Quartermaster Road at the southern boundary of the study area. A number of coral gravel surface roads leading to small commercial and residential buildings are present within the study area. The slope of the land becomes steeper above Middle Road and the watershed is broken into a series of irregular hills and valleys containing intermittent streams.

The Coastal Resources Management Commission has delineated 11 major watersheds on Saipan. The study area is located within the West Takpochao watershed (Figure 2). This watershed extends along the shoreline from about 500 feet south of Quartermaster Road to the area just north of Charlie Dock at Tanapag Harbor. The watershed extends inland to the ridgeline that runs up to Mount Takpochao and continues on through the Capitol Hill area.

The coastal areas of the study area are vegetated with ironwood (*Casuarina equisetifolia*), sea hibiscus (*Hibiscus tiliaceus*) and a number of ornamental trees with an understory dominated by grasses and seaside morning glory (*Ipomoea pescaprae*). The inland portions of the study area are either paved or overgrown by scrub vegetation dominated by tangantangan (*Leucaena leucocephala*), ivy gourd (*Coccinia grandis*), and occasional ironwood and coconut trees.

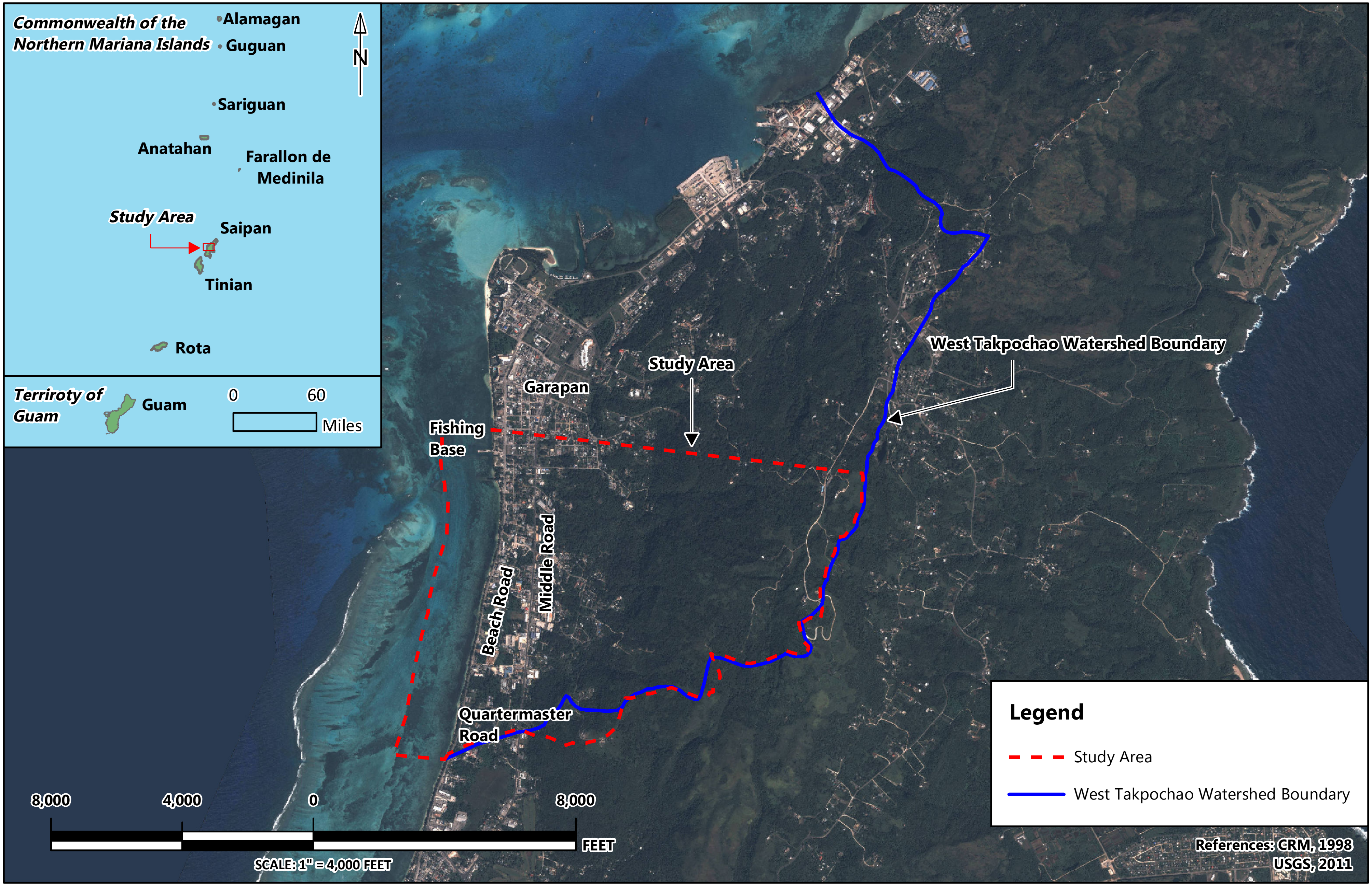
### 2.2.1 Climate

The climate in Saipan is warm and humid throughout the year and is classified as tropical marine, with an average temperature between 75 to 80 degrees Fahrenheit (°F) (Van der Brug, 1985). The humidity levels are very high, with monthly averages ranging from 79 to 86%. Typically, July to November have the highest humidity. Rainfall in the study area is seasonal and averages about 75 to 80 inches per year. The wet season usually extends from July through November, followed by a dry season from December through June. Saipan experienced drought-like conditions during 1998, when the rainfall between January and November totaled roughly 41 inches, or approximately half the annual mean. Based on data collected from the weather station at Saipan International Airport from years 2007 through 2011 (Table 1), monthly average temperatures range from 79 to 83 °F. Monthly average relative humidity at the same station from 2007 to 2011 range from 77 to 84%. The average yearly total precipitation for years 2007 through 2011 is 73.8 inches per year.

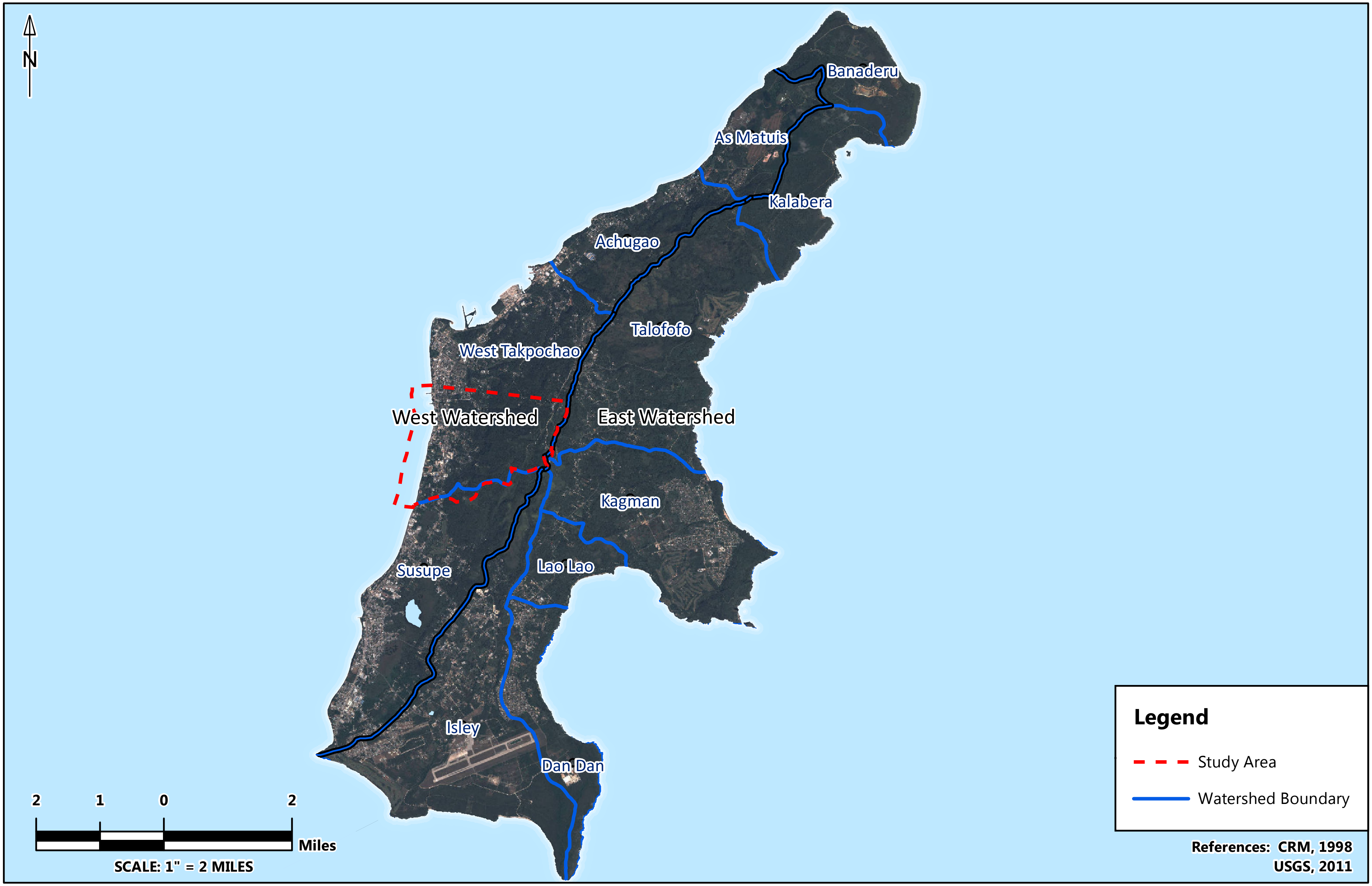
**Table 1: Summary of Weather Data at Saipan International Airport**

| **Monthly Averages for Years 2007 through 2011** | | | |
|---|---|---|---|
| **Month** | **Temperature (°F)** | **Relative Humidity (%)** | **Precipitation (inches)** |
| January | 80 | 77 | 4.2 |
| February | 79 | 77 | 2.8 |
| March | 79 | 78 | 3.0 |
| April | 81 | 79 | 3.3 |
| May | 83 | 77 | 5.6 |
| June | 83 | 77 | 5.4 |
| July | 82 | 82 | 7.0 |
| August | 81 | 84 | 11.4 |
| September | 81 | 84 | 9.4 |
| October | 81 | 84 | 12.9 |
| November | 81 | 81 | 5.3 |
| December | 81 | 78 | 3.5 |
| **Yearly Average** | **81** | **80** | **73.8** |

Source: University of Utah, 2012



|  |  |  |  |
|---|---|---|---|
| Environet, Inc. | PROJECT NO.: 1057 | ECOSYSTEM RESTORATION REPORT<br>SAIPAN LAGOON AQUATIC ECOSYSTEM RESTORATION STUDY | FIGURE<br>1 |
|  | DATE: SEPTEMBER 20, 2012 |  |  |
|  | DRAWN BY: CB | GENERAL STUDY AREA<br>SAIPAN, CNMI |  |
|  | REVIEWED BY: MA |  |  |



References: CRM, 1998
USGS, 2011

Environet, Inc.

PROJECT NO.: 1057
DATE: SEPTEMBER 20, 2012
DRAWN BY: CB
REVIEWED BY: MA

ECOSYSTEM RESTORATION REPORT
SAIPAN LAGOON AQUATIC ECOSYSTEM RESTORATION STUDY

WATERSHED MAP OF SAIPAN
SAIPAN, CNMI

FIGURE
2

The CNMI are dominated by tradewinds, which blow from the east or northeast. These winds are the strongest and most constant during the dry season, when wind speeds of 15 to 25 miles per hour are common. The CNMI is situated some 600 miles east of an area in the western Pacific which is the breeding ground of cyclonic disturbances. As a result, the CNMI is in typhoon condition four (i.e., 40 mile per hour winds are possible within 72 hours) at all times. These cyclonic disturbances can develop quickly and sometimes unexpectedly into typhoon force winds of 120 miles per hour or greater.

During the rainy season, the tradewinds often cease, and on some days, the weather may be dominated by westerly moving storm systems that bring heavy showers or steady, and at times, torrential rains. These episodic, heavy rainfall events contribute the majority of the sediment and surface water runoff that reaches the nearshore lagoon environment.

Table 2 shows storm frequency intensities calculated from data collected from a National Oceanic and Atmospheric Administration (NOAA) rain gauge station located at the Saipan International Airport from the years 1979 through 2001 (Environet, 2003). Other rain gauges maintained by the United States Geological Survey (USGS) as well as NOAA are located in various places around the island, but the airport station has recorded the most comprehensive data since 1979. Data quality for recent years is poor due to missing data, uncertainty of values, erroneous data, and other factors (NOAA, 2011).

**Table 2: Average Storm Frequencies and Intensities at Saipan International Airport**

| **Storm Frequency** | **Rainfall** (inches per 24-hour period) | **Rainfall** (inches per hour) |
|---|---|---|
| 100-year event | 16.80 | 4.48 |
| 50-year event | 14.87 | 4.06 |
| 25-year event | 12.94 | 3.64 |
| 10-year event | 10.33 | 3.06 |
| 5-year event | 8.26 | 2.61 |
| 2-year event | 5.14 | 1.93 |

Table 2 does not include two large rainfall events, Super Typhoon Kim in 1986 and Typhoon Lynn in 1987. In addition, since the gauge station is located on the southern part of the island, rainfall recorded at this station most likely varies from rainfall in the actual study area. However, this data does provide baseline conditions for the intensity and frequency of rainfall events in the study area.

### 2.2.2 Topography and Soil

The study area is situated in the western central part of the island of Saipan. The study area potentially receives runoff and sediments from the southern half of the West Takpochao watershed, which extends roughly two miles inland to the limestone ridge that peaks at 1,540 feet above mean sea level (msl) on the summit of Mount Takpochao. The area between the shoreline and Middle Road is a slightly to moderately sloping coastal plain composed of unconsolidated limestone-derived sediments. The area inland of Middle Road possesses the characteristic geomorphology of the island of Saipan with slightly to moderately sloping topographic plateaus separated by seaward-facing scarps of emergent limestone (Cloud et al., 1956).

The characteristics of the surface soils generally vary moving inland from the shoreline to the upland areas of the watershed. The lowland areas that extend from the shoreline to just inland of Middle Road are dominated by soils of the Chinen-Urban Land Map Unit (Young, 1989). These soils are composed of clay loam and are highly porous, accounting for the lack of natural streambeds or continuous drainage ways across the lowland areas. During the Japanese and German occupations, much of these lands were in intensive agricultural use. The areas upland of Middle Road in the vicinity of Gualo Rai are covered by soils of the Kagman-Saipan Map Unit (thick, brown clay) while further inland the land area is dominated by the Takpochao-Chinen-Rock Outcrop Map Unit (limestone and alluvial clay wash). The Chinen-Urban Land complex (clay loam soils) in the lowlands between Middle Road and Beach Road is the soil unit most prone to erosion in the area. However, the largest percentage of the sedimentation that occurs along the Beach Road drainages appears to come from quarried, crushed limestone backfill used for road and lot surfacing, rather than from erosion of the underlying native and disturbed soils. Extensive backfill was first used in this area during post-WW II American military construction activities. Saipan was quickly transformed into a major military installation, to be used as a logistical and training base for subsequent invasions of Iwo Jima, Okinawa, and Japan. The scale of the construction was massive and few portions of the island were left untouched (Butler and De Fant, 1991).

### 2.2.3 Erosion

Sediment transport to lowland areas occurs naturally in all island systems. In the study area, the amount of sediments being transported to the lagoon environment has increased in conjunction with the spreading urbanization of the lowland areas within the watershed. The increased number of roofs, roads, and other paved areas impervious to rain increases the amount of runoff and tends to channel the runoff between properties. Construction activities and clearing of the natural vegetation tend to disturb and expose the natural soils, rendering them more susceptible to sheet and rill erosion. A reduction in natural vegetation due to increased urbanization also limits the infiltration capacity of the substrate and exacerbates runoff and erosion capacities.

The Soil Conservation Service estimated erosion rates for Saipan soils present in the Kagman Watershed on the eastern side of the island. The average erosion rate from the forested upper watershed is estimated to be about three tons per acre per year while areas under construction may exceed rates of 20 tons per acre per year. The developed homestead area in Kagman, which is situated on a relatively flat limestone plateau, yields between two to five tons of soil per acre per year. Erosion rates for the soils present within the study area are not currently available. However, observations made during the 2011 reconnaissance field visit of eroded gravel roads, obvious sedimentation in storm drain gullies, and occasional lapses in implementation of best management practice (BMP) regulations at construction sites suggest that erosion rates may be high. An attempt to evaluate sedimentation rates within the study area was undertaken by studying deltaic deposits along the shoreline. Results of this study are discussed in detail in Appendix C.7.

### 2.2.4 Regional Geology and Hydrogeology

The island of Saipan, along with the other islands of the Mariana chain, is situated in a double-arc, convergent plate margin setting. Parts of the arc are still volcanically active, especially to the north of Saipan. Large-magnitude, deep-focus earthquakes, and volcanism are still common throughout the northern portion of the Mariana Islands (Meijer et al., 1982). Karig (1971) proposed a tectonic model for the evolution of this region in which volcanic arcs were rifted to produce remnant arcs, frontal arcs, active arcs, and interarc basins. The proto-arc system developed as a volcanic arc upon oceanic or interarc basin crust in late-Eocene to mid-Oligocene time. Part of the arc was rifted to produce the Palau-Kyushu Ridge remnant arc, the South Honshu Ridge active arc, and the Parace Vela and Shikoku interarc basins in the mid-Oligocene to late-Miocene Period. The southern portion of the South Honshu Ridge was, in turn, rifted in late Miocene time to produce the West Mariana Ridge remnant arc, the Mariana frontal arc, the Mariana active arc, and the Mariana Trough interarc basin. The island of Saipan is currently located within the Mariana frontal arc while the islands to the north are located in the Mariana active arc.

The island-arc volcanism that created the volcanic base of the islands of the Marianas chain was characterized by pyroclastic eruptions of andesitic and dacitic composition. The majority of the volcanic material exposed sub-aerially on Saipan was erupted in a submarine environment as the juvenile arc volcano steadily rose above the ocean floor. These basement volcanic rocks were placed into four formations by Cloud et al. (1956). Three of the four volcanogenic formations (Sankakuyama, Hagman, and Densinyama) comprise the “basement” rock encountered on Saipan. The Fina Sisu formation volcanics were placed in the middle of the stratigraphic section above the Matansa limestone unit. The Sankakuyama, Hagman, and Densinyama Formations were assigned a mid- to late-Eocene age by Cloud et al. (1956). This age assignment has been confirmed by subsequent K-Ar (potassium-argon) age dating conducted on lava units within these formations, yielding dates from 35.7 to 41.4 million years before present (Meijer et al., 1982). The Fina Sisu formation was assigned a late Oligocene age by Cloud et al. (1956) based on a study of the microfossils present in the marine tuff units of this formation. However, Meijer et al. (1982) determined a mid-Miocene age (12.9 million years) for this formation by dating an andesite lava flow exposed in a tunnel located along As Perdido Road. This younger age is consistent with a revised fossil age determination for the Fina Sisu formation that was previously reported.

Saipan has undergone significant tectonic uplift as a result of the flexure of the underlying outer edge of the Philippine Plate in response to subduction of the Pacific Plate to the east of Saipan along the Marianas trench. Subsequent sub-aerial exposure of the volcanic basement rock led to erosion and reworking of the original volcanic material to produce clastic sediments, which have become cemented to form sandstones, conglomerates, and breccias of low porosity. Tectonic uplift of the island has also exposed thick, fringing limestone units that at elevations of up to 1,540 feet above msl on the summit of Mount Tagpochau. Thus, the island consists of an andesitic-dacitic volcanic core overlain by sandstones, conglomerates, and breccias, which are, in turn, capped by limestones. At present, more than 90% of the surface of the island is currently mantled with these limestone formations and alluvium derived from the erosion of these units. The characteristic geomorphology of Saipan (i.e., flat to slightly sloping topographic plateaus separated by seaward-facing scarps) has been produced by episodic, upward faulting related to the ongoing subduction process to the east of the island.

The study area is predominately underlain by the Mariana limestone unit. This limestone unit is composed mostly of finely to coarsely fragmented, commonly coralliferous, algal, and, in part, clayey limestone (Cloud et al., 1956). The Mariana limestone typically is white to gray colored, moderately to cavernously porous, and non-bedded to indistinctly bedded. In the coastal portions of the study area, the land surface is typically covered by recent alluvium derived from erosion of the upland limestone areas.

Residents of the island of Saipan are almost entirely dependent on groundwater as a drinking water source. Historically, limited amounts of generally brackish water have been exploited by dug wells along the coastal portion of the watershed. Potable water is extracted from deep wells (the Gualo Rai well field) located in the more inland portions of the watershed.

Groundwater in the western portion of Saipan occurs as an unconfined fresh to brackish water lens that overlies saltwater. The top of the aquifer is thus bounded by the water table surface. Groundwater flows at a moderate gradient towards the ocean, becoming more brackish near the ocean. The base of the aquifer in the inland portions of the watershed is the westward plunging contact between volcanic basement and overlying coraline deposits. The depth to the volcanic basement in the coastal portions of the study area is unknown. The regional aquifer at the study area is made up of the coral and coral-derived material of the Marianas Formation. Due to the high permeability of this limestone unit, the water levels within this aquifer fluctuate with ocean tides (USGS, 2003).

The hydraulic conductivity of the Mariana Limestone, estimated from data collected at test wells drilled into Marianas units in the Kagman area, ranges from 290 to 2,500 feet per day. The calculated transmissivity values for the Mariana Limestone ranged from 7,600 to 62,000 square feet ($ft^2$) per day. The storage coefficient of the limestone, determined at one test well location in Kagman, is 0.06 to 0.11; the vertical conductivity at this location was estimated to be 0.1 feet per day (Hoffman et al., 1998).

### 2.2.5 Coral Reef and Lagoon Habitat

A healthy lagoon environment should have low abundances of seasonal macroalgae, and high abundances of sand and coral, with some nearshore seagrass beds. Inner lagoon habitats have the greatest amount of seasonal macroalgae due to their proximity to nutrient rich surface runoff from land. Outer lagoon and back reef habitats have the highest water quality and water movement, and are the most biologically diverse areas as a result.

The Saipan Lagoon nearshore environment is generally composed of a sand and sand/silt/rubble substrate covered by thick stands of seagrass and macroalgae with occasional coral colonies or limestone outcrops. Heavy input of freshwater (groundwater and surface water runoff) into the nearshore environment is conducive to dense beds of large bladed, tall (up to five feet) seagrass

(*Enhalus acoroides*) that are found in a 10 to 50 meter (m)-wide band along the shoreline. Freshwater and entrained nutrients are known to enhance the growth of *Enhalus*, but excessive nutrients are believed to promote abundant macro-algal growth that can have a negative impact on corals and the function of the marine ecosystem (Houk and Camacho, 2010; Houk and Van Woesik, 2008). Intermixed between stands of *Enhalus* and extending further out into the lagoon, often to the back reef, is the very common short seagrass *Halodule uninervis*, which covers 20 to 70% of the benthic substrate in the lagoon between the *Enhalus* beds and the coral reef. Macroalgal abundance tends to increase from reef to shore with *Halimeda*, *Padina*, *Caulerpa*, *Laurencia*, *Acanthophora*, and *Dictyota* included among the most common genera. In areas of high nutrient influx such as the northern end of the study area near Garapan, two types of rapidly growing, hair-like macroalgae, *Enteromorpha* and *Cladophora*, are dominant. The deep green *Enteromorpha* and the paler *Cladophora* are considered nuisance algae by some because of their undesirable appearance and abundance along beaches and in the nearshore lagoon that are used for tourist activities.

Corals in the inshore zone are very sparse and are characterized by scattered, small colonies of *Porites lutea* and *Pocillopora damicornis*. Live coral cover is less than 1% overall, but some areas may support colonies of *Porites* and *Pocillopora* at densities of up to 5% cover. Invertebrates conspicuous in the inshore zone include the common sea cucumber genera *Holothuria*, *Actinopyga*, and *Bohadschia*, the large, blue starfish, *Linckia laevigata*, and the clam, *Gafrarium pectinatum* known locally as “Amsum”. Lagoon fish resources include unicorn fish (*Nasinae*), rabbitfish (*Siganidae*), mullet (*Mugilidae*), goatfish (*Mullidae*), snappers (*Lutjanidae*), the emperor fish (*Lethrinus harak*), and silversides (*Atherinidae*). Juveniles of many species may be found in the seagrass beds and local fisheries target certain groups. Occasional predatory species such as groupers, jacks and barracuda may also be present. Local fishermen use these resources for both subsistence and sport. It is of common opinion that the inshore fisheries are in decline, and information from the CNMI Department of Lands and Natural Resources (DLNR) would seem to support this contention (DLNR, 1998). Additionally, fish surveys conducted by the University of Guam and DFW revealed a major decline in abundance of some of the major food fish groups between 1979 and 1996 in Saipan Lagoon (Starmer et al., 2008). An island-wide market survey in 2009 documented the continued decline of nearshore fisheries (Houk, 2010). Specific habitat units in Saipan Lagoon have been identified and delineated by the MMT and are discussed in detail in Appendix C.4.

## 2.3 STUDY AREA HISTORY

The Mariana Islands were discovered in 1521 by Ferdinand Magellan and were claimed for Spain in 1565 by de Legaspi. By 1568, the Spaniards relocated all Chamorros living on the Northern Mariana Islands (including Saipan) to villages on Guam in order to suppress indigenous resistance to foreign rule. Carolinians from the outer islands of the Truk district were the first Micronesians to repopulate Saipan in 1815 as a result of being displaced from their home islands by a devastating typhoon. In 1899, Spain sold the Mariana Islands to the Germans, whose primary contribution during their short occupation was the development of coconut plantations for copra production. In 1914, the Mariana Islands were seized by a Japanese naval fleet during the opening days of World War I (WWI). The League of Nations placed the islands under Japanese mandate in 1920. The Japanese actively colonized and cultivated the Mariana

Islands during their tenure, triggering the first significant urban and agricultural growth on Saipan. Roughly 32% of the land area on Saipan was planted with sugarcane by the 1930s, and by 1937, a total of 42,000 Japanese were living on the Northern Mariana Islands. A narrow-gauge railway was built around much of Saipan in order to transport harvested sugarcane to the cane mill located in Chalan Kanoa. Garapan and the northern half of the study area served as the commercial center on the island during the Japanese tenure. The Japanese heavily fortified the island during WWII as a result of the island's strategic location in relation to the Japanese mainland.

During WWII, US forces invaded Saipan on June 15, 1944, and successfully captured the island on July 9, 1944. The shoreline along the study area was heavily shelled during the invasion, as evidenced by the numerous live and dud ordnance that were encountered during construction of the beach path. The military quickly embarked on numerous construction projects throughout Saipan that required improving the existing transportation system on the island. Beach Road and the Garapan area infrastructure were upgraded and further developed by the US Navy shortly after the war.

The US military government administered Saipan until 1947 when the US and United Nations reached a trusteeship agreement that ultimately established the Trust Territory of the Pacific Islands (TTPI), which included Saipan. The US Navy began administration of Saipan with the establishment of the TTPI on July 18, 1947. Administration of the TTPI was transferred to the US Department of the Interior on July 29, 1951, but was quickly transferred back to the US Navy in November 1952. All the other Mariana Islands, except Rota, fell under the control of the US Navy shortly thereafter. Nearly a decade later, on May 7, 1962, the islands reverted back to civilian control. On January 9, 1978, the Northern Mariana Islands were declared a Commonwealth. On November 3, 1986, the Commonwealth was declared self-governing (Farrell, 1991).

Following a long period of relatively slow growth, Saipan underwent tremendous growth in the 1980s and early 1990s with the rise of the island's tourist and garment industries. This is reflected in the explosive growth in the island's population during this period, from approximately 15,000 in 1980 to over 62,000 in the year 2000 (US Census Bureau, 2000).

## 2.4 HISTORICAL LAND USE AND POPULATION GROWTH

Since its establishment during the Spanish occupation in the 19th century, Garapan has historically been the urban hub of Saipan and the Northern Mariana Islands. Japanese control of Saipan in 1915 triggered the first significant modern population growth on the island and in Garapan, which until then had remained relatively small, consisting predominantly of Caroline islanders, Chamorros from Guam, and a few German settlers during the short German occupation (1899-1914). The Japanese occupation of Saipan during WWI brought thousands of Japanese migrants, predominantly from Okinawa. Soon followed the development of intense economic and agricultural activity on Saipan, with Garapan serving as the economic and social center. By the 1930's, Garapan had evolved into a highly developed urban society, with urban services capable of sustaining its population to Japanese standards. The city included retailers, restaurants, bars, and factories from which products were exported as well as consumed locally.

The population of Saipan grew steadily to approximately 30,000 by the end of WWII and the American invasion (Ono et al., 2002).

During the American invasion, Garapan was almost completely destroyed. Large areas of the town were completely leveled and replaced with cleared areas used for the construction of military storage buildings and for military activities. The street patterns of Garapan that had been established by the Japanese and the Germans were completely changed to fit American military standards. The nearshore area between Beach Road and Middle Road was graded and filled using coral limestone fill taken from nearby quarries to provide level surfaces for military structures. It is estimated that approximately 75% of the coastal band within the study area consists of “artificial fill”, a predominant remnant of this post-war development. With the departure of the Japanese and the end of the industrial and agricultural commerce, the population decreased significantly after WWII, from 31,629 in 1944 to 4,898 in 1949. From 1949, the population increased slowly but steadily, reaching approximately 20,000 in 1989. The introduction of garment factories during the 1990s, together with the rise of tourism, brought an influx of laborers to Saipan, causing the population to explode to over 60,000 by 1999. At its peak, there were 36 garment factories on Saipan which employed over 15,000 contract workers mostly from Southeast Asian countries; however, there are currently no garment factories in operation on the island with the last one having closed in 2009 (Goodridge, 2009). The population of Saipan as of the 2010 census is 53,883 (US Census Bureau, 2010). The closure of garment factories on the island may have contributed to the slight decline in population.

In an effort to document changes in land use within the study area over time, historical aerial photographs were collected, viewed, and compared. Aerial photographic coverage of this area is limited, but decent quality photographs from 1944, 1945, 1956, 1969, 1976, 2000, and 2009 were obtained and used for this analysis. Aerial photographs are included in Appendix D. Table 3 summarizes the changes in population growth for Saipan during the periods that each aerial photograph was taken.

**Table 3: Population and Urban Growth Summary**

| PHOTO DATE | RULING GOVERNMENT | APPROXIMATE POPULATION | *PERCENT URBAN COVERAGE OF STUDY AREA |
|---|---|---|---|
| 1944 | Japanese Trust Territory | 31,129 | 15% |
| 1945 | United States Naval Military Government | *No Data* | 71% |
| 1956 | Unites States Trust Territory | 6,000 | 15% |
| 1969 | Unites States Trust Territory | 10,000 | 17% |
| 1976 | Unites States Trust Territory | 13,000 | 12%** |
| 2000 | Unites States Commonwealth | 62,392 | 37% |
| 2009 | Unites States Commonwealth | 53,883 | 43.5% |

*For this table "Study Area" includes the area bordered by the shoreline to the west, Middle Road to the east, and stretches from Garapan Fishing Dock to the north and Quartermaster Road to the South. The entire area is 260 acres. The percent urban coverage was calculated by using Autocad to calculate the areas of polygons drawn around urban areas on each of the historical aerial photographs within the area defined above. The percent urban coverage for the 2009 aerial photograph was calculated using ArcGIS.

**The 1976 photo shows only a partial view of the study area; the percent urban coverage was calculated using the study area that is visible in the photograph.

Detailed descriptions of the aerial photographs, obtained for the time period extending from 1944 to 2009, are provided in the following sections. Major land-use changes observed in these photographs are summarized in Section 2.4.3. An emphasis on comparison of vegetative ground cover pervades this historical analysis in an effort to link changes in exposed terrestrial areas with changes in the lagoon environment. Interpretation of apparent changes within the lagoon environment is discussed in further detail in Appendix C.3.

### 2.4.1 Aerial Photographs

**February 23, 1944.** Black and White Aerial Photograph (Source: Bishop Museum, Honolulu, Hawaii).

This photograph was taken by military reconnaissance during the Japanese occupation prior to the American invasion. The population during this time was inflated due to the large number of Japanese armed forces stationed on the island.

Visible in this photograph is the shoreline extending from just north of Garapan Fishing Dock to the Susupe area to the south. Coverage extends inland approximately one-half mile, beyond the present day Middle Road location. This photograph also includes offshore coverage of the lagoon, nearly to the outer reef. The quality of this photograph of the study area and the nearshore lagoon is good, with just a small portion of the lagoon obscured by cloud cover.

A dense band of development, extending from Garapan to the Gualo Rai area, is visible in this photograph. The area appears to be highly urbanized, with an advanced street and block system extending south from Garapan to the Gualo Rai area. Development in the area between the shoreline and the approximate current location of Middle Road consists of very densely arranged building structures and roads with little or no vegetative land covering. Further inland, bordering this highly developed area, are areas that are cleared of trees and appear to be agricultural land. Land located south of the development, in the areas of present day Quartermaster Road and Susupe, consists mainly of agricultural land with little urban development.

Offshore coverage of the lagoon extends to just inside the outer reef. The lagoon is characterized by a nearshore, light colored band that is assumed to be an area devoid of shallow water vegetation or which is covered by sediment deposited from surface runoff. An adjacent dark colored band that appears to be some kind of seagrass or algae extends from the nearshore sand/sediment band approximately one eighth-mile offshore. At this point, there appears to be striations in the lagoon bottom and a distinct contrast between the sea vegetation band, indicating an area of high energy or current that flows to the south.

**May 9, 1945**. Black and White Aerial Photograph (Source: University of Hawaii, Honolulu, Hawaii).

This photograph was taken after the American invasion of Saipan, at which time large areas of land were cleared and used for US military installations. The population of the island was still impacted by the large transient military population.

Visible in this photograph is the shoreline extending from just north of Garapan Fishing Dock to the Susupe area to the south. Coverage extends approximately one and one-half miles inland. This photograph also includes offshore coverage of the lagoon, to the outer reef on the lower half of the photograph and to just beyond the fishing dock in the upper portion of the photograph. The quality of this photograph is good. The photograph was taken from an altitude of approximately 5,000 feet roughly eleven months after the American invasion of Saipan.

The study area appears significantly altered compared to the 1944 pre-invasion photograph. The previously existing band of development, including structures and streets, has changed dramatically. Middle Road, Beach Road, and Quartermaster Road, as they appear today, are visible and were apparently constructed by US forces shortly after the American occupation of the island. The densely arranged, small building structures and street grid visible in the 1944 photograph are replaced by large tracts of cleared land covered by large military warehouses and storage containers. The cleared land extends into the Gualo Rai area and to the inland side of Middle Road to the south, for the entire extent of the study area.

This photograph shows a band of what is probably *Enhalus* seagrass nearest to shore. This black band extends out to the deeper mid-lagoon region. The assumption is made that the *Enhalus* seagrass region, similar to all other photographs, extends only a couple hundred meters off-shore. The remaining portion of the black band in the 1945 image is probably *Halodule* seagrass or macroalgae stands. An additional bed of *Halodule* seagrass or macroalgae near the lighthouse in the outer lagoon is shown in the image. This is significant because the deeper mid-lagoon region is associated with stronger currents and tidal exchanges. These events would theoretically exchange high nutrient lagoon waters before they reach the outer lagoon. The large stand of seagrass present in the 1945 image suggests that nutrient rich groundwater may have been affecting aquatic communities of the outer lagoon within the study area.

The beach/nearshore lagoon area is characterized by tracks in the lagoon floor that may be remnant landing craft tracks from the invasion. There are several sediment deltas visible along the shoreline, most likely a result of the large scale clearing for reconstruction. The dark band of sea vegetation appears to be of equal width as the previous photograph and extends to the same high energy-current band located inside of the reef.

**December 9, 1956**. Black and White Aerial Photograph (Source: University of Hawaii, Honolulu, Hawaii).

This photograph was taken following the designation of Saipan as a Trust Territory of the United States. The population and development reflect the relatively small population of permanent residents, with the military population having left with the closure of the last military installation in 1950 (Spoehr, 2000).

Visible in this photograph is the Saipan shoreline extending approximately from the Gualo Rai area to just south of Quartermaster Road. Coverage extends inland just beyond Middle Road. This photograph also includes offshore coverage of the lagoon, to an extent of approximately one-quarter mile. The quality of this photograph is good and it was taken from an altitude of approximately 1,500 feet.

The study area appears far less developed than in the invasion-era photographs. Areas that previously appeared as exposed soil are now covered by vegetation. Vegetation appears to consist predominantly of underbrush with sparse trees. Some of the warehouses, and cleared areas associated with the warehouses that were built in 1945, are still visible, but are overgrown with vegetation. Beach Road, Middle Road, and Quartermaster Road are visible.

The lagoon appears to have changed, with a relatively small band of sea vegetation visible along the shoreline. Sediment deltas are visible along the shoreline. The remaining portion of the lagoon that is visible is sparsely vegetated and is characterized by a lighter albedo, which probably reflects the presence of a relatively barren sandy lagoon floor. The high level of seagrass and macroalgae development is absent in this image. A band of *Enhalus* seagrass is still visible in areas close to shore. The seagrass and macroalgae growth extending from shore to the mid-lagoon region that was visible in the 1945 photograph is no longer visible. There is also no visible large development of seagrass or macroalgae in the outer lagoon that was previously present. The majority of the lagoon visible in the photograph consists of a barren sandy bottom, which requires lower levels of nutrients in runoff water and groundwater to maintain. This is consistent with the diminished level of onshore development present in the study area. Nonpoint sources of pollution such as unpaved roads, and other sediment and nutrient sources within the study area were not as widespread compared to the photograph taken in 1945.

**January 29, 1969**. Black and White Aerial Photograph (Source: University of Hawaii, Honolulu, Hawaii).

This photograph was taken at a time of gradual increase in development/population of Saipan. Visible in this photograph is the shoreline extending from Garapan to south of Quartermaster Road. Coverage extends approximately one-half mile inland, beyond the present-day Middle Road location. This photograph also includes offshore coverage of the lagoon, well beyond the outer reef. The photograph was taken from an altitude of approximately 4,500 feet and is of good quality.

The terrestrial landscape within the study area reflects little change from the 1956 photograph. Development along the shoreline appears to be relatively unchanged other than advanced overgrowth of some of the WWII remnant structures.

The lagoon vegetation growth pattern appears to be unchanged, with sparse vegetation spots visible in a nearshore band, but little else extending to the outer reef. The visible sediment deltas also appear to be unchanged.

**February 23, 1976**. Black and White Aerial Photographs (Source: University of Hawaii, Honolulu, Hawaii).

This photograph includes coverage of most of the study area, extending from Garapan Fishing Dock to just south of Quartermaster Road. Onshore coverage is limited in these photographs, extending inland to Middle Road in the southern half of the study area, but extending only just beyond Beach Road in the northern half. This photograph also includes offshore coverage of the lagoon, extending to just beyond the outer reef in the southern portion, and to just inside of the outer reef in the northern half. The quality of this photograph is good, with slight cloud interference in the center of the area.

The continuation of gradual population/development growth is evident in this photograph. Although coverage is limited, it is evident that there is more land development along Beach Road than in the 1969 photograph. The density of urbanization is not at the level that it was in the 1940s, but it appears to be increasing. The lagoon appears unchanged from the 1969 photograph.

**April 25, 2000.** Color Aerial Photograph (Source: R.M. Towill, Honolulu, Hawaii).

This photograph depicts present-day population/development levels. Saipan’s status as a Trust Territory of the United States, coupled with non-stringent labor laws, created the opportunity for garment companies to produce clothing using cheap labor while still printing “Made in the USA” on the labels. The rise of the garment industry in Saipan in the early 1990s brought a rapid increase in population to the study area that has continued through the 1990s, raising the population from approximately 20,000 in 1989 to approximately 60,000 in 2000 (Farrell, 1991).

Visible in this photograph is the shoreline extending approximately from the Gualo Rai area to just south of Quartermaster Road. Onshore coverage extends inland to just beyond Middle Road. This photograph also includes offshore coverage of the lagoon, to an extent of approximately one-quarter mile. The quality of this photograph is good and was taken from an altitude of approximately 1,500 feet.

This photograph depicts present-day levels of development in the study area. The tract of land between Beach and Middle Roads is significantly more developed than in the 1976 photograph. Vegetation is still prevalent among many of the structures, unlike in the 1940s photographs. Major terrestrial changes include the presence of a bike path constructed on the shoreline-side of Beach Road and stretching the entire length of the study area, and the widening and pavement improvement of Middle Road. Overall, the level of on-shore development closely resembles that of the late Japanese era.

Nearshore sea vegetation consists of the relatively narrow, dark band of vegetation observed in previous photographs. The remaining visible segment of the lagoon appears to have sparse growth of sea vegetation. Several sediment deltas are visible at stormwater outfall locations. The 2000 image shows the most resemblance to the 1945 image in terms of seagrass and macroalgae stands, and onshore development.

**May 24, 2009.** Color Aerial Photograph (Source: Google Earth 2009).

This photograph shows the most recent image of the study area from Garapan Fishing Dock to just south of Quartermaster Road. Onshore coverage extends inland to just beyond Middle Road. Although the southernmost portion of the study area is slightly obscured by cloud coverage, the overall quality of the image is good.

As with the 2000 aerial photograph, this photograph depicts present-day levels of development in the study area. Areas cleared of vegetation and paved areas have increased since 2000.

The narrow, dark band of nearshore sea vegetation and the relatively sparse growth of sea vegetation in the remaining segment of the lagoon are consistent with the 2000 aerial photograph, as well as with the 1945 aerial photograph. Sediment deltas are visible at the stormwater outfall locations. The *Halodule* and macroalgae stand development in the outer lagoon near the lighthouse that was visible in the 1945 photograph is again visible in this photograph. This appears to support the argument that increased onshore development (which leads to increased sediment/nutrient loads to the lagoon) results in altering the marine system by stimulating *Halodule* and macroalgae growth.

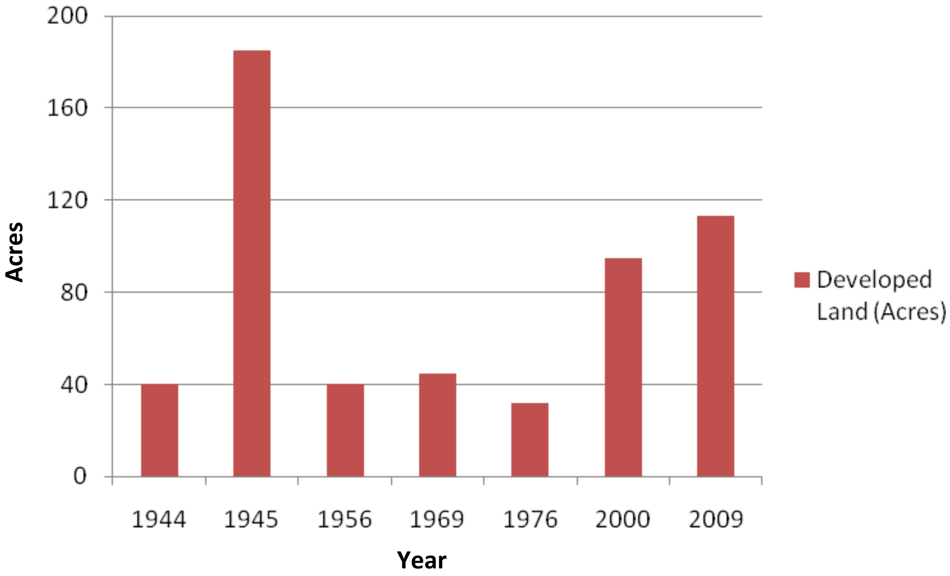
### 2.4.2 Aerial Photograph Comparison

In an effort to determine how land use has changed over time in the study area, the area of developed land, including land cleared of vegetation (i.e., roads, buildings, and bare lots) visible in each of the historic photographs was calculated. Coverage of the study area in each photograph varies, and in some cases is incomplete; therefore, land areas calculated are general estimates. The land area used for the comparison includes the area bordering the fishing dock to the north, the lagoon shoreline to the west, Quartermaster Road to the south, and Middle Road to the east. The purpose of this calculation is to compare sediment contributory areas within the study area during recent history. Areas devoid of vegetation that are unpaved tend to contribute greater amounts of runoff, and facilitate sediment transport than comparably sized areas that are covered by natural vegetation. Cleared paved areas minimize sediment contribution, but contribute excessive rainfall runoff to the shoreline. Middle Road and Quartermaster Road were first constructed after the American occupation, and are thus not visible in the 1944 photograph. Table 4 and Figure 3 depict the comparison of land use from 1944 to 2009.

**Table 4: Historical Developed Land Comparison**

| YEAR | DEVELOPED/DE-VEGETATED LAND (ACRES) | COMMENTS |
|---|---|---|
| 1944 | 40 | - |
| 1945 | 185 | - |
| 1956 | 40 | Partial Photograph Coverage |
| 1969 | 45 | - |
| 1976 | 32 | Partial Photograph Coverage |
| 2000 | 95 | - |
| 2009 | 113 | - |

**Figure 3: Developed Land Within the Study Area**



## 2.4.3 Summary

During the Japanese occupation, Garapan was densely developed by structures and a street grid, and stretched into the northern portion of the study area. Dense development extended approximately to the southern end of the Guala Rai area, south of which consisted of land used primarily for agricultural purposes. The present day land use pattern and development of the study area stemmed from the American occupation of Saipan during WWII. This is evidenced by the clearly visible Beach Road, Middle Road, and Quartermaster Road in the photograph taken in 1945. The 1956 photograph depicts much of the WWII development to be overgrown with vegetation, though the northern-most portion of the study area is not visible. Between the 1950s and present day, development of the study area has steadily increased, with a large population growth spike during the 1990s from garment factory development, though the area of land devoid of vegetation is still significantly less than what was present in 1945 during the American occupation of Saipan.

Vegetation consisted only of the agricultural land in the 1944 photograph, with very little natural vegetation present within the study area between present day Beach Road and Middle Road. The study area in 1945 was vastly changed with respect to building structures and roads, but the vegetation remained relatively unchanged, other than the advancement of overgrowth on land formerly used for agriculture. The 1956 photograph shows the further advancement of natural vegetation over the land formerly cleared during WWII. The vegetation growth pattern has remained relatively unchanged to the present day, with the overgrowth primarily consisting of shrubs with a canopy of larger trees in some areas.

The shoreline, specifically the beach, is characterized by deltas of sediment deposits at entry points of surface water runoff. These deltas are visible in all of the photographs, fluctuating minimally in size depending on the year. The beach appears to be at its widest in the 1945 photograph, while it seems to have remained relatively unchanged in the 1956, 1969, and 1976 photographs. There seems to be an increase in the size of the sediment deltas in the 2000 photograph, although there is a decrease in the overall width of the beach in comparison to the 1976 photograph. This is most likely the result of the construction of the beach path along the shoreline that acts as a barrier or armor, inhibiting the regeneration of the beach from eroded sediments. The increased size of the sediment deltas can be attributed to the increased sediment load entering the lagoon as a result of urbanization within the study area. Minimal changes are observed between the 2000 and 2009 aerial photographs, except for the increase in urbanized areas along Beach Road and Middle Road in the 2009 image.

The aerial photographs are of varying quality and scope, and some general trends can be deduced from their review. Increasing urbanization within the watershed has led to the exposure of more sediment, leaving the area susceptible to erosion and increasing the sediment load transported to the lagoon during rainfall events. Lack of a stormwater control and/or treatment system has left the lagoon susceptible to nutrient and contaminant-laden sediment, decreasing the overall quality of the lagoon environment.

## 2.5 CURRENT LAND USE

The two major thoroughfares on Saipan, Beach Road and Middle Road, run through the study area, with the majority of urban development in the area concentrated along these two roads. The watershed area inland of Middle Road is predominately covered by forest vegetation, with the exception of the Gualo Rai community. The areas immediately adjacent to and in between Beach Road and Middle Road are the currently most heavily developed areas within the study area. These areas are where most of the PCAs within the study area are located (see Appendix

C.5). There is great potential that the entire land area between these two roads will become heavily urbanized within the next decade due to its close proximity to the island's commercial and governmental center in Garapan, and to meet the demands of a rapidly increasing island population.

## 2.6 WATER RESOURCES

Saipan has unique water issues that offer challenges to regulatory agencies such as the CNMI DEQ and CRMO. Finite freshwater sources and impacts of urban development on surrounding marine environments are of constant concern. Decreased water quality threatens marine environments because coral reefs and other marine systems rely on good water quality for proper function and prosperity. This section summarizes general water characteristics on Saipan according to the CNMI DEQ Integrated 305(b) and 303(d) Water Quality Assessment Report, dated November, 2010 (DEQ, 2010).

### 2.6.1 Groundwater

Two types of aquifers are dominant on Saipan, isolated limestone aquifers and the more prevalent basal aquifer, which serves as the predominant source of freshwater on the island. Due to limited freshwater sources, the location and distribution of these aquifers is of extreme importance in the CNMI. Urban growth and an increase in population have led to several issues that threaten the freshwater aquifers. Increasing demand of freshwater has led to over-pumping of the basal lens aquifer, causing high chloride levels due to saltwater intrusion.

Although most occurrences of groundwater contamination in Saipan have not been linked with a specific identifiable source, the highly suspected sources, in addition to saltwater intrusion, include the following:

- petroleum compounds from underground storage tanks;
- pesticides, halogenated solvents, petroleum compounds, nitrate, metals, bacteria, protozoa, and viruses from disposal activities at landfills;
- nitrate, bacteria, protozoa, and viruses from septic tanks, as well as pipelines and sewer lines; and
- halogenated solvents, petroleum compounds, and metals from small-scale manufacturing and repair shops.

These point and nonpoint source pollution due to heavy urbanization can threaten groundwater sources through infiltration of the study area's highly permeable top soils.

### 2.6.2 Surface Water

The CNMI has designated two classes of water (AA and A) for marine uses. AA represents high-quality waters that are considered to be in a "natural" and "pristine" state. The CNMI Water Quality Standards state that "to the extent practicable, the wilderness character of such areas shall be protected," and does not permit any discharge of pollutants into class AA waters (DEQ, 2002a). Class A waters have been designated in two parts of Saipan, and generally represent a slightly lower quality of water in which some discharges may be permitted, for example, the two sewage treatment plant outfalls on Saipan. Nevertheless, Class A waters must support recreational use and the propagation of fish, shellfish, and wildlife. Strict water quality standards have been set for the protection of these uses in Class A marine waters. Additionally, further protection is afforded through the CNMI Anti-Degradation Policy, which is part of the Water Quality Standards and protects existing uses and water quality in any waters, despite their classification.

The majority of the coastal marine waters on Saipan are designated as Class AA, including the study area. These waters should remain in their natural pristine state as closely as possible with an absolute minimum of pollution or alteration of water quality from any human-related sources or actions. The uses protected in these waters are the support and propagation of shellfish and other marine life, as well as the conservation of coral reefs and wilderness areas, oceanographic research, aesthetic enjoyment and compatible recreation inclusive of whole body contact (e.g. swimming and snorkeling), and related activities.

Both point and nonpoint source pollution are responsible for lowering the quality of the CNMI's surface waters. Sewage out-falls, sewer collection overflows, sediment from unpaved roads and development, urban runoff, reverse osmosis discharges from hotel treatment systems, and nutrients from agricultural areas and golf courses are the most significant contributors to the degradation of the CNMI's surface and marine water quality. Surface water quality is difficult to measure and properly assess due to the many interrelated variables that affect surface water, including rainfall events, tidal fluxuations, and other atmospheric and oceanographic conditions. According to the MMT, in order to properly and accurately assess water quality, it is best to couple both marine habitat health data with water quality measurements. Decreased water quality threatens marine environments because coral reefs and other marine systems rely on good water quality for proper function and prosperity. Further discussion of the effects of degraded water quality on Saipan Lagoon's ecosystem is provided in the next section.

# 3. PROBLEMS, GOALS, AND OBJECTIVES

The following sections describe the existing environmental issues in the study area and the need for a restoration alternative that would meet the study objective of restoring the lagoon to a less degraded, more natural condition. The importance of the lagoon ecosystem to the overall health of the Saipan marine ecosystem is also discussed.

## 3.1 EXISTING ENVIRONMENTAL ISSUES IN STUDY AREA

### 3.1.1 Background

Coral reefs are one of the most ecologically significant and diverse systems found within the natural environment. Coral reefs provide habitats for 25% of all marine fish species although they cover less than 1% of the Earth's surface (Burke et al., 1998). Coral reefs serve as an integral part of Earth's ecosystem and also support a variety of human needs such as subsistence, fisheries, tourism and recreation, shoreline protection, and even yield compounds that are used to develop new medicine. At least 500 million people depend on food, coastal protection, and livelihoods provided by coral reefs (Wilkinson, 2004). Coral reefs are also of great cultural importance to many regions in the world.

Under the CWA (Section 404(b)(1), Part 230), coral reefs are considered "Special Aquatic Sites", and "they are geographic areas, large or small, possessing special ecological characteristics of productivity, habitat, wildlife protection, or other important and easily disrupted ecological values. These areas are generally recognized as significantly influencing or positively contributing to the general overall environmental health or vitality of the entire ecosystem of a region." The CWA also states that "degradation or destruction of special sites may represent an irreversible loss of valuable aquatic resources."

In spite of their ecological, social, and economical value, coral reefs are in decline primarily from global climate change, impacts from unsustainable fishing, and land-based pollution. According to the Global Coral Reef Monitoring Network, the single largest coral reef monitoring effort in the world, of all the reefs that is monitored worldwide, 27% has already been lost, and it is predicted that another 32% could be lost in the next 20 to 30 years (Pockley, 2000). In addition, a report published by the World Resources Institute states that 58% of all reefs are at serious risk from human development. Both of these reports point to human activities as the major cause of decline in reefs (Weier, 2001).

This study focuses on one of the major causes of coral reef and ecosystem degradation; land-based pollution that ultimately reaches the nearshore waters of Saipan Lagoon, which ultimately causes alteration of the ecological system within the surrounding area. Some of the most diverse and economically significant coral reefs that support many forms of sea life are found in the CNMI. In Saipan, not only does the reef surrounding the island provide habitats for numerous marine species, but also provides protection from typhoon damage and erosion, supports fish species that are consumed regularly by local residents, and are used by local residents and tourists for recreational purposes. Further degradation of the lagoon ecosystem due to human activities will lead to ultimate destruction and irreversible loss of valuable aquatic resources in Saipan. All components of the ecosystem rely on each other, and destruction of one part of the system will cause the entire system to respond or to become altered. Implementing management measures to reduce human impacts on the lagoon system is crucial in preserving a healthy and natural balanced ecosystem within the study area as well as areas that are outside of the study area.

### 3.1.2 Preservation Issues

Increasing population and urbanization have led to rapid development of Garapan, the largest village on Saipan, and the study area just south of Garapan. The urbanization of the inland watershed area that has occurred over the past twenty years has dramatically increased the amount of sediments and stormwater runoff discharged into Saipan Lagoon. The probable future increase in urbanization of this area would likely increase the volume of sediment, nutrients, and contaminants entering the lagoon via rainfall runoff. During rainfall events, large sediment, nutrient, and contaminant loads entering the lagoon have a deleterious impact on the water quality and aquatic ecosystems within the lagoon. Photographs showing the conditions of the lagoon and surrounding areas during rain events are included in Appendix E.

Results of the MMT’s lagoon monitoring study and published literature (Houk and Camacho, 2010; Houk and Van Woesik, 2008) indicate that the inner lagoon habitats are affected by increased nutrient load entering the lagoon via stormwater runoff within the study area. The lagoon area that is within the study area receives drainage from the West Takpochau watershed, an area of dense commercial and residential development. Paved roads, asphalt parking lots, and areas devoid of vegetation enable stormwater runoff to flow unimpeded to the lagoon, transporting and depositing sediments, nutrients, and pollutants from the watershed to the lagoon. As a result of the influx of additional nutrients, these nearshore habitats have higher abundances of seasonal macroalgae growth and *Enhalus* seagrass compared to outer lagoon habitats (Houk and Van Woesik, 2008). Components of the lagoon ecosystem are interrelated, with the health of each depending upon the health and function of the other components. Changes to a single component, in this case, increase in macroalgae due to the addition of nutrients, affects the entire aquatic ecosystem and can totally change and eventually destroy the naturally existing marine community. In general, an influx of too many nutrients will stimulate growth of certain organisms within the ecosystem in the short term, and eutrophication over an extended period of time will lead to overall degradation of the aquatic ecosystem by decreasing the population diversity.

A healthy saltwater lagoon community in the region of this study should ideally be characterized by a band of nearshore *Enhalus* seagrass, adjoined by a predominantly sandy bottom with few and sparse stands of macroalgae and *Halodule* seagrass. In the case of Saipan Lagoon, sediment-laden stormwater runoff (associated with nonpoint source pollution) drains into the ocean, providing excess nutrients to the coral reef system. As a result, organisms that can utilize these additional nutrients are quickly becoming dominant. In tropical marine systems, turf and macroalgae can uptake nutrients at a faster rate than corals or coralline algae (Littler and Littler, 1988). The result of continuous sediment-laden, nutrient-rich stormwater runoff entering the lagoon is an increase in macroalgae cover to the detriment of seagrass and coral habitat. As nutrient levels entering the lagoon have increased, there has been a shift from barren sand regions to larger and denser macroalgae stands. In certain areas of the lagoon, particularly at the northern end of the study area near Garapan, the continuous discharge of high nutrient waters during storm events and from other point source discharges, such as runoff discharge or sewer failures, has led to a shift from the once seagrass dominated system to a macroalgae dominated community. The natural progression resulting from a continuous supply of high nutrient waters entering the lagoon is the initial development of *Halodule* seagrass stands in sandy regions, eventually to be overgrown by macroalgae (DEQ, 2002b). This macro-algal community has a short life cycle and continuously changes from one species to the next. Marine communities characterized predominantly by macroalgae also provide little refuge for juvenile fish when compared to a healthy seagrass-dominated system.

Macroalgae are able to overgrow slower-growing coral and seagrasses, and eventually replace them by creating a shaded environment that is not tolerated by these taxa. An increase in macroalgae also affects juvenile coral larvae that would normally settle and grow on the reefs, by reducing available area for settlement, resulting in a decrease in corals. Nutrients also promote turf and filamentous algal growth, which further reduces available area for coral settlement. Fewer corals settling on the reefs leads to less available habitat for marine life to exist within the aquatic ecosystem, since corals provide habitat and refuge for the numerous species of fish and invertebrates that compose a healthy marine ecosystem.

In addition to altering the aquatic ecosystem due to increases in nutrient levels, increased sediment entering the lagoon can create the following problems:

- increase the turbidity of the water and block the sunlight from reaching corals and their associated photosynthetic symbionts;
- physically smother corals;
- prevent the recruitment and settlement of coral larvae;
- fine clay particles can clog the gills of smaller organisms;
- larger particles such as sand and silt can scour organisms off the bottom and off of submerged rocks and coral;
- deposited sediments can bury and smother sessile or sedentary bottom life, nests, and deposited eggs; and
- sediment deposit deltas continually shift with the influx of sediment during storm events, preventing reestablishment of undisturbed aquatic habitats.

Macroalgae communities are currently dominant in the lagoon at the northern end of the study area, adjacent to the heavily urbanized Garapan. Continuation of the influx of sediment-laden runoff water, expedited by increasing development within the study area south of Garapan, will likely lead to a shift to a macroalgae-dominated marine system within the southern portion of the lagoon as well.

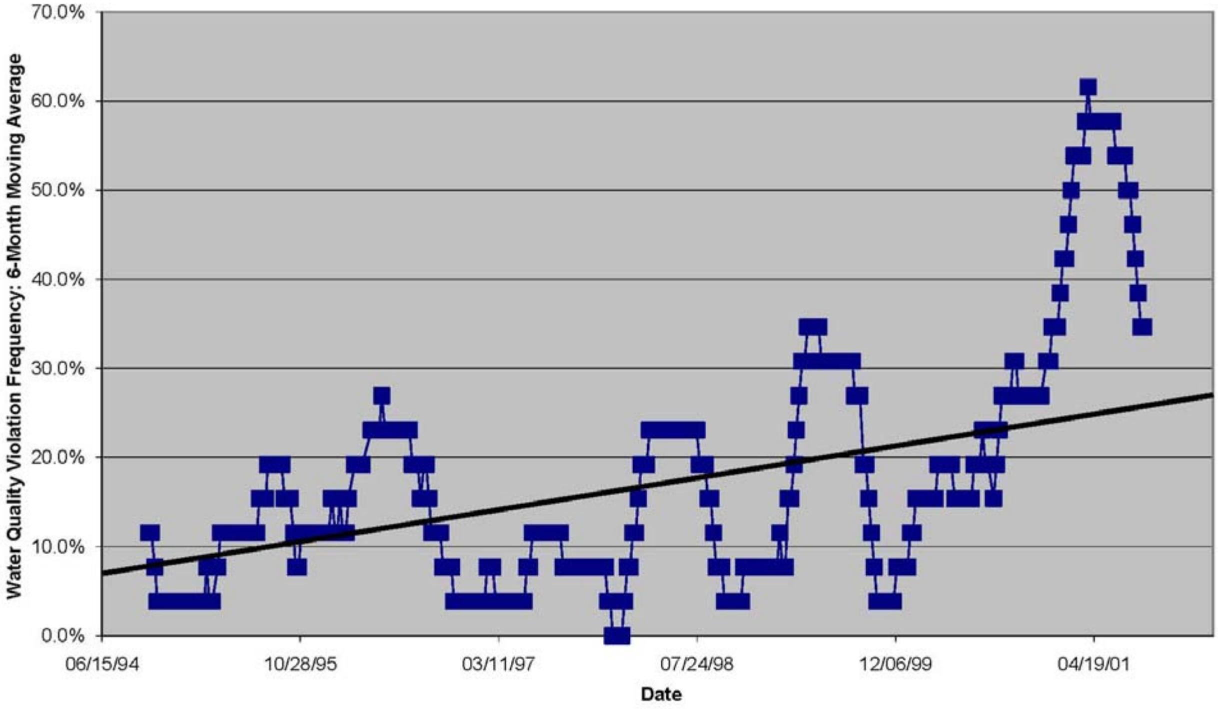
### 3.1.3 Economic Issues

Deterioration of aquatic ecosystems and lagoon water quality is of concern not only for conservation issues, but also for economic reasons. The economy of Saipan is heavily reliant upon tourism with the sun, sandy beaches, spectacular reefs and marine life, and clean water being the primary attractions for tourists. Many hotels are located along the shoreline, with the beach and ocean providing the majority of tourist activities. Beach closures due to high levels of microbial contamination are becoming increasingly frequent along the west coast of Saipan (see Section 3.1.4). Additionally, the presence of nuisance macroalgae within the nearshore waters of Saipan has had deleterious impacts on the aesthetic value of the lagoon. Local fishermen who depend upon the reef for subsistence, as well as recreational and commercial fishing interests, are similarly concerned about the perceived degradation to the nearshore reef system. Further deterioration of the lagoon would be a great detriment to the tourist economy of Saipan and could cause irreparable harm to the economy of Saipan. The remainder of this section discusses specific factors that are contributing to the degradation of the lagoon ecosystem.

### 3.1.4 Water Quality

An interpretation of water quality data collected by DEQ from 1994 to 2002 indicates that there is a significant trend of increasing microbial (enterococci bacteria) contamination detections exceeding water quality standards. Figure 4 shows the increasing incidence of water quality violations at Garapan Fishing Dock located at the northern end of the study area.

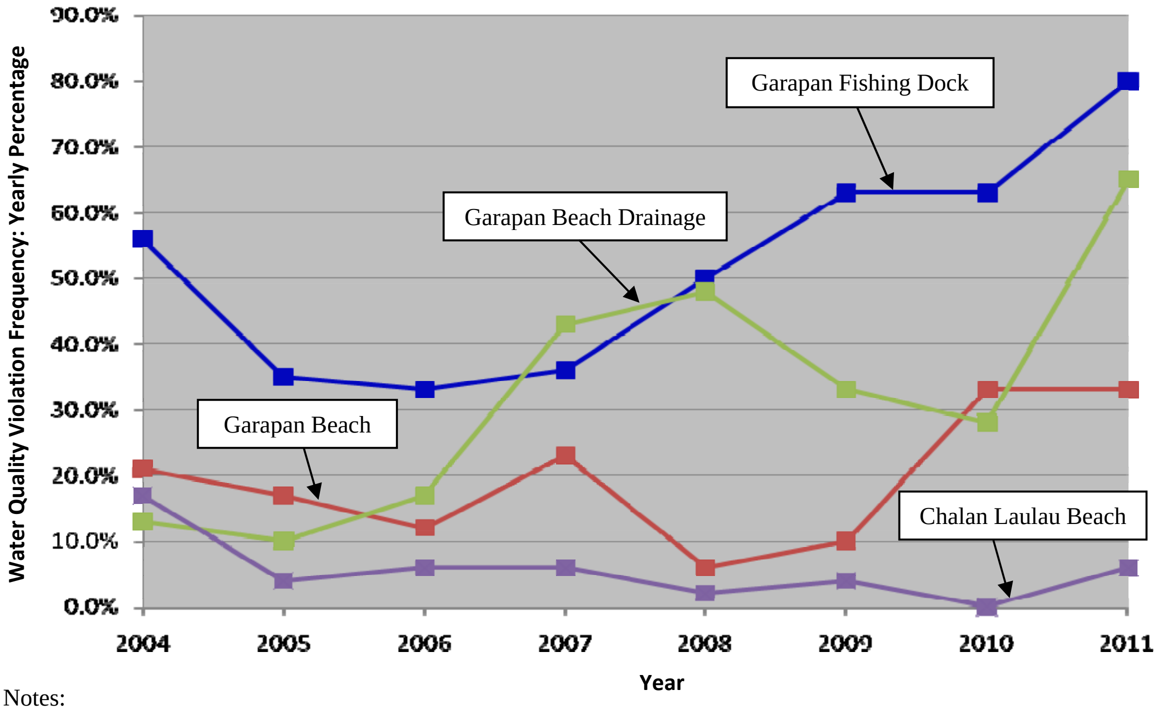
**Figure 4: Water Quality Violation Frequency at Garapan Fishing Dock, 1994-2002**



The increase in bacteriological contamination is a direct result of an increase in nonpoint source pollution associated with urbanization and population growth. Nonpoint source contamination occurs predominantly from surface runoff and sediments transported by runoff, solid and human waste disposal, and agricultural activities.

Water quality data from 38 fixed stations along Saipan's most commonly used west coast beaches collected during more recent years by the CNMI DEQ indicate that sampling sites within the West Takpochau (Central) Watershed continue to consistently experience a significant number of water quality violations, leading to multiple "impaired" (violation frequency exceeds 10%) or "significantly impaired" (violation frequency exceeds 25%) listings (DEQ, 2010). Beach advisories notifying the public that the beach waters within 300 feet of the sampling point are not safe for swimming are triggered when either the single sample maximum (SSM) or geometric mean (GM) for the most recent four sampling events exceeds the CNMI water quality criteria. Figure 5 shows the yearly percentage of water quality violations from 2004 to 2011 at four of the DEQ sampling stations that fall within the study area. Three stations (Garapan Fishing Dock, Garapan Beach, and Garapan Beach Drainage) occur at the northern end of the study area, whereas Chalan Laulau Beach occurs within the southern portion of the study area.

**Figure 5: Water Quality Violation Frequency at Monitoring Stations Within Study Area, 2004-2011**



Notes:
1. Contaminant: Enterococci
2. Violation frequencies are based on the number of samples (either the SSM or GM where sampling data exists for four previous sampling events) that exceeded the CNMI water quality criteria.

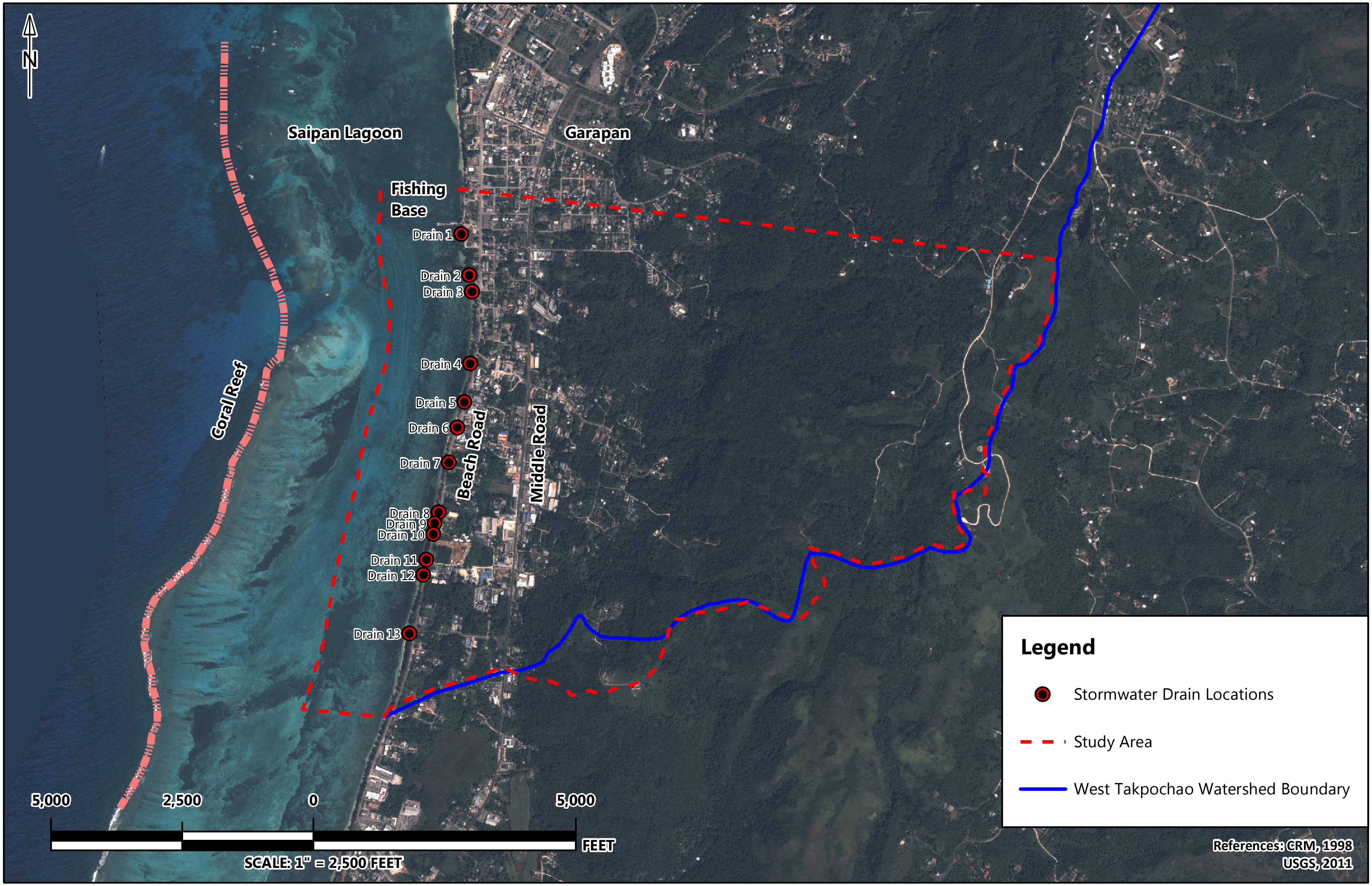
Water quality violation frequencies over the past eight years at the three stations located at the northern end of the study area show an overall increasing trend, which is likely due to the more densely populated and urbanized areas within the northern part of the study area. On the other hand, water quality violations at Chalan Laulau Beach in the West Takpochao (South) Watershed, which is less populated and urbanized, peaked in 2004 at 17%, and have subsequently decreased to 0-6% in recent years. In fact, the CNMI has proposed to delist the West Takpochao (South) segment from the impaired listing based on improvements in water quality relative to enterococci contamination. However, the impaired listing of the West Takpochao (South) segment (total maximum daily load (TMDL) required, medium priority) is also related to low dissolved oxygen (DO) contents, bio-specific criteria, and the frequent occurrence of orthophosphates from sanitary sewer overflows (SSOs), urban runoff, and sedimentation.

The West Takpochau (Central) Watershed is also listed as impaired, TMDL required, and given a high priority designation by the CNMI. This impaired listing is specific to dangers to aquatic life, fish consumption, and recreation as a result of enterococci, mercury, DO, biocriteria, and orthophosphate contamination from sanitary SSOs, urban runoff, and sedimentation (DEQ, 2010). Water quality data collected within the study area, as well as the impaired listings of the watershed areas, indicate that anthropogenic degradation of the water quality within the lagoon remains an issue and continued close monitoring of the lagoon water quality is necessary. Improved water quality will lead to a more sustainable environment for the marine species in the lagoon as well as decreased seasonal macroalgae growth which is stimulated by the influx of nutrient-rich water. Less macroalgae growth within the lagoon will in turn allow slower-growing coral and seagrass to become more dominant in the area providing habitats for many species of fish and invertebrates.

### 3.1.5 Flooding

At present, there are 13 storm drainage outlets within the study area that drain into Saipan Lagoon (Figure 6). The drains were originally installed during construction of Beach Road in the early 1980s. Headwalls for the drain outlets were constructed when the beach walk (bike path) was built in the mid-1990’s. These storm drains collect stormwater from the immediate vicinity of Beach Road (i.e. runoff from Beach Road and properties adjacent to the road. A typical storm drain consists of a grated catch basin on the inland side of Beach Road, followed by 30-inch diameter reinforced concrete pipes (RCPs) that run beneath Beach Road and convey the stormwater from the catch basin to the lagoon. Drainage outlets consist of a single 30-inch diameter RCP or multiple 30-inch RCPs.

Middle Road parallels Beach Road about a half-mile inland and is similarly drained by three individual storm drains. The design of the drains is similar to that of Beach Road with catch basins on the inland side of the road and outlets on the seaward side of the road. The contributory flow from the upland areas of Middle Road consists of overland flow and patchwork drainage swales, but no unified drainage system. The drains along Middle Road discharge to the properties between Beach Road and Middle Road. However, there is no connection between the storm drains on the upper road and those on the lower road. There does not appear to be any drainage easement through this area. Since the topography between Middle Road and Beach Road is relatively flat, runoff tends to pond in the area during moderate to heavy rainfall, before making its way to the lagoon. Only a small fraction of the runoff from properties inland of



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| PROJECT NO.: 1057 | ECOSYSTEM RESTORATION REPORT<br>SAIPAN LAGOON AQUATIC ECOSYSTEM RESTORATION STUDY | FIGURE<br>6 |
| DATE: SEPTEMBER 20, 2012 | | |
| DRAWN BY: CB | STORM DRAIN OUTLETS WITHIN THE STUDY AREA<br>SAIPAN, CNMI | |
| REVIEWED BY: MA | | |

Middle Road reach the storm drains at Beach Road during small intensity rainstorms, with the majority of the runoff infiltrating into the highly permeable limestone. Depending on the severity of the rainfall event, heavy flooding of the down-slope properties and roads occurs. During moderate to heavy rainfall events, both Middle and Beach Roads become severely flooded. Without a system to properly divert and capture stormwater runoff, and release in a more controlled manner, untreated land-based contaminant, nutrient, and sediment laden runoff water is more likely to overflow and enter nearshore waters within the study area during large rain events. With a proper system to capture stormwater runoff, the amount of contaminant, nutrient, and sediment entering the lagoon will be more controlled, leading to a better environment for proper ecosystem function.

### 3.1.6 Runoff and Sedimentation

Increased sediment, nutrient, and contaminant loads entering the lagoon can be generally attributed to several factors, including: the lack of comprehensive land management planning and zoning practices, the absence of an adequate stormwater collection and conveyance system, and the removal of vegetation that serves to detain and filter sediments naturally. Prior to urban development of the study area, the majority of sediment and stormwater runoff was trapped by the natural vegetation present along the coastal plain before reaching the lagoon. Many of the roads and building lots between Beach and Middle Roads and upslope of Middle Road are unpaved, exposing loose sediment to surface water runoff during rain events. Because of the lack of an adequate stormwater collection, conveyance, and treatment system, sediment is directly transported from these exposed areas to the lagoon. During heavy rain events, surface runoff water flows unimpeded down roads and through parking lots to the lagoon.

Sediment transported from the watershed to the lagoon contains high levels of nutrients as well as contaminants. Sediment-laden runoff waters transport surficial contaminants from upslope surfaces and deposits them into the lagoon. Contaminants vary depending upon activities that take place within the watershed (e.g., construction, agricultural, or mechanical). The resulting increased levels of runoff and sedimentation to the lagoon overload the ability of the natural seagrass and coral communities to cope with these pollutants and can damage these delicate ecosystems. Damage to coral reef ecosystems can result from direct sedimentation onto coral polyps or from increased nutrient concentrations that may lead to overgrowth by algal species. In addition, pollutants that are carried by the stormwater can cause damage to the reefs by blocking coral fertilization during spawning events, some of which occur only twice per year. Finally, a large influx of freshwater runoff into the shallow lagoon changes the salinity of the water, potentially outside the narrow range required to sustain healthy corals.

A shift in reef species towards more nutrient tolerant and less diverse communities as a result of increased levels of runoff and sedimentation will also lead to changes in the fish populations inhabiting the reef. In addition, less diverse communities of coral are more susceptible to damage during natural disasters such as typhoons. In order to prevent further irreversible damage to the nearshore ecosystem in Saipan Lagoon, it is critical to implement management measures to control or reduce the amount of sediment, nutrient, and contaminant loads entering the lagoon.

### 3.1.7 Contamination of the Lagoon

At present, the homes and businesses within the study area are not connected to a municipal sewer system and use septic systems for disposal of wastewater. No records were available describing the number and location of septic systems in the area. Local regulatory officials suggested that some gray water disposal is discharged directly to the surface without benefit of a septic system or leach field. It is believed that septic system failures probably contribute a significant amount of nutrients to the nearshore waters within the study area. The CWA Section 319 Nonpoint Source Grant Program administered by the DEQ Nonpoint Source Pollution Control Program is currently funding an on-going inventory and inspection of septic systems throughout Saipan (DEQ, 2010).

SSOs have been reported for the existing wastewater collection system. However, there are no records that detail the frequency, location, quantity, cause, or affected area. The only information available is a trouble call log. There have been reports that some overflows have caused wastewater to be discharged into the nearshore marine environment. According to local personnel familiar with the system, the major causes for SSOs have been reported to be:

- Failure of lift station pumps due to clogging of the impellers.
- Capacity of the collection system exceeded during storm events. During storm events, collection systems occasionally receive excessive flow and infiltration causing them to backup and overflow.
- Large portions of the existing collection systems in the Chalan Kanoa/Kobler area and in the Garapan area were constructed in the early 1970s. The original sewers were constructed using vitrified clay pipe. The age of the sewer coupled with the pipe material may be conducive to leaks.
- The sewers are located in areas that have a shallow groundwater table, further increasing the possibility of contamination.
- Localized flooding during storm events may lead to inflow at discrete points within the collection system (e.g., manholes or lift station wet wells), and subsequent overloading of the collection systems.

As discussed in earlier sections, nutrient enrichment leads to overgrowth of macroalgal species that can uptake nutrients faster than corals, coralline algae, or seagrass communities, eventually outgrowing these species. Fewer seagrass and coral communities mean that there will be less available habitat and refuge for many species of fish and invertebrates to exist. In order to restore and sustain a healthy lagoon environment, measures must be taken to control the amount of nutrients entering Saipan Lagoon.

## 3.2 PROBLEM AND OPPORTUNITY STATEMENTS

Sedimentation and increased nutrient load is recognized as one of the most significant problems facing Saipan Lagoon and is a direct result of urban development that has taken place within the West Takpochau watershed. The following items provide a summary of the main problems identified within the study area:

- Continued input of nutrient-rich stormwater runoff into the lagoon has led to a shift from the once seagrass dominated system to a macroalgae dominated community within the inner lagoon habitats, which can be detrimental for the development of slower-growing coral and seagrass.
- Increased sediment load entering the lagoon via stormwater runoff can hinder the development and growth of corals and other organisms by increasing the water turbidity or by physically smothering them and their habitats.
- Increased frequencies of microbial contamination detections exceeding water quality standards as a direct result of increase in nonpoint source pollution associated with urbanization and population growth has contributed to a shift to a macroalgae dominated system in the nearshore waters.
- Increasingly frequent beach closures due to high levels of microbial contamination and the presence of nuisance macroalgae within the nearshore waters have had deleterious impacts on the recreational use as well as the aesthetic and economic value of the lagoon.
- Decline in abundance of nearshore fish species is not only a concern from an ecological standpoint but also a concern for economical reasons for local fishermen who depend on the resources for subsistence.

## 3.3 FORECASTED WITHOUT-PROJECT CONDITIONS

Future outcomes without implementation of preventive measures to address the problems identified in the study area are as follows:

- Continuous supply of nutrient-rich waters to the lagoon will continue to enhance the growth of macroalgae within the nearshore area, especially in the northern end of the study area adjacent to the heavily urbanized Garapan where macroalgae communities are currently dominant.
- The macroalgae community that is currently dominant in the northern end of the study area will eventually replace the slower growing coral and sea grasses, which will lead to less or no available habitat for marine life to exist within that area of the lagoon.
- Alteration of one area of the lagoon, in this case the northern part of the study area, is likely to negatively impact and cause imbalance within the ecosystem of the remaining portions of the lagoon.
- Continuous supply of nutrient-rich waters to the lagoon will likely lead to a shift to a macroalgae-dominated marine system within the southern portion of the study area as well.
- Continued input of sediment into the lagoon via stormwater runoff will hinder the development and growth of corals and other organisms by increasing the water turbidity or by physically smothering them and their habitats, which will lead to a decrease in the diversity of marine species within the lagoon ecosystem.

- Continued enhancement of macroalgae growth within the study area will lead to eventual depletion of valuable aquatic resources including the coral reef and the organisms that it supports.
- Microbial contamination associated with nonpoint source pollution will further enhance the growth of macroalgae as well as result in increased frequencies of beach closures within the study area.
- Increasingly frequent beach closures due to high levels of microbial contamination and the presence of nuisance macroalgae within the nearshore waters will have negative impacts on the tourism industry in Saipan as many hotels are located along the shoreline within the study area.
- The decline in abundance of nearshore fish species as a result of ecosystem degradation within the study area will have a negative impact on the local economy as many local fishermen depend on the resources within the study area for subsistence and because marine life is one of the major tourist attractions in Saipan.

## 3.4 STUDY OBJECTIVES

The objective of this study is to recommend an environmentally sensitive and economically feasible restoration alternative that would best restore the degraded aquatic ecosystem structure, function, and dynamic processes to a less degraded and more natural condition. The objectives of the restoration alternative are to:

- Reduce the abundance and frequency of occurrence of fast growth nuisance macroalage within the study area.
- Decrease the amount of sediment and nutrients that enter the lagoon.
- Decrease the concentration of microbial contamination in nearshore waters of the lagoon.

A detailed description of the quantitative goals of these objectives is further discussed in Section 5 of this report. Achievement of these objective would improve the lagoon ecosystem in the following ways:

- reduce the amount of nutrients entering the lagoon, thus enabling natural seagrasses, corals, and aquatic life to regenerate in areas currently dominated by macroalgae, characteristic of a high nutrient environment;
- reclaim nearshore areas of the lagoon ecosystem that are currently inundated with sediment;
- regain diversity within the aquatic ecosystem; and
- improve lagoon water quality to a state conducive to coral reef ecosystem restoration.

Reduction of the sediment and nutrient load transported to the lagoon would significantly improve the overall function of the aquatic ecosystem. Restoration of the lagoon ecosystem would also benefit the local tourist economy, the fishery, and the overall development of Saipan.

Constraints that may restrict achievement of the study objectives include the following:

- Factors that are not directly linked with stormwater runoff that the restoration alternative intends to address, such as groundwater or other drainages outside of the study area, may have influence on the outcome of the project.
- Limited knowledge on the specific sources of nutrient and sediment loads that enter the lagoon as well as runoff processes within the watershed may restrict the ability of the restoration alternative to address these issues in the study area.
- Natural disasters such as large hurricanes or tsunamis during implementation of the management measure may pose limitation to assess the outcome of the project.

Alternative plans will need to take these constraints into consideration in order to reach the planned study objectives and to achieve the desired outcomes.

# 4. BASELINE MONITORING RESULTS

Review of previous biological and environmental studies conducted on Saipan during the Phase I portion of this study identified a number of additional studies required to adequately establish baseline environmental conditions within Saipan Lagoon. The results of these baseline studies will be used to aid in the development of remedial measures within the study area and will facilitate evaluation of the effectiveness of these measures in the future. In addition, data derived from field studies was used to assist in identification of deleterious impacts of contaminant sources entering the lagoon. The data generated by these studies will be combined with the existing site data and utilized to refine the design of future remedial measures. The CNMI DEQ and CRMO personnel were instrumental in many of these studies, assisting with research, laboratory analyses, and field activities.

## 4.1 STORMWATER QUALITY INVESTIGATION

Stormwater runoff samples were collected between February and December 2002 from four storm drains located along the shoreline within the study area, one storm drain located south of the study area, and two storm drains located north of the study area, and analyzed for priority pollutant metals. The stormwater runoff sample results were compared against the EPA national recommended water quality standards for priority pollutants (EPA, 2009), chronic and acute toxicity values for the freshwater aquatic life criteria. Cadmium, copper, lead, nickel, selenium, and zinc were detected at a concentration exceeding the acute or chronic toxicity standards in at least one of the samples collected.

Some metal species were detected at elevated concentrations during times of high stormwater discharge, which provides some evidence for anthropogenic sources of these metal species washing into the lagoon via stormwater runoff during large rainfall events. However, runoff sample exceedances occurred during both the dry and wet season, and the results were not consistent enough to conclude that more metals are carried into the lagoon during larger rainfall events. Rather, the results of this 2002 study likely suggest that the amount of metals that are carried into the lagoon via stormwater runoff are more dependent on the source of contamination (e.g., from pervious *vs*. impervious surfaces) and the relative timing of the rain event. Stormwater runoff during early season rains or after a prolonged dry period usually contain the highest pollutant content due to the amount of time that has allowed pollutants to be deposited and accumulate on impervious surfaces. Pollutants from pervious surfaces on the other hand may be found at a constant rate regardless of the timing of the rain event. Additional investigation and more frequent stormwater quality monitoring would be required to determine the sources of metal pollutants and assess their timing of release into the lagoon relative to precipitation and runoff totals. Since the current study proposes a solution that will capture and retain contaminated stormwater regardless of the source of metal pollutants, additional study is considered outside the scope of this study. A detailed description of the 2002 investigation results as well as the laboratory analytical reports are included in Appendix C.1.

## 4.2 LAGOON SEDIMENT PHYSICAL AND CHEMICAL PARAMETERS

As part of an effort to characterize the general distribution and abundance of pollutants in sediments in the study area, a total of 18 surface sediment samples were collected from the lagoon bottom in September 2002. Samples were collected from six transects extending from nearshore to the outer lagoon, stretching the entire length of the study area. The starting point for each transect was established at five storm drains located along the shoreline of the study area as well as a wetland location at the southern end of the study area.

Each transect included a sample location within the nearshore *Enhalus* beds, within the nearshore *Halodule* band, and within offshore *Enhalus* beds located beyond the channel. These sampling locations were estimated to be at 250 m, 500 m, and 1,000 m from shore. Each sediment sample was analyzed for priority pollutant metals, polychlorinated biphenyls (PCBs), and polycyclic aromatic hydrocarbons (PAHs), as well as specific PCB congeners known to be found north of the study area in the Tanapag area during the Water and Environmental Research Institute of the Western Pacific (WERI) study.

As a non-regulatory comparison, analytical results of sediment samples were compared to the EPA regional screening levels (RSLs) for residential soil (EPA, 2012). Overall metals concentrations detected in lagoon sediment were low, but analytical results indicate that in general, sediment collected from the nearshore contained slightly higher concentrations of metals than those samples collected from mid- to off-shore locations. Concentrations of arsenic exceeded the EPA RSL for residential soil in some or all of the locations for all six transects. Concentrations of arsenic detected in samples ranged from 5.1 to 12 milligrams per kilogram (mg/kg), compared to the residential RSL of 0.39 mg/kg.

PCBs, PAHs, and PCB congeners were not detected in any of the samples above the laboratory reporting limits. All laboratory reporting limits were below the EPA RSLs except for benzo(a)anthracene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene.

More recent data characterizing the sediment composition of Saipan Lagoon are available from a study conducted by Denton and Starmer (2009) in which sediment samples for heavy metals analysis were collected from 16 of 22 coastal stormwater discharge points that currently exist along the southern half of the lagoon. Surface sediments were collected at offshore locations at 0 m, 10 m, 25 m, 50 m, 100 m, and 250 m from shore along transect lines perpendicular to the discharge points. Samples were also collected from 500 m and 1,000 m offshore where possible. Geometric means were calculated at each distance and the minimum and maximum concentrations were determined.

Metals concentrations found in surface sediment samples collected in 2009 were all below the EPA RSL, and were similar to those found in sediment samples collected in 2002. The 2009 data collection found the highest levels of metals in sediment samples close to shore, as opposed to those collected further offshore. This is in agreement with findings from the 2002 data collection and appears to support the theory that urban runoff is one of the major contributing sources for metal contamination in the lagoon sediment. A detailed discussion of the sediment sample results as well as the laboratory analytical reports are included in Appendix C.2.

## 4.3 HISTORICAL ASSESSMENT OF THE LAGOON FROM AERIAL PHOTOGRAPHS

A historical assessment of the lagoon environment was completed simultaneously with the historical assessment of the land area. A detailed description and visual analysis of the aerial photographs are included in Section 2.4. DEQ marine biology staff members were instrumental in the interpretation of changes in the lagoon environment apparent in the aerial photographs. Historic aerial photograph comparisons indicate that the nearshore lagoon ecosystem has shifted from a healthy seagrass and sandy-bottom community to a less healthy, macroalgae dominated community in response to heavy urbanization and development within the watershed both currently and in the past. A detailed assessment of the lagoon environmental change observed from aerial photographs of the study area is included in Appendix C.3.

## 4.4 INSHORE LAGOON SEAGRASS AND ASSOCIATED FAUNA SURVEY

The MMT Saipan Lagoon monitoring effort has completed an inventory of the lagoon, including the study area. Results of the initial assessment efforts in the study area indicate that the inner lagoon habitats are affected by increased nutrients associated with stormwater from the West Takpochau watershed reaching the drainages and shores in this region, and entering the lagoon. These habitats have high abundances of seasonal macroalgae growth when compared to outer lagoon habitats. The MMT has designated 18 habitat classifications within the lagoon. Detailed descriptions of the habitats that exist within the study area are included in Appendix C.4.

## 4.5 INVENTORY OF POTENTIALLY CONTAMINATING ACTIVITIES IN WATERSHED

An integral part of this aquatic ecosystem restoration study was to identify land-based sources of pollution that could potentially contribute nutrients, sediments, or contaminants to the lagoon. PCAs within the study area were inventoried and subjected to a susceptibility analysis. Fifty four (54) sites were identified during the PCA inventory. The number and category of PCAs found within the study area were used to quantify the environmental output that would result from implementing the restoration alternatives. A detailed discussion and inventory of the PCAs within the study area are included in Appendix C.5.

## 4.6 GROUNDWATER INVESTIGATION

Nearshore groundwater samples were collected along the entire length of the study area and beyond in March, June, and August, 2002, in an effort to determine the impact of on-shore surface contaminants on the lagoon via groundwater infiltration. The 2002 analytical results indicate that there are elevated nitrate levels in nearshore groundwater infiltrating to the lagoon. Nitrate levels of nearshore coastal marine waters may be affected by activities within the watershed.

Although semi-annual groundwater monitoring, including monitoring for nitrate indicators, has been required by the DEQ for many years, more recent groundwater data collected within the study area are not available due to the lack of a comprehensive groundwater management plan that includes methods for analyzing the collected samples and actions to be taken based on the data collected (DEQ, 2010). The nearshore groundwater nitrate results from 2002 are included in Appendix C.6.

## 4.7 HYDROLOGIC STUDY OF RUNOFF PROCESSES IN THE WATERSHED

### 4.7.1 Rainfall and Runoff Data Collection

In order to help determine general comprehensive hydrologic processes within the study area, rainfall and runoff data were collected in 2002 from rain gauges, transducers, and by manual measurements within the study area. Stormwater peak flow rates at nearshore locations were found to range from 12 gallons per minute (gpm) to 1,000 gpm at individual discharge locations. Although no additional rainfall data has been collected at the study area since 2002, the 2002 data indicates that large volumes of runoff from the steep upper/inland portion of the watershed flows down onto Beach Road and enters the lagoon via surface sheet flow during large rain events. Rainfall and runoff data collected in 2002 as well as a detailed discussion of the results are included in Appendix C.7.

### 4.7.2 Sediment Delta Surveys

In an effort to quantify the sediment load entering the lagoon via stormwater runoff, three sediment deltas within the study area were surveyed five times from 2001 to 2002, during both the wet and dry seasons. The approximate volumes of the sediment deltas were measured and compared against the corresponding monthly rainfall data during each monitoring event. The change in sediment delta volume throughout the study interval varied among the survey locations. The total volume of sediment lost from the three deltas during the study interval was 478 cubic yards. The volume of sediment lost was most likely washed into the lagoon during the two-month period. The results of the sediment delta surveys are included in Appendix C.7.

## 4.8 LAGOON WATER QUALITY INVESTIGATION

In order to obtain general lagoon water quality data, lagoon water samples were collected by DEQ personnel from February 2002 to February 2003. Samples were collected in nearshore waters adjacent to three storm drains located within the study area and one storm drain located immediately south of the study area. Samples were analyzed for microbiological and chemical parameters by the DEQ Environmental Surveillance Laboratory. The analytical results were compared against the CNMI water quality criteria for Class AA marine waters (DEQ, 2010).

During the 2002-2003 sampling period, water quality standard exceedances were regularly observed for instantaneous enterococci measurements, DO, turbidity, hydrogen activity (pH), nitrate, and orthophosphate, although strong correlations among the measured parameters were not noted. Average values of the water quality sample results for the 2002-2003 sampling period during the wet season (July through November) and dry season (December through June) were calculated for all parameters except fecal coliform. Enterococci values were consistently higher at all four sample locations during the wet season than during the dry season, as was turbidity at three sample locations. Salinity was consistently higher during dry season sampling events at all four sample locations, as were DO and chloride. These patterns fit the general presumption that nearshore lagoon waters are affected by an increased volume of stormwater runoff during the rainy season, leading to an increase in turbidity and microbial contamination. During the dry season, less freshwater runoff is experienced, leading to higher salinities and chlorides, and lower turbidity and less microbial contamination.

The DEQ currently monitors 38 fixed stations along Saipan's most used west coast beaches on a weekly basis for microbiological and chemical parameters. Four of these fixed stations occur within the study area. During a more recent monitoring period (July 2010 to June 2011), water quality standard exceedances were regularly observed for instantaneous and GM enterococci measurements, DO, turbidity, and pH, although strong correlations were not noted.

As a comparison, average values of the 2010-2011 monitoring data for the wet season and dry season were also calculated. No significant correlation between the season and the water quality parameters were observed for the 2010-2011 monitoring data, which is not entirely surprising given the short period of time analyzed. This may indicate that other factors play a role in the transport of contaminants to the lagoon. There may be periodic releases of pollutants not associated with rainfall, a better system of contaminant uptake, a natural filtration or buffering of stormwater runoff prior to discharging into the lagoon, or a difference in upgradient land use. The lagoon water sample results are included in Appendix C.8.

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# 5. RESTORATION ALTERNATIVE EVALUATION

In order to achieve the overall project goal of restoring the lagoon aquatic ecosystem structure, function, and dynamic processes to a less degraded and more natural condition, restoration alternatives were formulated with the goal of restoring the ecosystem to be self-sustaining in its substantially modified environment. This section discusses ecosystem restoration policy, the restoration alternative formulation process, the evaluation of restoration alternatives using cost effectiveness (CE)/incremental cost analysis (ICA), as required by the *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies* developed by the Water Resources Council (WRC) (WRC, 1983), and the selection of the best restoration alternative. The CE/ICA was conducted using the USACE Institute of Water Resources (IWR) Planning Suite Decision Support Software. A detailed description of the processes used as part of the CE/ICA for the evaluation of the restoration alternatives is included in Section 5.9.

## 5.1 ECOSYSTEM RESTORATION POLICY OVERVIEW

Applicable policy governing USACE restoration projects include the *Planning Guidance Notebook* (ER 1105-2-100) and the *Ecosystem Restoration Guidance* (ER 1165-2-502 in support of ER 1165-2-501). Ecosystem restoration reestablishes a self-maintaining state that optimally should require very little human intervention.

Additionally, the entire ecosystem is the target of transformation by restoration, as opposed to a specific species or a single component of habitat. Ecosystem restoration includes the entire biotic community together with its physical environment, considered as an integrated unit (EP 1165-2-502). Often, only partial ecosystem restoration is practical, but the parts restored are done so holistically.

According to USACE policy requirements, restoration projects should conform to the following constraints:

- the project should restore ecosystem structure, functions and values;
- the project should result in improved environmental quality;
- the sum of all monetary and non-monetary benefits should exceed the sum of all monetary and non-monetary costs;
- the measures taken to improve environmental quality should result in a more naturalistic and self-regulating system; and
- the measures should reestablish, to the extent possible, a close approximation of pre-existing conditions.

Constraints specific to this study are included in Section 3.4.

## 5.2 RESTORATION PLAN FORMULATION PROCESS

Restoration plan formulation strategies are based on guidelines set forth by the USACE Ecosystem Restoration Planning and Evaluation Program. There are two primary principles applied when determining plans:

1. Plans must meet each of the planning objectives without violating any constraints such as regulatory, economic, or social constraints.
2. Plans must be based on institutional, technical, and public variables that are important to the entities involved (i.e., local cooperators, community, and USACE).

In order to fulfill the above principles, USACE guidelines offer the following criteria that a restoration plan must meet:

- must address the objectives of the project;
- must define the management measures that are required for the alternative;
- must be able to estimate the total cost of the alternative; and
- must be able to estimate a positive, quantifiable output.

In an effort to find the best possible solution for areas in need of restoration, alternative restoration plans have been developed as part of the formulation process. Exploring and developing alternative plans is beneficial because it leads to the best possible solution by encouraging creative thinking, allowing a broad view of the natural resources and planning perspective, and promoting a greater understanding of natural processes, risks, and concerns associated with the project.

## 5.3 FORMULATION OF ALTERNATIVE PLANS

The following management measures were considered during the initial alternative formulation process:

- no action;
- capturing and pumping contaminants offshore;
- erosion control; and
- detention basins.

The no action alternative was considered to be unresponsive to the needs of the local sponsor and was eliminated from further evaluation. The no action alternative was, however, included in the alternatives analysis in the EA (Appendix A) as well as in the CE/ICA as required by the Council of Environmental Quality (CEQ) regulation 40 Code of Federal Regulations (CFR) Section 1502.14(d).

Capturing and pumping contaminants offshore was eliminated from further evaluation because CNMI stated that they cannot afford to maintain the mechanical pumps. In addition, this management measure would not fulfill the objective of this study since it would not reduce the amount of nutrients/sediment entering the lagoon but would rather relocate them offshore. This would not result in an overall restoration of the lagoon ecosystem, which is the ultimate goal of this study; therefore was not carried forward for further evaluation.

Erosion control within the upper portion of the watershed was not carried forward for further consideration because it was not considered feasible to manage or control the widespread areas within the watershed that contribute to the input of sediment/nutrients to the lagoon via stormwater runoff. Many roads remain unpaved within the watershed, and clearing of natural vegetation that makes the native soil susceptible to erosion is expected to increase with the increased urbanization that is expected to occur within the study area. It was considered inefficient and impractical to consider implementing erosion control in all of these areas. Although not carried forward for consideration as one of the management measures, erosion control including paving or armoring unpaved roads, land use controls, public education, reforestation, and enforcing existing CNMI regulations for new construction projects to reduce or control the amount of sediment and runoff generated within the study area are recommended as one of the local BMPs to be implemented by the CNMI Government in conjunction with the management measure recommended in this study (see Section 5.11.5).

Construction of detention basins was considered the most cost effective and efficient management measure in addressing the objectives of the study by efficiently collecting the majority of sediment, nutrient, and contaminant laden runoff that would otherwise become directly washed into the lagoon. The detention basins would capture and temporarily retain stormwater runoff from the upper watershed and allow suspended sediment and nutrients to settle out before stormwater is released to the lagoon, thereby reducing the amount of sediment and nutrients that is transported to the lagoon. Sources of excess sediment, nutrient, and contaminants that reach the lagoon are spread out throughout the study area, and construction of detention basins would be most efficient in collecting the runoff from the upper watershed prior to it reaching the lagoon; therefore, was carried forward for further evaluation. As discussed further in the following section, three detention basin sites within the study area were selected, each with three storage capacities. A combination of two or more of these detention basins sites were considered in formulating and evaluating a restoration alternative that would best achieve the study objectives.

## 5.4 DESCRIPTION OF FORMULATION ALTERNATIVES

Three detention basin sites were considered to achieve the overall project goal of restoring the Saipan Lagoon aquatic ecosystem structure, function, and dynamic processes to a less degraded and more natural condition. Dual-purpose type uses, such as soccer fields or parks, for the detention basins were originally considered but the project sponsor evaluated the level of effort that would be required for maintenance and upkeep and determined that it was impractical and could not be supported. Three sizes of dry detention basins were designed for each of the three sites, corresponding to the expected influx of water during a two-year rainfall event, a five-year rainfall event, and a 10-year rainfall event. There are thus a total of nine possible detention basins over three different sites. A detailed description and design for each detention basin are included in the Preliminary Drainage Design Report prepared for the project (Appendix F).

The three sites evaluated through the CE/ICA are located within the southern portion of the West Takpochao watershed (Figure 7). The three sites were selected based on available vacant land within the vicinity of Beach Road and Middle Road, and had to meet the requirement of being low-lying areas that flood during heavy rains. Placement of a detention basin at a location where stormwater runoff naturally accumulates was considered most appropriate in capturing runoff that flows down the steep upper/inland part of the watershed. The three sites were evaluated in terms of the amount of freshwater they could hold (capacity), the percent of the watershed that would drain into the detention basin, and the relative amount of sediment, hazardous runoff, and runoff loading they would receive compared to the amount generated within the entire study area.

### 5.4.1 China House Site

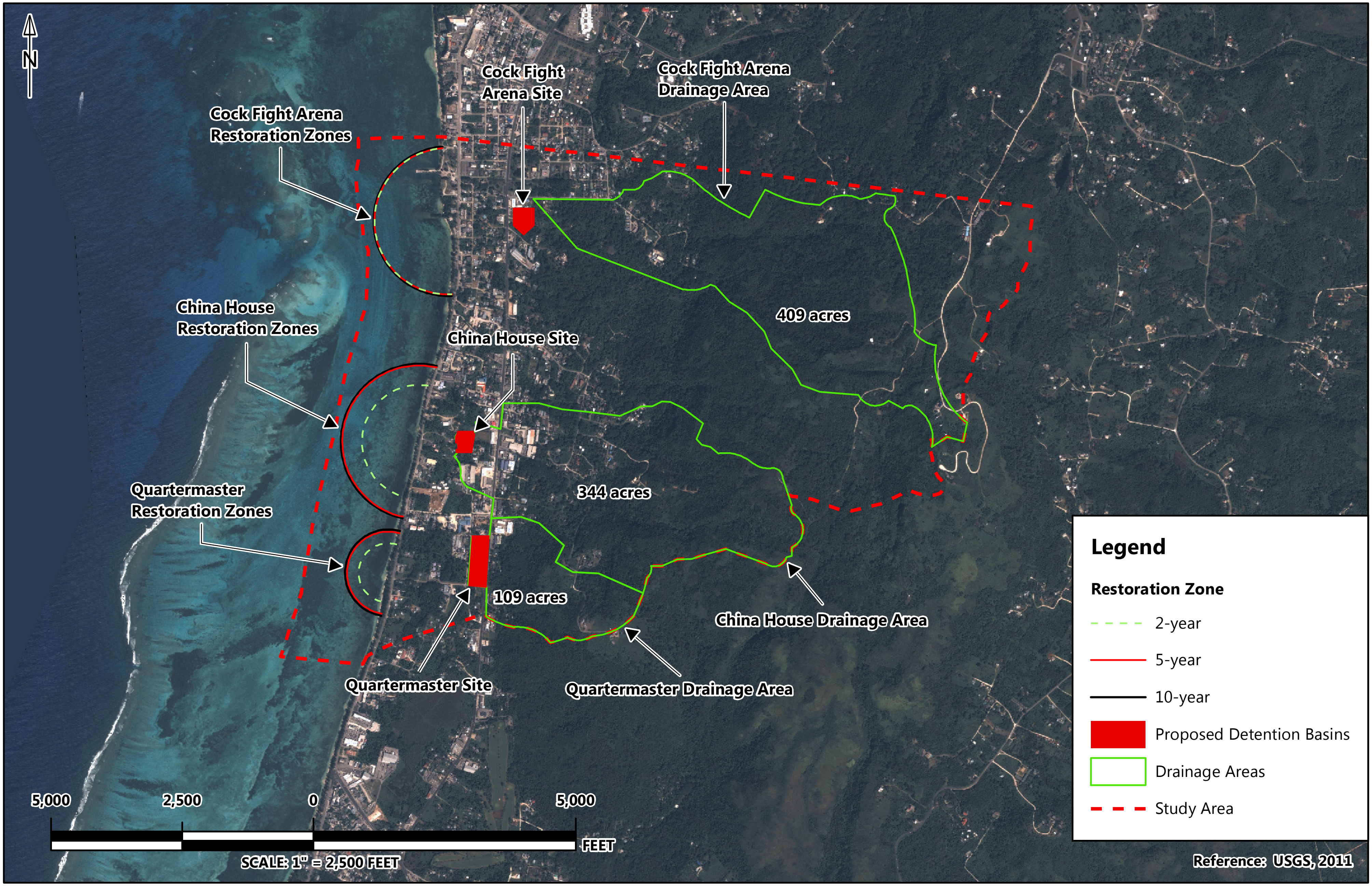
The proposed China House site is approximately 2.8 acres in area and is located in the mid-southern portion of the study area, about halfway between Middle and Beach Roads. The China House site occurs between Middle Road, across from the Pizza Hut building, and Beach Road near the China House restaurant. Topographically, the site is characterized by a natural drainage channel that flows to an outfall located along Beach Road in the center of the proposed site. The remaining site area is predominantly flat to slightly sloping (approximately 3.5%) toward Beach Road and the lagoon.

The site currently serves as a natural drainage area for surface water from Middle Road and the upper parts of the Gualo Rai area. Surface water reaches the lagoon through this area via surface sheet flow and through the natural swale. There is currently a stormwater catch basin, located along Middle Road adjacent to Pizza Hut, which collects surface water and diverts it beneath Middle Road, and into the proposed detention basin site. During medium to large storm events, the catch basin is insufficient to handle the volume of runoff and severe flooding occurs along Middle Road at the Pizza Hut location. The topographic nature of this site is conducive to the construction of a detention basin. The entire parcel of the site is currently publicly owned.

### 5.4.2 Quartermaster Site

The proposed Quartermaster site is approximately 6.6 acres and located at the southern-most end of the study area. The site is located at the intersection of Quartermaster Road to the south and Middle Road to the east. The site is currently vacant and overgrown, and generally slopes to the southwest corner at approximately 4 to 5%. Several commercial and residential buildings lie adjacent to the proposed site.

Quartermaster Road, together with adjacent swales, serves as a major drainage route for surface water during rain events. A drainage culvert is located beneath Middle Road at the intersection of Middle and Quartermaster Roads. The contributory area to surface runoff in this area includes Middle Road and areas in the southern portion of the West Takpochao watershed. A detention basin that would act as a settling pond for sediment and contaminants prior to discharging surface water to the lagoon would be constructed at this site. The land required for the site is currently privately owned.



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| PROJECT NO.: 1057 | ECOSYSTEM RESTORATION REPORT<br>SAIPAN LAGOON AQUATIC ECOSYSTEM RESTORATION STUDY | FIGURE 7 |
| DATE: SEPTEMBER 20, 2012 | | |
| DRAWN BY: CB | PROPOSED DETENTION BASINS AND DRAINAGE AREAS<br>SAIPAN, CNMI | |
| REVIEWED BY: MA | | |

### 5.4.3 Cock Fight Arena Site

The proposed Cock Fight Arena site is approximately 4.2 acres in area and is located on the east side of Middle Road at the northern end of the study area. The closest cross street is Commonwealth Road, located approximately 200 feet north of the Cock Fight Arena site. This site is characterized by an abandoned quarry pit that occupies roughly one third of the site, in the southeastern corner. The depression of the pit extends approximately ten feet in depth at its deepest point. The remaining portion of the site is predominantly flat to slightly sloping (at approximately 12%) in the direction of the quarry depression. The arena is currently located on the western side of the site. Commonwealth Road acts as a major channel for surface runoff water from a large contributory area during medium to large flood events. During rain events, surface water streams down Commonwealth Road and into storm drains located at the intersection of Commonwealth Road and Middle Road. The storm drain diverts the water north toward Garapan and into a large surface water outfall that enters the lagoon near the Dai Ichi Hotel. The area of restoration for this alternative thus may extend north of the study area indicated on Figure 7. The contributory area for surface flow in this area includes many unpaved areas in the upper reaches of the watershed, leading to large amounts of sediment transport from the upper reaches of the watershed to the lagoon. During medium to large rain events, the current storm drain is insufficient to handle the amount of flow that occurs, resulting in severe flooding at the intersection of Commonwealth Road and Middle Road, and the surrounding areas. The land required for the site is currently privately owned.

## 5.5 REAL ESTATE REQUIREMENTS

USACE Civil Works policy requires the local sponsor provide all LERRD for the project construction, operation, and maintenance of the proposed action.

The China House site would require acquisition of the entire lot (Parcel 1833) which is approximately 12,550 square meters ($m^2$), and an estimated 1,823 $m^2$ of channel improvement easement for the out-flow works. Additionally, permanent access encompassing approximately 972 $m^2$ from Middle Road to the site would be required since there is no direct public access to the China House site.

The Quartermaster site would require acquisition of the entire Parcel 1826-4 (approximately 1,507 $m^2$), partial acquisition of Parcel 1826-R1 (approximately 2,000 $m^2$, 3,780 $m^2$, and 6,113 $m^2$ for the two-year, five-year, and 10-year design, respectively), and partial acquisition of Parcel 1822 (approximately 946 $m^2$, 2,000 $m^2$, and 2,500 $m^2$ for the two-year, five-year, and 10-year design, respectively). In addition, the Quartermaster site would require approximately 3,400 $m^2$ for channel improvements to an existing swale.

The Cock Fight Arena site would require acquisition of the entire Parcel 078 D 01 (approximately 5,378 $m^2$), partial acquisition of Parcel 25-4 (approximately 10,080 $m^2$), and partial acquisition of Parcel EA 693-2 (approximately 1,140 $m^2$). The cock fight arena, which is an approximately 12,500-$m^2$ structure located at the site would be acquired and demolished for the project. In addition to the land required at the site, land area to accommodate approximately 2,200 linear feet of an 18-inch RCP for the diversion outlet flow is required for the Cock Fight Arena site.

The Quartermaster and Cock Fight Arena sites are both located on public roads and would have readily available access for the implementation of the project. Additional information regarding real estate requirements and associated costs for the project are included in the Real Estate Planning Report (Appendix G).

## 5.6 OPERATION AND MAINTENANCE

Implementation of detention basin systems would require ongoing maintenance in order to assure their efficient and proper function. The local project sponsor will be responsible for the operation and maintenance of the completed project. The following maintenance activities should be conducted on an annual basis before the rainy season:

- cutting of grass and weed removal in and around the basin and within the outlet swales;
- removal of accumulated sediment from the basin bottom to maintain designed capacity; and
- clearing of the basin inlet of debris, leafs, and any sediment.

## 5.7 DESCRIPTION OF COSTS

Each detention basin was characterized in terms of its cost and expected benefits. The preliminary CE/ICA was performed using cost estimates associated with each detention basin, which was based on the sum of the real estate cost and construction cost. Real estate costs were based on the Real Estate Planning Report prepared for the study (Appendix G). Construction costs were developed for features identified in the Preliminary Drainage Design Report prepared for the study (Appendix F). It is important to note that the estimated construction costs for the detention basins do not include annual operation or maintenance costs. A recommended plan for regular basin maintenance is included in Section 5.6.

Further refinement of the costs for a more realistic and accurate estimates were only completed for the three alternatives which were retained following the preliminary CE/ICA. The three alternatives retained for the final ICA were subjected to an Abbreviated Cost and Schedule Risk Analysis. From this risk analysis, the contingencies were calculated from a risk register with risk elements collaborated on from the PDT. Once the contingencies were calculated, they were placed in the Total Project Cost Summary (TPCS) along with the construction cost; real estate cost; the planning, engineering, and design cost; and the construction management cost. All of these costs were added together, along with the monies spent (i.e., the feasibility study cost) and an escalation factor, to determine the total project cost of each alternative. TPCSs that include a detailed breakdown of the total projects costs as well as the risk registers used to calculate the contingencies for each alternative are included in Appendix H.

Table 5 shows the breakdown of the total project cost for each of the three alternatives retained for the final ICA. Prefixes C, Q, or A refers to the China House, Quartermaster, or Cock Fight Arena site, respectively. Numeral 0, 1, 2, or 3 refers to the no action, two-year, five-year, or 10-year design level, respectively. For example, A1 is the Cock Fight Arena 2-year design while Q0 refers to the Quartermaster no action alternative.

**Table 5: Cost Breakdown of Alternatives Retained for Final ICA**

| Combination | Construction Cost | Real Estate Cost | Planning, Engineering, and Design | Construction Management | Operation and Maintenance | Feasibility Study | Total Project Cost |
|---|---|---|---|---|---|---|---|
| C0 Q0 A1 | $2,986,000 | $1,062,000 | $2,345,000 | $576,000 | $5,600 | $1,483,000 | **$8,451,000** |
| C2 Q0 A1 | $7,769,000 | $1,680,000 | $2,561,000 | $785,000 | $9,800 | $1,483,000 | **$14,277,000** |
| C2 Q2 A1 | $10,723,000 | $2,288,000 | $2,674,000 | $912,000 | $12,300 | $1,483,000 | **$18,079,000** |

Notes:
1. Construction and real estate costs include contingencies (see Appendix H).
2. Construction costs include post-construction monitoring costs.
3. Operation and maintenance costs shown are annual costs and are not included in the total project cost. The local project sponsor is responsible for providing operation and maintenance costs associated with the proposed detention basins.

## 5.8 DESCRIPTION OF BENEFITS

Identification of a quantifiable environmental output serves to establish a measure of success for the implemented restoration plan. Ideally, an environmental output should be quantifiable and able to be documented. Commonly used environmental outputs are acres of habitat restored and habitat units restored (e.g., number of fish, plants, or acres of restored habitat).

The total lagoon acreage assumed to fall within the potential restoration zone includes the area of the lagoon from Quartermaster Road at the southern end to just beyond the Garapan Fishing Dock at the northern end, the shoreline, and the extent of the seasonal macro-algal zone which occurs approximately 1,500 feet from the shoreline (Figure 7). This area totals approximately 371 acres. Implementation of restoration alternatives will most likely positively impact waters beyond this area, but for evaluation purposes these boundaries were chosen because they will see the most dramatic changes.

For this study, the habitat restoration does not target a single fish or plant species. The premise behind this restoration study is to restore the habitat of the entire nearshore lagoon aquatic ecosystem. Therefore, the single habitat unit comparison developed for this study is based on the number of acres of lagoon aquatic ecosystem (i.e., a nearshore, shallow, marine environment with low abundances of seasonal macroalgae, and high abundances of sand and coral, with some nearshore seagrass beds) that are restored. For the purpose of the CE/ICA, the following broad habitat type category has been identified and quantified.

- Nearshore lagoon habitat (1 lagoon habitat unit [LGHU] = 1 equivalent acre of restored nearshore lagoon water habitat).

Restored nearshore lagoon habitat refers to areas of the lagoon that would be positively impacted by the restoration alternative. One equivalent acre consists of the following quantifiable components. It is assumed that improvement of the following components of the lagoon is indicative of a restored and more natural condition of the lagoon state:

1. Decrease in percent cover of nearshore nuisance macroalgae.
2. Decrease in percent cover of nearshore and mid-lagoon seasonal macroalgae.
3. Lowered turbidity of nearshore water.

4. Decrease in incidents of microbial contamination of nearshore water.
5. Decrease in nutrient concentration of nearshore lagoon water.

While these components are quantifiable and will be used in conjunction with other components to gauge the success of implemented restoration alternatives, it is not practical to assign numerical values or projected goals to these components for purposes of the CE/ICA. It is also important to note that success of the detention basins will be augmented by local implementation of land use controls and other BMPs for contaminant reduction in the West Takpochao watershed.

The number of LGHUs expected to be restored was calculated by first estimating the lagoon acreage that would be impacted by constructing each detention basin at the three sites. Each of the three proposed detention basin designs has three different storage capacities of freshwater, and it is unlikely that the smallest basin would have a positive effect on all 371 acres of the restoration zone. For each variable evaluated below, there is thus some application of the reduction factor “Y”, calculated as:

Y = (Average annual reduction in runoff for the detention basin design / average annual reduction in runoff for the 10-year detention basin design).

Appendix I includes the calculations used to estimate the average annual reduction in runoff for each drainage basin.

The overall benefit was estimated by evaluating several factors such as hazardous waste runoff, sedimentation, storage capacity of the different basins and basin sizes, and runoff from PCAs. Each of the following factors is expressed in terms of the LGHUs restored, in equivalent acres. Individual tables showing how each of the factors was calculated are included in Appendix I.

FW: acres of lagoon restored by reducing freshwater runoff. FW was calculated by the following four-step process:

1. divide the average annual runoff reduction of the basin by the average annual runoff reduction of that basin’s 10-year estimate (Reduction factor “Y”);
2. divide the drainage area for the basin by the total watershed area and convert to a percentage;
3. multiply the percentage calculated in step 2 by 371 (the total lagoon acres within the restoration zone); and
4. multiply the result of step 3 by the result of step 1. The result, FW, is an estimate of the acres of lagoon restored by reducing freshwater runoff for each of the nine potential designs.

As an illustrative example, the China House detention basin storage capacity of the two-year design was calculated at 4.765 acre-feet (ac-ft) (see Appendix F). FW for the two-year China House design was calculated as follows:

1. Y = 3.38315 / 6.35629 = 0.53225

2. 344 / 2000 * 100 = 17.2%

   344 is the drainage area for the China House detention basin, while 2000 is the drainage area of the entire watershed within the study area;

3. 371 acres * 0.172 = 63.812 acres

   371 is the total acreage of the "restoration zone" within the lagoon. It was multiplied by 0.1720, the percentage of the China House basin drainage area comprising the entire watershed area within the study area; and

4. 63.812 acres * 0.53225 = 33.964 acres = FW

   63.812 acres is the total acres of lagoon estimated to be restored by implementing the China House design. However, the two-year design does not have the same storage capacity as the 10-year design, and thus the factor calculated in step 1 is applied to account for the difference in storage capacity. FW for the China House two-year design is 33.964 acres.

R: acres of lagoon restored by reducing runoff from runoff PCAs. This factor is based on the inventory of PCAs (Appendix C.5). To calculate R, the number of runoff PCAs within the drainage area for each drainage basin was divided by the total number of runoff PCAs identified in the study area. This factor was multiplied by the reduction factor Y, and by 371 (the total lagoon acres within the restoration zone). The result, R, is an estimate of the acres of lagoon restored by reducing runoff PCAs for each of the nine potential detention basin designs.

H: acres of lagoon restored by reducing runoff from hazardous waste PCAs. This factor is also based on the inventory of PCAs. To calculate H, the number of hazardous waste PCAs within the drainage area for each detention basin was divided by the total number of hazardous waste PCAs identified in the study area. This factor was multiplied by the reduction factor Y, and by 371 (the total lagoon acres within the restoration zone). The result, H, is an estimate of the acres of lagoon restored by reducing hazardous waste PCAs for each of the nine potential designs.

S: acres of lagoon restored by reducing sedimentation. This factor is based on estimating the number of acres of unvegetated and/or unpaved land within the drainage area for each detention basin, and within the entire study area, using Google Earth. To calculate S, the estimated number of acres of unvegetated/unpaved land within the drainage area for each detention basin was divided by the estimated number of acres of unvegetated/unpaved land within the entire study area. This factor was multiplied by the reduction factor Y, and by 371 (the total lagoon acres within the restoration zone). The result, S, is an estimate of the acres of lagoon restored by reducing sedimentation for each of the nine potential designs.

In addition to the runoff and hazardous waste PCAs, the PCA inventory identified several sedimentation and nutrient PCAs within the study area (Appendix C.5). Because of the limited number of nutrient PCAs that were identified within the study area, the calculation of nutrient runoff was not considered in the LGHU calculation. The small number of nutrient PCAs was considered to have a negligent impact on the outcome. The sedimentation factor calculation was based on Google Earth and not on the number of sedimentation PCAs to include unvegetated/bare land in the upper watershed within the study area that were not identified during the PCA inventory. This method was considered to result in a more accurate estimate of sedimentation that occurs within the study area.

An CE/ICA can only be conducted by comparing one cost parameter with one output parameter. The four factors described above had to be combined into one output parameter. To accomplish this, a derived variable was calculated by weighting each of the four factors described above. The derived variable LGHUs was calculated by the formula below.

$$\text{LGHUs} = 0.7\text{FW} + 0.1\text{R} + 0.1\text{H} + 0.1\text{S}$$

FW was assigned the heaviest weight because it is the primary vehicle for transportation of pollutants such as nutrients, hazardous materials, and sediment. The three other components were assigned equal weights because they all contribute to degradation of the lagoon habitat, albeit through different mechanisms.

Table 6 shows the calculated and derived variables used to conduct the preliminary CE/ICA. The Cock Fight Arena site had identical storage capacities for the two-year and five-year designs, thus the values in the table are identical for the two-year and five-year design levels.

**Table 6: Derived Variables Used to Conduct the CE/ICA**

| Management Measure | Site/ Design Level | Cost Estimate* | FW (acres) | R (acres) | H (acres) | S (acres) | LGHUs (equivalent acres) |
|---|---|---|---|---|---|---|---|
| C1 | China House Two-Year | $2,164,900 | 33.96 | 60.76 | 43.20 | 83.25 | 42.50 |
| C2 | China House Five-Year | $3,376,000 | 61.27 | 109.61 | 77.93 | 150.19 | 76.66 |
| C3 | China House 10-Year | $4,810,800 | 63.81 | 114.15 | 81.16 | 156.41 | 79.84 |
| Q1 | Quartermaster Two-Year | $1,485,800 | 9.30 | 13.13 | 10.67 | 24.33 | 11.32 |
| Q2 | Quartermaster Five-Year | $2,118,000 | 18.29 | 25.82 | 20.98 | 47.85 | 22.27 |
| Q3 | Quartermaster 10-Year | $2,757,500 | 20.22 | 28.54 | 23.19 | 52.89 | 24.62 |
| A1 | Cock Fight Arena Two-Year | $2,747,800 | 74.29 | 27.68 | 44.97 | 110.64 | 70.33 |
| A2 | Cock Fight Arena Five-Year | $5,231,500 | 74.29 | 27.68 | 44.97 | 110.64 | 70.33 |
| A3 | Cock Fight Area 10-Year | $5,686,300 | 76.61 | 28.54 | 46.38 | 114.10 | 72.53 |

FW = Acres of lagoon habitat restored by reducing freshwater runoff.
R = Acres of lagoon habitat restored by reducing runoff from runoff PCAs identified during the study.
H = Acres of lagoon habitat restored by reducing runoff from hazardous waste PCAs identified during the study.
S = Acres of lagoon habitat restored by reducing sedimentation.
LGHUs = lagoon habitat units, or equivalent acres of lagoon restored by implementing the chosen drainage basin design. This is a derived variable based on FW, R, H, and S.
*Cost estimate is based on the sum of the construction cost and real estate cost prior to adding contingencies.

## 5.9 COST EFFECTIVENESS/INCREMENTAL COST ANALYSIS

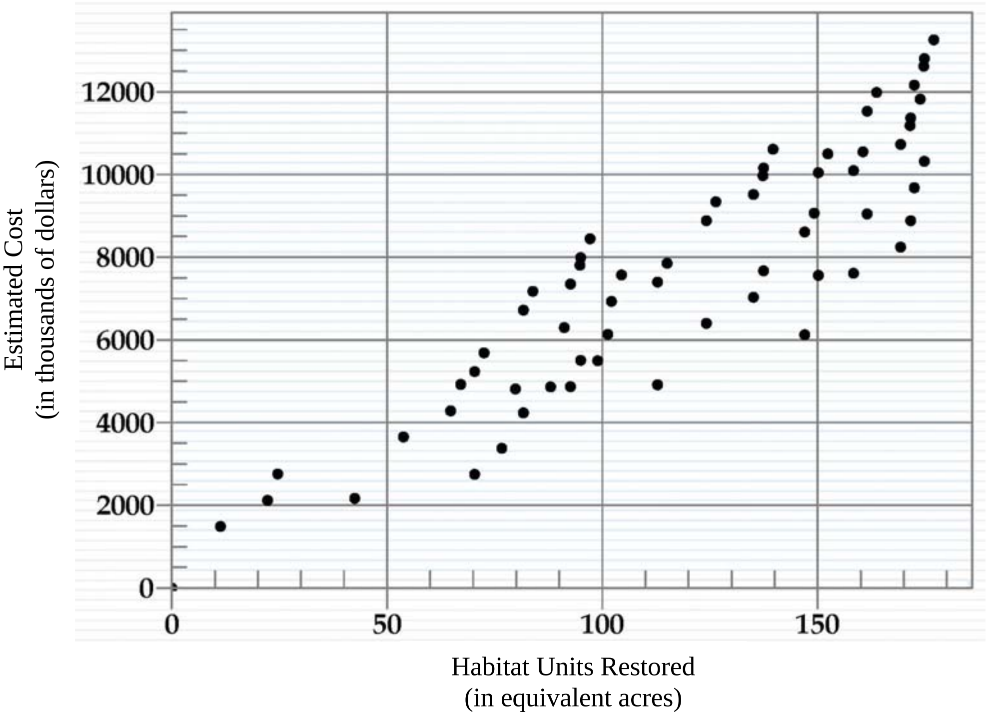
Economic analysis for environmental planning consists of two analytical processes that together form the CE/ICA. CE analysis identifies the least cost alternative for each level of environmental output. Following the CE analysis, an ICA is performed to show the incremental change in project cost with increasing levels of environmental output. The program relies upon IWR Planning Suite Decision Support Software to complete the analyses as part of the following four step process:

1. identify least-cost combinations;
2. identify the cost-effective combinations;
3. apply the ICA to the combinations identified in step 2 above; and
4. evaluate the combinations retained during step 3 above.

### 5.9.1 Least-Cost Combinations

The cost estimates and LGHU variables from Table 6 were used to conduct the preliminary CE/ICA. IWR-Planning Suite first builds all possible alternative plan combinations based on the number of individual restoration sites, whether the sites can be combined with each other (i.e., implemented in tandem), or whether any of the sites are dependent on each other. Based on the assumptions that any or all of the three sites can be developed concurrently, at the no-build, two-year, five-year, or 10-year design level, there are 64 different plan combinations. All 64 combinations are shown on Figure 8 and listed in Appendix J.

**Figure 8: All Plans, Estimated Cost versus Output**

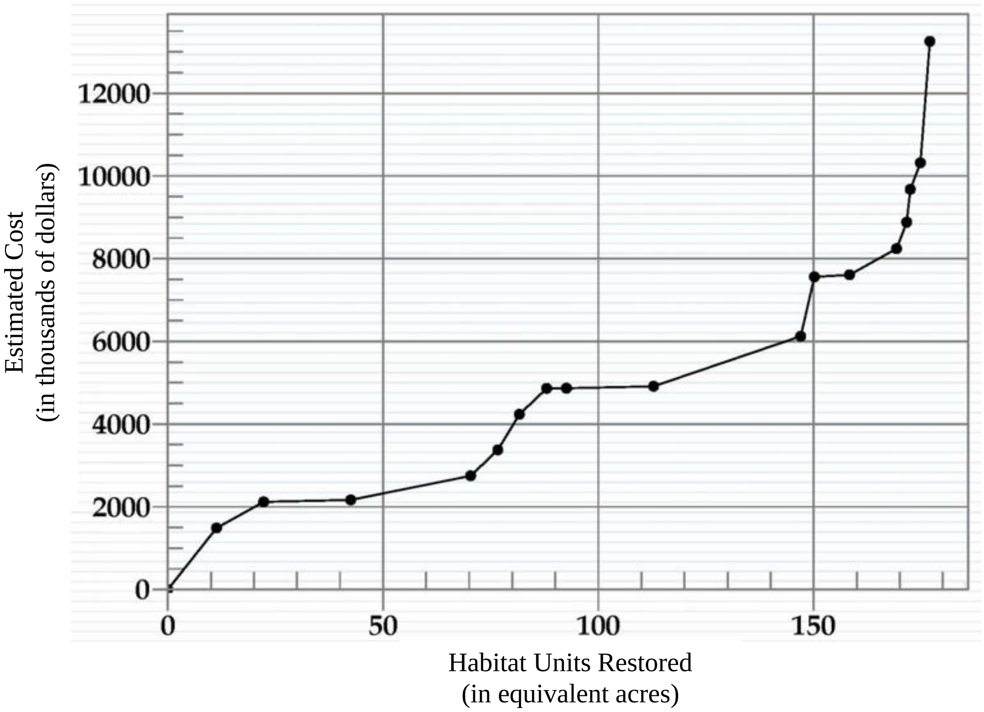


After building all possible plan combinations, inefficient combinations were eliminated by identifying combinations with identical levels of output and eliminating the higher cost alternative. This process results in the identification of a least-cost combination for each level of output produced by the initial list of combinable measures. Forty-eight (48) least-cost combinations were identified in this step.

### 5.9.2 Cost-Effective Combinations

The 48 least-cost combinations identified in step 1 were analyzed for CE by identifying and eliminating those combinations which produce a lower level of output for the same or greater cost than another combination. The CE analysis indicates that there are 18 cost-effective plans. The 18 cost-effective plans are shown in Figure 9 and listed in Appendix J.

**Figure 9: Cost Effective Plans, Cost versus Output**



### 5.9.3 Preliminary Incremental Cost Analysis

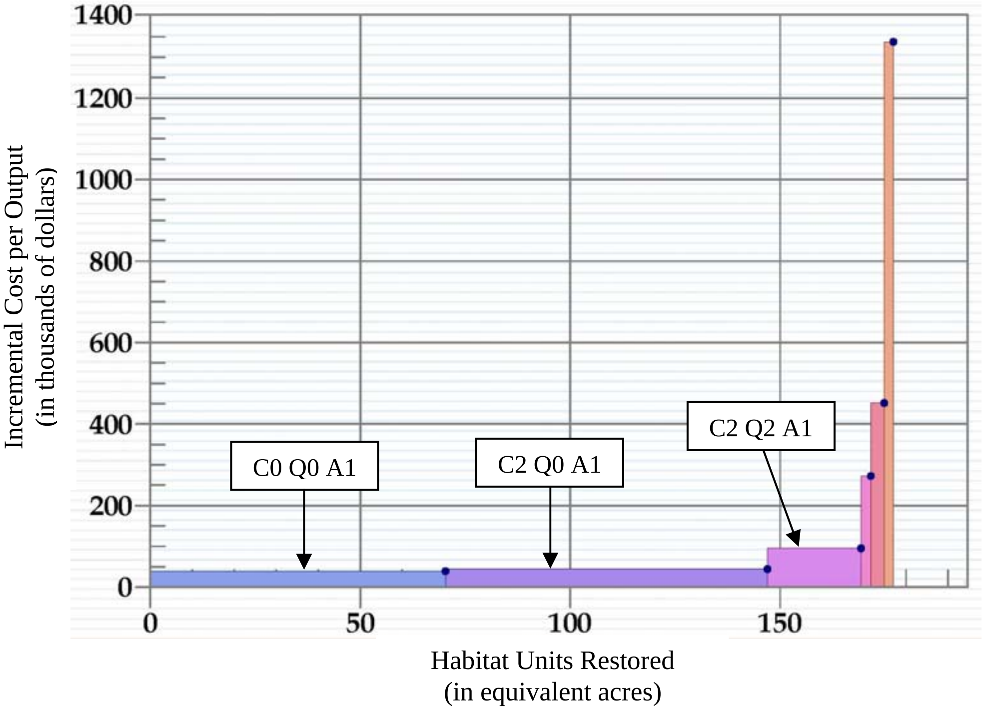
The 18 remaining cost-effective combinations were subjected to a preliminary ICA in which the incremental cost per output between successively larger (i.e., more output) combinations are determined, and the best buy plans as those combinations for which the incremental cost per output is lowest for a particular output level is identified. Seven best buy plans (i.e., the plan combinations with the lowest incremental cost per output level) were retained as a result of this analysis. These seven best buy plans are listed in Table 7 and shown in Figure 10. The tables and graphs generated with the IWR Planning Suite are included in Appendix J.

**Table 7: Best Buy Plans, Preliminary Incremental Cost Analysis**

| Combination | Cost Estimate* | LGHUs (equivalent acres) | Average Cost per LGHU | Incremental Cost | Incremental Output (equivalent acres) | Incremental Cost per Output |
|---|---|---|---|---|---|---|
| C0 Q0 A0 | $0.00 | 0 | $0 | $0 | 0 | $0 |
| C0 Q0 A1 | $2,747,800 | 70.33 | $39,069.0 | $2,747,800 | 70.33 | $39,069.0 |
| C2 Q0 A1 | $6,123,800 | 146.99 | $41,660.2 | $3,376,000 | 76.66 | $44,037.5 |
| C2 Q2 A1 | $8,241,800 | 169.26 | $48,692.6 | $2,118,000 | 22.27 | $95,114.1 |
| C2 Q3 A1 | $8,881,300 | 171.61 | $51,752.8 | $639,500 | 2.35 | $272,359.5 |
| C3 Q3 A1 | $10,316,100 | 174.79 | $59,021.0 | $1,434,800 | 3.18 | $451,621.0 |
| C3 Q3 A3 | $13,254,600 | 176.98 | $74,8915 | $2,938,500 | 2.19 | $1,337,505.7 |

*Cost estimate is based on the sum of the construction cost and real estate cost prior to adding contingencies.

**Figure 10: Best Buy Plans, Preliminary Incremental Cost Analysis**



### 5.9.4 Evaluation of Alternative Plans

In accordance with ER 1105-2-100, the seven best buy plans were evaluated against the four criteria outlined in the Principles and Guidelines adopted by the Water Resources Council: completeness, efficiency, effectiveness, and acceptability. According to ER 1105-2-100, "completeness is the extent to which the alternative plans provide and account for all necessary investments or other actions to ensure the realization of the planning objectives, including actions by other Federal and non-Federal entities. Effectiveness is the extent to which the alternative plans contribute to achieve the planning objectives. Efficiency is the extent to which an alternative plan is the most cost effective means of achieving the objectives. Acceptability is the extent to which the alternative plans are acceptable in terms of applicable laws, regulations and public policies." Each combination was given a rating (i.e., poor, fair, good, very good, and excellent) for each criterion according to the ability of the alternative to achieve the objectives of the criterion. Table 8 presents the comparative analysis and ratings of the seven best buy plans.

The no action combination (C0 Q0 A0) was given the lowest ranking for all four criteria because it does not meet the study objectives and would not result in any benefits to the environment or the local economy. For the "Completeness" criteria, all combinations (besides the no action combination) was given a "Good" ranking considering that all plans will be implemented in consultation with and with the corporation of the local sponsor, and will also take into account any existing or future plans that would have any impacts on the objectives of this study.

For the "Efficiency" criteria, each combination was given a ranking based on its incremental cost per output (see Table 7 and Figure 10). The last three combinations (C2 Q3 A1, C3 Q3 A1, and

C3 Q3 A3) were given the lowest ranking since their incremental costs are significantly higher than the remaining combinations, adding merely two or three equivalent acres of restoration area for a cost of over $600,000 to almost three million dollars.

For the "Effectiveness" criteria, each combination was given a ranking based on the expected equivalent acres of restoration area under each alternative. The last four combinations (C2 Q2 A1, C2 Q3 A1, C3 Q3 A1, and C3 Q3 A3) are expected to restore 169.26 to 173.98 equivalent acres of the lagoon. In addition, these combinations include the construction of a detention basin at all three proposed sites, which in turn will result in restoration of all three areas of the lagoon; therefore, was given the highest rankings.

For the "Acceptability" criteria, the highest rankings were given to all combinations (except for the no action combination) since all plans are expected to be in compliance with existing laws, regulations, and public policies.

**Table 8: Best Buy Plans, Comparative Analysis**

| Combination | Completeness | Efficiency | Effectiveness | Acceptability |
|---|---|---|---|---|
| C0 Q0 A0 | Poor | Poor | Poor | Poor |
| C0 Q0 A1 | Good | Excellent | Good | Excellent |
| C2 Q0 A1 | Good | Very Good | Very Good | Excellent |
| C2 Q2 A1 | Good | Good | Excellent | Excellent |
| C2 Q3 A1 | Good | Poor | Excellent | Excellent |
| C3 Q3 A1 | Good | Poor | Excellent | Excellent |
| C3 Q3 A3 | Good | Poor | Excellent | Excellent |

Note:
The 5-tiered scale is a subjective scale that includes the following categories in decreasing order used to indicate the degree to which criteria are met: Excellent, Very Good, Good, Fair, and Poor.

The no action combination (C0 Q0 A0) does not meet the study objectives and is considered to be unresponsive to the needs of the local sponsor; therefore, is eliminated from further evaluation. The remaining six combinations, with cost estimates and LGHU output ranging from $2,747,800 to $13,254,600 and 70.33 to 176.98 equivalent acres, respectively are evaluated below.

The first combination (C0 Q0 A1) results in 70.33 equivalent acres of restored area and would most likely impact the northern part of the lagoon (Figure 7) where water quality violation frequencies and metals contamination are observed to be highest based on currently available baseline data of the lagoon. Since this combination does not involve the construction of detention basins at the China House site or the Quartermaster site, areas to be restored with this alternative is likely to be more pronounced within the northern section of the study area compared to the southern portion of the study area. Compared to the without-project conditions, the northern part of the study area would receive less input of nutrient and sediment load as well as experience less frequencies of microbial contamination within the nearshore zone. Less input of nutrient and sediment load would allow slower-growing coral and seagrass to develop within the restoration zone and would prevent the area to become completely replaced by a macroalgae dominant community. This would result in more habitats available for fish and invertebrate species to thrive within the restoration zone. Reduction in the amount of nutrient and sediment input to the lagoon as well as the frequency of microbial contamination is expected to occur as soon as the alternative measure is implemented. Changes in the ecosystem structure of the study area may take up to several years until it is observed. This alternative would contribute to achieve the study objectives and is cost efficient, therefore is retained for further consideration.

The second combination (C2 Q0 A1) results in a total of 146.99 equivalent acres of restored area within the northern part of the lagoon (Figure 7) where water quality violation frequencies and metals contamination are observed to be highest as well as within the mid-portion of the lagoon (Figure 7). Since this combination does not involve the construction of a detention basin at the Quartermaster site, the very southern part of the study area is less likely to be impacted by this alternative. Compared to the without-project conditions, the northern part and the mid-section of the study area would receive less input of nutrient and sediment load as well as experience less frequencies of microbial contamination within the nearshore zone. As with the first combination, less input of nutrient and sediment load would allow slower-growing coral and seagrass to develop within these restoration zones and would prevent the area to become completely replaced by a macroalgae dominant community in the future, resulting in increased habitats that are available for fish and invertebrate species to thrive in. Reduction in the amount of nutrient and sediment input to the lagoon as well as the frequency of microbial contamination is expected to occur as soon as the alternative measure is implemented, and changes in the ecosystem structure of the study area is expected to take up to several years until it is observed. This alternative would contribute to achieve the study objectives and is cost efficient, therefore is retained for further consideration.

The third combination (C2 Q2 A1) results in a total of 169.26 equivalent acres of restored area within portions of the lagoon throughout the study area (Figure 7) since it involves the construction of a detention basin at all three proposed sites. Compared to the without-project conditions, all three restoration zones within the lagoon would receive less input of nutrient and sediment load as well as experience less frequencies of microbial contamination within the nearshore zone. The significant reduction in input of nutrient and sediment load to the lagoon by implementing this alternative would allow slower-growing coral and seagrass to develop, providing increased habitats available for fish and invertebrate species to thrive in. As with the previous two alternatives, reduction in the amount of nutrient and sediment input to the lagoon as well as the frequency of microbial contamination is expected to occur as soon as the alternative measure is implemented, and changes in the ecosystem structure of the study area is expected to take up to several years until it is observed. The larger output expected under this alternative corresponds to an increase in cost; however, it is retained for further evaluation considering that a significant portion of the lagoon is expected to be restored.

The last three combinations; C2 Q3 A1, C3 Q3 A1, C3 Q3 A3, result in a total of 171.61, 174.79, and 176.98 equivalent acres of restored area, respectively. Restoration zones for these alternatives would include areas throughout the study area since they would entail construction of detention basins at all three proposed sites. Compared to the without-project conditions, these alternatives would result in reduction of input of nutrient and sediment to the lagoon as well as reduction in frequencies of microbial contamination within the nearshore zone. These outputs are expected to be observed immediately following the construction of the detention basins and would prevent the shift to a macroalgae dominated community within the restoration zones, allowing for coral and seagrass communities to develop, which in turn, will provide increased habitats for fish and invertebrate species within the area. The outputs expected under these alternatives are large; however the corresponding incremental costs are significantly high. These alternatives do not provide a cost-efficient means of achieving the study objectives; therefore are eliminated from further consideration.

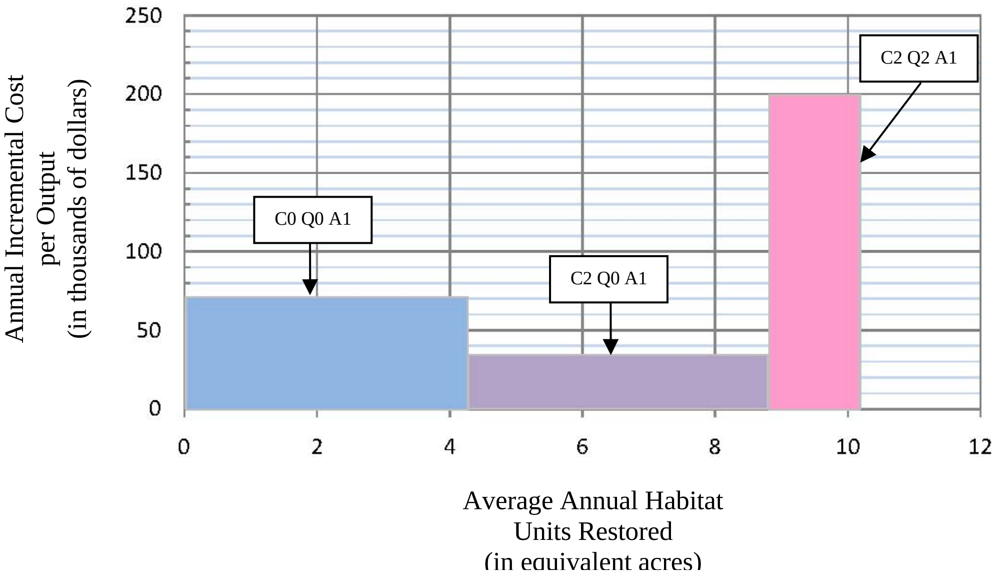
### 5.9.5 Final Incremental Cost Analysis

The three alternatives retained for further consideration were subjected to an Abbreviated Cost and Schedule Risk analysis. Once the contingencies were calculated, they were placed in the TPCS to determine the total project cost for each alternative. The final ICA was performed using annualized total project costs instead of the cost estimates that were used for the preliminary ICA as well as using average annual outputs (Table 9 and Figure 11). The three alternatives are independent of each other, thus the output of each alternative is not dependent on any other alternative nor are the alternatives combinable. Annualization of total project costs and outputs were conducted using the IWR Planning Suite annualization tool. The tables and graphs generated with the IWR Planning Suite are included in Appendix J.

**Table 9: Final Incremental Cost Analysis**

| Combination | Average Annual Cost | Average Annual LGHUs (equivalent acres) | Average Annual Cost per LGHU | Incremental Annual Cost | Incremental Annual Output (equivalent acres) | Annual Incremental Cost per Output |
|---|---|---|---|---|---|---|
| C0 Q0 A1 | $300,375 | 4.22 | $71,182 | $300,375 | 4.22 | $71.18 |
| C2 Q0 A1 | $458,532 | 8.82 | $51,991 | $158,157 | 4.60 | $34.38 |
| C2 Q2 A1 | $723,889 | 10.16 | $71,280 | $265,356 | 1.34 | $198.59 |

**Figure 11: Final Incremental Cost Analysis, Incremental Cost versus Output**



### 5.9.6 Plan Comparison

The first combination (C0 Q0 A1) has the lowest annual cost of all three final alternatives, which also corresponds to the lowest annual number of equivalent acres restored. The restoration area would be mostly observed within the northern section of the study area. The second combination (C2 Q0 A1) adds 4.6 annual equivalent acres of restored area in two distinct areas of the lagoon, which is a two-fold increase compared to the first combination. The jump in annual output is matched by an increase in annual cost from $300,375 to $458,532. Although the cost is much higher compared to the first combination, the average cost per LGHU and incremental cost per output is the lowest of all three final combinations.

The third combination (C2 Q2 A1) is the only combination that includes all three proposed detention basin sites. The incremental cost per output for this combination is much higher than the first two combinations. The increase in the annual output (from 8.82 to 10.16 equivalent acres) compared to the second combination corresponds to a double in annual incremental cost per output (from $34.38 to $198.59). This alternative is considered the most preferred considering that all three restoration zones corresponding to the three detention basin sites will be restored. However, the increase in annual incremental cost per output is not matched by its level of incremental output; therefore, this combination is considered the least preferred from a cost perspective.

## 5.10 SELECTION OF PREFERRED ALTERNATIVE

Comparison of the three alternatives that were retained for the final ICA was carefully reviewed to select the preferred alternative. The comparison discussed in the previous section indicates that the third alternative (C2 Q2 A1) would result in the greatest amount of output but with a high cost. The first alternative (C0 Q0 A1) would be the most cost efficient; however, would have the least amount of output. The second combination (C2 Q0 A1) was considered to be inbetween the first and third alternatives, with a cost and output inbetween the two. The average cost per LGHU and incremental cost per output was the lowest; therefore, the second combination was considered the most cost efficient when considering the unit cost per restored acre of the lagoon.

As discussed earlier in Section 5.9.4, the completeness and acceptability of all three final alternatives are considered to be equal. Efficiency of the three alternatives was ranked based on their incremental cost per output, with the first alternative (C0 Q0 A1) having the highest ranking based on its low cost and the third alternative (C2 Q2 A1) having the lowest ranking based on its high cost. Effectiveness of the three alternatives was ranked based on the expected equivalent acres of restoration area under each alternative, with the third alternative (C2 Q2 A1) given the highest ranking based on its highest amount of output and the first alternative (C0 Q0 A1) having the lowest based on the least amount of output expected.

Based solely on cost, the first alternative (C0 Q0 A1) was considered the most preferred. The second and third alternatives (C2 Q0 A1 and C2 Q2 A1) were preferred over the first combination because they involved construction of a detention basin at more than just one site, which would allow restoration in more than one area of the lagoon. The first alternative involves construction of one detention basin at the Cock Fight Arena site, which corresponds to restoration within the northern section of the study area.

Because of funding constraints, the CNMI preferred alternative was the first alternative. The PDT went back to review the existing data to determine whether it would be worth investing in a project that involves construction of a single detention basin at the Cock Fight Arena site rather than selecting an alternative that would involve construction of multiple detention basins that would result in restoration of more than one section of the study area.

Review of currently available baseline data indicates that water quality violation frequencies and metals contamination are observed to be the highest within the northern section of the lagoon. The drainage area for the Cock Fight Arena site is the largest of all three sites (Figure 7), and it is expected to result in a measurable improvement of the lagoon state by capturing a majority of runoff that reaches Saipan Lagoon. Although the first alternative has the least amount of expected equivalent acres of restoration area, the degree to which the lagoon will be restored is considered to be significant considering that degradation is most advanced within the northern section of the study area where restoration is expected to take place under this alternative. The selected plan will restore 70.33 equivalent acres of lagoon habitat at an estimated total project cost of $8,451,000. Table 10 shows the cost breakdown of the preferred alternative.

**Table 10: Cost Breakdown of Preferred Alternative**

| Preferred Alternative | Construction Cost* | Real Estate Cost* | Planning, Engineering, and Design* | Construction Management* | Feasibility Study | Total Project Cost |
|---|---|---|---|---|---|---|
| C0 Q0 A1 | $2,986,000 | $1,062,000 | $2,345,000 | $576,000 | $1,483,000 | **$8,451,000** |

*Costs include contingencies (see Appendix H).

## 5.11 IMPACTS OF SELECTED PLAN

The selected plan will restore the lagoon aquatic ecosystem to a less degraded and more natural condition. Specific impacts of the selected alternative on various components of the lagoon ecosystem, as well as additional benefits are discussed below.

### 5.11.1 Ecosystem Enhancement

The predominant focus of the preferred alternative is to restore the degraded Saipan Lagoon aquatic ecosystem. The single most detrimental influence on the lagoon is the influx of sediment, nutrient, and contaminant-laden runoff. The implementation of a detention basin would serve to improve the overall function and health of the lagoon aquatic ecosystem by capturing stormwater prior to it entering the lagoon, and allowing sediment and contaminants to settle out before the water is discharged into the lagoon.

#### 5.11.1.1 Aquatic Ecosystem

With a reduction of sediment, nutrients, and contaminants entering the lagoon, the aquatic ecosystem, including corals, fish, and seagrasses, will function more naturally (see Section 3.1). Implementation of controls for runoff will also aid in limiting the otherwise unavoidable further degradation of the lagoon with future development within the West Takpochao watershed. Ultimately, the intention of the preferred alternative is to reduce nonpoint source pollution, and thereby allow the return of seagrass and corals to dominance in currently degraded habitats.

#### 5.11.1.2 Endangered Species

The Green Sea Turtle and the Hawksbill Sea Turtle, both endangered species, would benefit from an increase in quality of the Saipan Lagoon habitats. Green Sea Turtles, in particular, feed on seagrass; therefore an increase in healthy seagrass would result in an expansion of potential foraging areas.

### 5.11.2 Water Quality

Restoration of water quality is a key component of the preferred restoration alternative. Detention basins serve to improve runoff water quality by allowing sediments and nutrients to settle out prior to its transport to the lagoon, leading to an improvement of lagoon water quality. In addition to improving aquatic ecosystem function, improved lagoon water quality would be conducive to the tourism industry of Saipan. Controlling and treating surface water flow entering the lagoon, together with local policy changes that are part of the preferred alternative (see Section 5.11.5), would most likely lead to a decrease in microbial contamination that has recently become a significant concern for beach front hotels and tourism-related businesses.

### 5.11.3 Flood Control

The preferred alternative would offer limited mitigation of localized flooding within the study area. Currently, the drainage system within the study area is insufficient to handle even medium sized rain events. Collection and conveyance systems that would be implemented for the restoration alternative would aid in controlling the localized flooding that occurs frequently in the area. These conveyance systems would be a significant improvement over the current minimal stormwater drainage system.

### 5.11.4 Recreational/Aesthetic Improvements

The cumulative impact of implementing the preferred alternative could include not only preserving the natural environment, but also improving the quality of living for residents, the atmosphere for local businesses, and tourist attractions. In particular, reducing the presence of nuisance macroalgae is an active issue of concern for the tourism/hotel industry that would be improved or resolved in the study area. Reduction of nutrient levels that promote microalgal growth, along with reduced input of silt and sediment, would improve water clarity, which is another benefit from a recreational perspective.

### 5.11.5 Recommended Local Best Management Practice

It is strongly recommended that the CNMI Government implement the following local BMPs to further reduce contamination and degradation of Saipan Lagoon. These BMPs were identified based on land-use practices or activities on land that generate a majority of nutrients, sediment, or contaminants that reach the lagoon via stormwater runoff (DEQ, 2010). Each of the BMPs will result in reduction of at least one or more of these contaminant sources, and will contribute towards a less degraded and more natural condition of the lagoon.

1. Pave or armor unpaved roads that contribute a majority of sediment to the lagoon, which would significantly reduce the amount of sediment that is washed into the lagoon via stormwater runoff.
2. Conduct sanitary sewer surveys and repair damaged portions of the sewer system, which would reduce the amount of nutrients and contaminants that reach the lagoon via stormwater runoff or infiltration through the ground.
3. Extend sewer lines to replace septic and cesspool systems within the study area, which would reduce the amount of nutrients and contaminants that reach the lagoon during accidental spills or flooding during large storm events.
4. Implement watershed management measures such as land use control measures, public education, reforestation, etc. in order to control activities that involve clearing of natural vegetation. Clearing of natural vegetation not only disturbs the natural soil, but also renders the land more susceptible to runoff and erosion. Raising public awareness and restoring the natural vegetation will contribute to a watershed that is less susceptible to runoff and erosion, thereby reducing the amount of sediment, nutrients, and contaminants that are directly transported to the lagoon via runoff.
5. Establish BMPs for the island with respect to trash and waste disposal in order to reduce the amount of nutrients or hazardous waste that may leach through the ground or become transported to the lagoon via stormwater runoff.
6. Enforce existing CNMI regulations for sediment and runoff capture for new construction projects in order to control the amount of sediment and runoff generated during ground disturbing activities.
7. Enact land use restrictions on placement of livestock farms and other sources of nutrients, which would contribute to controlling and reducing the amount of nutrients that are washed into the lagoon during rain events.

Implementation of some or all of these BMPs will enhance the environmental quality of Saipan Lagoon; however, the success of this project is not dependent upon implementation of these BMPs.

This DPR includes a post-construction monitoring plan that will measure the success of the detention basins for the five years immediately following construction (Appendix K). BMPs were not considered in the plan development.

It may be difficult to distinguish the degree of lagoon restoration attributable to the detention basins from the degree of lagoon restoration attributable to the implementation of BMPs. The most effective way to individually quantify the benefits is to establish or re-establish the baseline conditions of the lagoon immediately following implementation of BMPs. The following options provide a suggested framework for considering baseline conditions and evaluating project success and BMP success:

1. The data included in this DPR establishes the baseline condition of the Saipan Lagoon aquatic ecosystem prior to implementation of detention basins or BMPs. It will be used as the baseline for measuring success of detention basin installation.
2. If BMPs are implemented prior to the construction of the detention basins, the baseline conditions of the Saipan Lagoon aquatic ecosystem should be reestablished via a new round of sampling (aquatic habitat assessment, water quality parameters, stormwater quality, and sediment delta surveys).
3. If BMPs are implemented concurrently with construction of the detention basins, the first sampling event conducted ‘post construction’ will be used as the new baseline for evaluating the effectiveness of constructing the detention basins
4. If BMPs are implemented at some point during the five years following construction of the detention basins, the sample data will be evaluated to look for a significant change in the aquatic ecosystem that can be specifically attributed to the BMPs; otherwise the continued improvement of the aquatic ecosystem will be attributed to the construction of the detention basins.

## 5.12 POST CONSTRUCTION MONITORING PLAN

The data collected during the course of this study will serve as a baseline measurement of “before project” conditions. In order to properly and accurately assess the progress of ecosystem restoration, it would be best to couple both marine habitat health data with water quality measurements. An increase in water quality should be accompanied by a restoration of critical ecosystem components. A five-year post-construction monitoring plan (Appendix K) should be implemented to compare the aquatic ecosystem before project conditions to the post-construction state. Specific components of the plan include:

- weekly assessment of the presence and abundance of nearshore nuisance macroalgae;
- re-assessment of the inshore lagoon area;
- continued weekly nearshore lagoon water sampling, compared to rainfall data;

- stormwater sample collection and analysis at influent and effluent points of the drainage basin(s); and
- resurvey of sediment deltas at Drains 4, 6, and 11.

The project could be deemed a success if at least five of the following benchmarks were achieved:

1. Reduction in the frequency and abundance of nearshore, fast growth nuisance macroalgae (at least a 20% reduction in percent cover or 25% reduction in days of occurrence).
2. Decrease in the abundance of seasonal macroalgae in the nearshore and mid-lagoon regions (at least a 20% reduction in percent cover).
3. Decrease in turbidity of nearshore waters, particularly following storm events (at least a 25% reduction in number of violations of DEQ water quality standards for turbidity).
4. Decrease in microbial contamination in nearshore waters (at least a 25% reduction in number of violations of DEQ water quality standards for microbial contamination).
5. Decrease in nutrient levels in nearshore waters (at least a 25% reduction in number of violations of DEQ water quality standards for nutrients).
6. Decrease in contaminant (i.e., turbidity, microbial, and nutrient) concentrations in stormwater exiting the detention basins (at least a 25% reduction in number of violations of DEQ water quality standards for turbidity, microbial contamination, and nutrients).
7. Decrease in sediment load entering Saipan Lagoon at mitigated drainages (at least a 10% reduction in sediment delta area).

Table 11 summarizes the benchmarks and their corresponding reduction goals.

**Table 11: Post-Construction Monitoring Benchmarks and Reduction Goals**

| | Monitoring Parameter | Reduction Goal |
|---|---|---|
| 1 | Nearshore, fast growth nuisance macroalgae | 20% reduction in percent cover or 25% reduction in days of occurrence |
| 2 | Nearshore/mid-lagoon, seasonal macroalgae | 20% reduction in percent cover |
| 3 | Turbidity in nearshore waters | 25% reduction in number of violations of CNMI DEQ water quality standard |
| 4 | Microbial contamination in nearshore waters | 25% reduction in number of violations of CNMI DEQ water quality standard |
| 5 | Nutrient levels in nearshore waters | 25% reduction in number of violations of CNMI DEQ water quality standard |
| 6 | Contaminant (turbidity, microbial, and nutrient) concentrations in stormwater existing detention basin | 25% reduction in number of violations of CNMI DEQ water quality standards |
| 7 | Sediment load entering the lagoon | 10% reduction in sediment delta area at mitigated drainage |

Achievement of the first two benchmarks is less certain than the remaining five benchmarks because factors that are not directly linked to the proposed detention basins such as groundwater or other drainages may also affect the outcomes. The last five benchmarks are directly linked to the proposed detention basins and should be achieved by the project.

The following table summarizes the risk register to capture the risk of not reaching these goals and risks associated with factors that may have impacts on accomplishing the reduction goals.

**Table 12: Post-Construction Monitoring Risk Register**

| Risk Name | Probability (low, medium, high) | Mitigation | Contingency |
|---|---|---|---|
| Less than five of the benchmark reduction goals met | Medium | • Ensure operation and maintenance of the detention basin (see Section 5.6) is conducted regularly to maintain the designed filtration capacity<br>• Ensure local BMPs identified in Section 5.11.5 are implemented | • Review factors within the study area that may be influencing monitoring parameter<br>• Adjust reduction goals or extend monitoring period if necessary |
| Large storm event during post-construction monitoring period | High | Ensure operation and maintenance of the detention basin is conducted at all times to ensure maximum capacity | Reevaluate baseline conditions and adjust benchmark goals if necessary. |
| Large sewage spill during post-construction monitoring period | Low | Ensure sewage system is maintained properly | Reevaluate baseline conditions and adjust benchmark goals if necessary. |

Since unpredicted events or unknown/unpredicted factors may influence the outcome of the project, it is important to allow for adaptive management if it becomes necessary. As stated earlier in this section, success of the project is dependent upon proper operation and maintenance of the detention basin as well as implementation of local BMPs. In the event that less than five of the benchmark reduction goals are met, factors within the study area that may be contributing to the increased input of contaminants (nutrients, sediments, or contaminants) will be reviewed, and if necessary, the monitoring period may be extended or the reduction goals may be adjusted. In case of a large storm event or sewage spill, it may become necessary to reevaluate the baseline conditions since these events are expected to impact the monitoring parameters.

# 6. PROJECT IMPLEMENTATION

The success of the project is highly dependent upon local cooperation and understanding of what their roles and responsibilities are during the implementation of the project. The following sections identify the project local cooperators and sponsors, as well as their roles and financial obligation that will need to be fulfilled.

## 6.1 LOCAL COOPERATION

Local cooperators involved with this project include the following:

- CRMO;
- DEQ;
- DFW;
- CNMI Department of Public Works (DPW); and
- MMT.

CRMO is the local sponsor for this project. It is the role of the CNMI Government, to fulfill the following for the project:

- Provide all LERRD required for the project.
- Provide all access routes and relocations of utilities necessary for project construction, and for operation and maintenance.
- Contribute in cash, the local share of project cost (the Federal contribution limit is five million dollars).
- The local sponsor will be responsible for all operations and maintenance.

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# *Appendix A*
# *Environmental Assessment, Saipan Lagoon Aquatic Ecosystem Restoration Study*

# *DRAFT FINAL*
# ENVIRONMENTAL ASSESSMENT

## *SAIPAN LAGOON*
## *AQUATIC ECOSYSTEM RESTORATION STUDY*

*Contract No. DACA83-01-D-0014-0002*

*Prepared For:*

U.S. Army Corps of Engineers
Honolulu Engineering District

*Prepared By:*

Environet, Inc.

September 2013

United States Army Corps of Engineers
Honolulu Engineering District
Environmental Engineering

# Draft Final
# Environmental Assessment

## Aquatic Ecosystem Restoration Study
## at
## Saipan Lagoon
## Saipan, Commonwealth of Northern Mariana Islands

Prepared for: U.S. Army Corps of Engineers, Honolulu Engineering District

Prepared by: Environet, Inc.
1286 Queen Emma Street
Honolulu, Hawai‘i 96813

Contract No. DACA83-01-D-0014-0002

September 2013

# TABLE OF CONTENTS

## LIST OF TABLES

## LIST OF FIGURES

## APPENDICES

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# EXECUTIVE SUMMARY

The United States (U.S.) Army Corps of Engineers (USACE) and local sponsor Commonwealth of the Northern Mariana Islands (CNMI) Coastal Resources Management Office (CRMO) are proposing to restore the aquatic ecosystem of Saipan Lagoon. Urban runoff from upland areas over the years has led to degradation of the lagoon's marine ecosystems. The Proposed Action is to construct a detention basin to capture sediment, nutrients, and contaminants in runoff waters on Saipan for purposes of restoring the lagoon's aquatic ecosystem. Improvement in the lagoon water quality is needed in order to maintain the ecological health and function of the lagoon which is a vital cultural, recreational and economic resource for Saipan. Stormwater capture and filtration through environmentally sound engineering means is necessary to address the need to improve the natural ecology of Saipan Lagoon. This project is authorized under the Continuing Authorities Program (CAP) section 206-Aquatic Ecosystem Restoration of the Water Resources Development Act (WRDA).

This Environmental Assessment (EA) prepared in accordance with the National Environmental Policy Act (NEPA) of 1969 as amended, examined the No Action and Preferred ("Build") Alternative. Under NEPA the purpose of an EA is to evaluate whether an action may result in a significant environmental impact. Because an engineering solution is needed to address the lagoon's water quality and ecosystem degradation, the No Action scenario is not acceptable as it does not meet the project's purpose and need. An Ecosystem Restoration Report (ERR) (Environet, 2013) prepared concurrently with this report focuses on field studies, alternatives analysis and an incremental cost analysis of the numerous alternatives evaluated to recommend a Preferred Alternative that would best restore the lagoon to a less degraded, more natural condition.

The Draft EA examined the following environmental impact categories: Geology and Soils; Solid and Hazardous Waste; Noise; Climate and Air Quality; Hydrology and Water Quality; Traffic and Circulation; Biological (Fish, Wildlife and Plants) Resources; Historical and Cultural Resources; Land Use; Visual Resources; Recreation/Resource Use; Economic and Social Resources and Cumulative Impacts.

Project related construction activities may result in significant short-term environmental impacts which could be mitigated to less than significant. Fugitive dust and noise generated by construction equipment such as backhoes, jack hammers, and large trucks will be mitigated by best management practices (BMPs) such as use of dust screens, site watering, and proper maintenance of contractor equipment. Beneficial long term environmental impacts expected are improved water quality and resultant restoration of Saipan Lagoon's health and ecosystem function.

As described in the Draft EA, the Preferred Alternative and No Action alternative were analyzed to determine the potential impacts and appropriate mitigation measures for those impacts. Thus, based on the evaluation conducted, the USACE has determined that a Finding of No Significant Impact (FONSI) is anticipated.

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# LIST OF ACRONYMS

| | |
|---|---|
| % | percent |
| APC | Area of Particular Concern |
| BMP | best management practice |
| CAA | Clean Air Act |
| CE | cost effectiveness |
| CEQ | Council on Environmental Quality |
| CFR | Code of Federal Regulations |
| CNMI | Commonwealth of the Northern Mariana Islands |
| CRMO | CNMI Coastal Resources Management Office |
| CWA | Clean Water Act |
| CZM | Coastal Zone Management |
| CZMA | Coastal Zone Management Act |
| dBA | decibels |
| DEQ | CNMI Division of Environmental Quality |
| DFW | CNMI Division of Fish and Wildlife |
| DNL | day-night sound level |
| DO | dissolved oxygen |
| DPW | CNMI Department of Public Works |
| DLNR | CNMI Department of Natural Resources |
| EA | Environmental Assessment |
| ER | Engineer Report |
| EIS | Environmental Impact Statement |
| EO | Executive Order |
| EPA | United States Environmental Protection Agency |
| ERR | Draft Ecosystem Restoration Report |
| ESA | Endangered Species Act |
| FONSI | Finding of No Significant Impact |
| GHG | greenhouse gas |
| HPO | CNMI Historic Preservation Office |
| ICA | incremental cost analysis |
| LEDPA | least environmentally damaging practicable alternative |
| LGHU | lagoon habitat unit |
| MMPA | Marine Mammal Protection Act |
| MMT | CNMI Marine Monitoring Team |
| NAAQS | National Ambient Air Quality Standards |
| NEPA | National Environmental Protection Act |
| NHPA | National Historic Preservation Act |
| NMFS | National Marine Fisheries Service |
| NOAA | United States National Oceanic and Atmospheric Administration |
| OSHA | United States Occupational Safety and Health Administration |
| PCA | potentially contaminating activities |
| RCRA | Resource Conservation and Recovery Act |
| SDWA | Safe Drinking Water Act |
| SSO | sanitary sewer overflows |
| SWAP | Source Water Assessment Program |

| | |
|---|---|
| TMDL | total maximum daily load |
| U.S. | United States |
| USACE | United States Army Corps of Engineers |
| USACE POH | United States Army Corps of Engineers, Honolulu District |
| USD | United States Dollar |
| USFWS | United States Fish and Wildlife Service |
| WRC | Water Resources Council |
| WRDA | Water Resources Development Act |

# 1. INTRODUCTION

## 1.1 SCOPE AND AUTHORITY

The United States (U.S.) Army Corps of Engineers (USACE) is conducting an Environmental Assessment (EA) for the restoration of the Saipan Lagoon Aquatic Ecosystem. The Commonwealth of the Northern Mariana Islands (CNMI) Coastal Resources Management Office (CRMO) is the local sponsor of the Proposed Action analyzed in this EA. This document is prepared in accordance with the National Environmental Policy Act (NEPA) of 1969, as amended, Council on Environmental Quality (CEQ) regulations (40 Code of Federal Regulations (CFR) 1500-1508), USACE Regulation 33 CFR Part 230; Procedures for Implementing NEPA, as well as the Water Resources Development Act of 2007, to evaluate the economic and environmental consequences of the Proposed Action.

Under NEPA the purpose of an EA is to evaluate whether or not an action may have a significant environmental impact. Based on the study contained in the EA, it will be determined whether the Proposed Action will significantly affect the environment. A Finding of No Significant Impact (FONSI) will be issued if no adverse environmental impacts are anticipated. If it is determined that the Proposed Action will result in adverse environmental impacts, an environmental impact statement (EIS) will be prepared.

The USACE is authorized under the Continuing Authorities Program (CAP) section 206-Aquatic Ecosystem Restoration of WRDA to provide design and construction assistance to non-Federal interests for aquatic ecosystem restoration and protection projects that are cost-effective and in the public interest. The USACE evaluates projects that benefit the environment by restoring, improving, or protecting aquatic habitat for plants, fish, and wildlife. Projects typically involve restoration of aquatic ecosystems in rivers, lakes, wetlands, and lagoons.

Applicable policy governing USACE restoration projects include the Planning Guidance Notebook (ER 1105-2-100), Ecosystem Restoration Guidance (EP 1165-2-502 in support of ER 1165-2-501), Engineer Regulation 200-2-2: Procedures for Implementing NEPA, and the principles and guidance document approved by the Water Resources Council (WRC) in 1983 (WRC, 1983). Ecosystem restoration purpose differs from the majority of USACE projects in that the goal is to reverse, at least in part, past influence of human action. Instead of building an environment-altering structure such as a bridge or a dam, restoration projects attempt to restore ecosystems to a close approximation of their natural state. Ecosystem restoration reestablishes a self-maintaining state that optimally should require little human intervention.

Additionally, the entire ecosystem is the target of transformation by restoration, as opposed to a specific species or a single component of habitat. Ecosystem restoration includes the entire biotic community together with its physical environment, considered as an integrated unit (EP 1165-2-502). Often only partial ecosystem restoration is practical, but the parts restored are done so holistically.

According to USACE policy requirements, restoration projects should conform to the following constraints:

- the project should restore ecosystem structure, functions and values;
- the project should result in improved environmental quality;
- the sum of all monetary and non-monetary benefits should exceed the sum of all monetary and non-monetary costs;
- the measures taken to improve environmental quality should result in a more natural and self-regulating system; and
- the measures should reestablish, to the extent possible, a close approximation of pre-existing conditions.

This EA incorporates guidance established under 40 CFR Part 230.10(a). Under these guidelines the USACE requires that the least environmentally damaging practicable alternative (LEDPA) is considered, so long as the alternative does not have other significant adverse environmental consequences. The guidance also includes the following environmental analysis:

Alternative Analysis

- The No Action Alternative.
- The Preferred Alternative

Environmental Impact

- Assess the impact of each alternative on the aquatic ecosystem and the surrounding environment overall. Compare the impact of the alternatives and identify which alternative is the LEDPA and why. Identify practicable alternatives that have no significant or easily identifiable difference in impact from the LEDPA.

Practicability

- Address the practicability of the above alternatives. Practicability depends on cost, technical, and logistic factors. To be practicable, an alternative must be available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall purposes. If it is otherwise a practicable alternative, an area not presently owned by the applicant which could reasonably be obtained, utilized, expanded, or managed in order to fulfill the overall purpose of the proposed activity should be considered. Technical and logistical factors that should be considered include, but are not necessarily limited to: access, transportation needs, utilities, topography, and available construction techniques.
- Address the consequences on the applicant and the public of not implementing the project.

- Mitigation

  If the alternative identified as the LEDPA still has adverse impacts to the aquatic ecosystem, identify how it is proposed to further minimize those impacts and provide compensatory mitigation for any remaining unavoidable adverse impacts.

## 1.2 STUDY AREA LOCATION

The location of this restoration study is the Saipan Lagoon, located in Saipan, CNMI. The study area encompasses the southern portion of the West Takpochao watershed. The study area extends from Quartermaster Road to just past the Fishing Base in Garapan along the western shoreline of the island of Saipan, CNMI. The study area includes the entire inland watershed that contributes groundwater and surface water runoff to this approximately two-mile length of shoreline, as well as the adjacent offshore lagoon area extending out approximately 0.3 miles (Figure 1).

## 1.3 OVERVIEW OF THE PROPOSED ACTION

The Proposed Action involves the construction of a detention basin that would capture sediment, nutrients, and contaminants entrained in runoff waters before they enter the lagoon. This would help improve the water quality of runoff waters into the lagoon, which in turn would help restore the degraded aquatic ecosystem structure within the lagoon to a more natural state.

### Alternatives Considered

The alternatives analysis process was extensive, beginning with the overall consideration of three alternative detention basin sites and a variety of detention basin sizes at each site, to achieve the overall project goal of restoring the Saipan Lagoon aquatic ecosystem to a less degraded, more natural condition. Detention basins are temporary holding areas for stormwater that may also act as settling ponds for sediment transported by sheet flow. The detention basins would be designed to capture first flush sediment and other contaminants that enter the basins. The basins would include overflow systems that would route the water to the lagoon via pipe or drainage swale systems. Dual-purpose type uses (soccer fields, parks, etc.) for the detention basins were originally considered, but were found to be impractical. Three sizes of detention basin were designed and considered for each of the three sites, corresponding to the expected influx of water during a two-year rainfall event, a five-year rainfall event, and a 10-year rainfall event.

The project alternatives were evaluated in terms of the cost to construct the different detention basin sizes at each of the three sites, as well as the estimated amount of environmental restoration that would occur in the lagoon as a result of the different project alternatives (Figure 2). The incremental cost analysis conducted in the Ecosystem Restoration Report (ERR) (Environet, 2013) concluded that the Cock Fight Arena site with a single two-year design basin is the most appropriate alternative, as it best meets the purpose and need of the project by providing adequate lagoon restoration at a feasible cost. In addition, a No Action alternative was evaluated. The three sites originally considered for the detention basins, along with the proposed alternative basin designs at the three sites are further described in Section 2 of this EA, and in detail in the ERR.

## 1.4 PURPOSE AND NEED

### Purpose

The purpose of the Proposed Action is to determine an environmentally sensitive and economically feasible means to improve the ecosystem function in the Saipan Lagoon by reducing the amount of sediment, as well as other suspended solids that enter the lagoon via stormwater runoff. A reduction of these constituents within the lagoon would help to improve lagoon water quality, leading to an improvement of the degraded lagoon ecosystem structure and function.

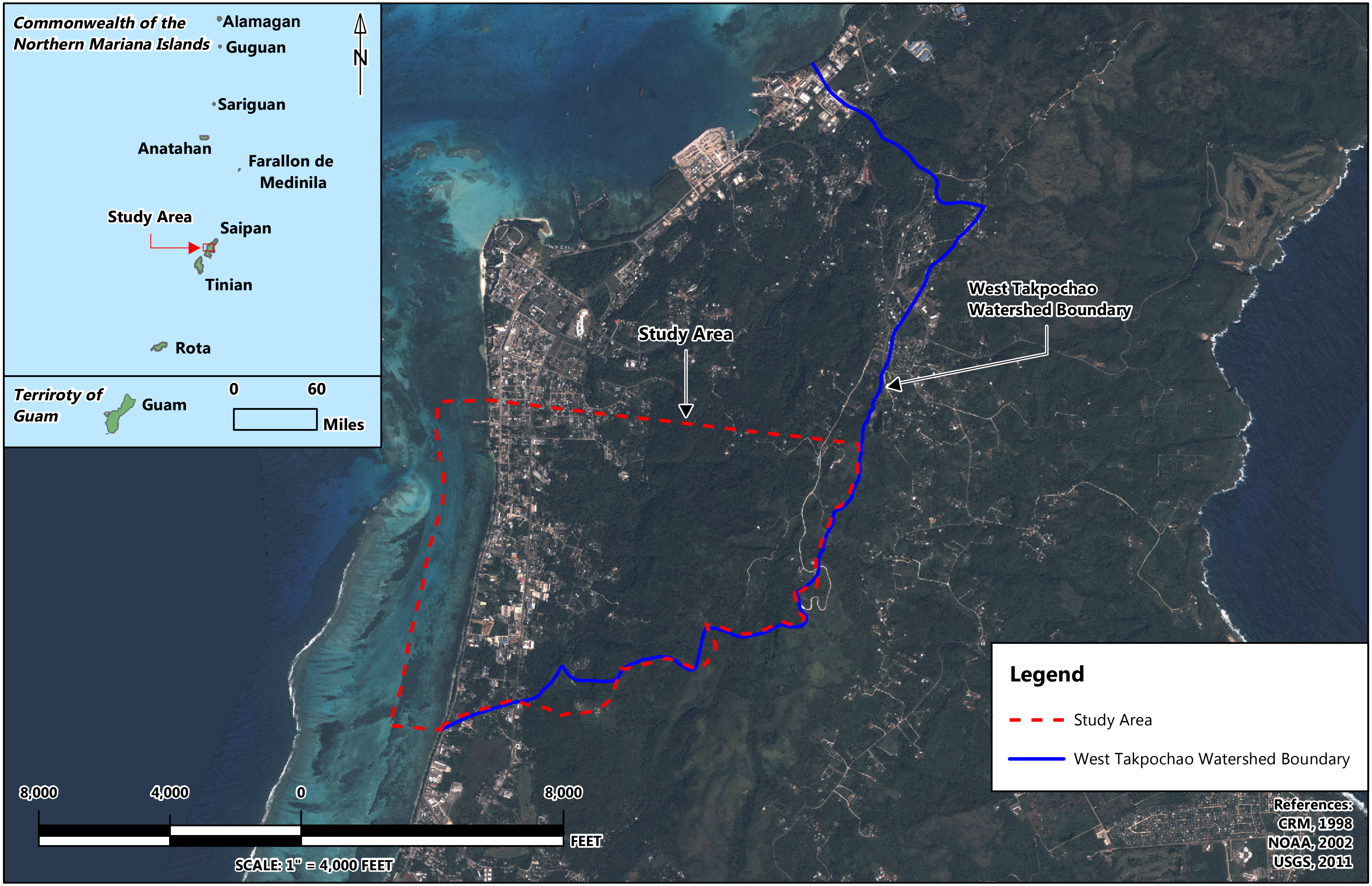
Indicators of this degradation include increased frequency of water quality standard violations in near-shore recreational waters, changes in density, distribution and composition of sea grass communities in near-shore waters, high abundance of seasonal macro-algal growth, decrease in near-shore lagoon fish and degraded lagoon coral health.

The Proposed Action would provide the most appropriate environmental engineering solution to address the ongoing degradation of the water quality in the lagoon due to unmitigated stormwater runoff. The Proposed Action would help meet the CNMI’s interest in restoring the Saipan Lagoon’s natural ecosystem function through capture of sediment and suspended solids in stormwater before entering coastal waters.

### Need

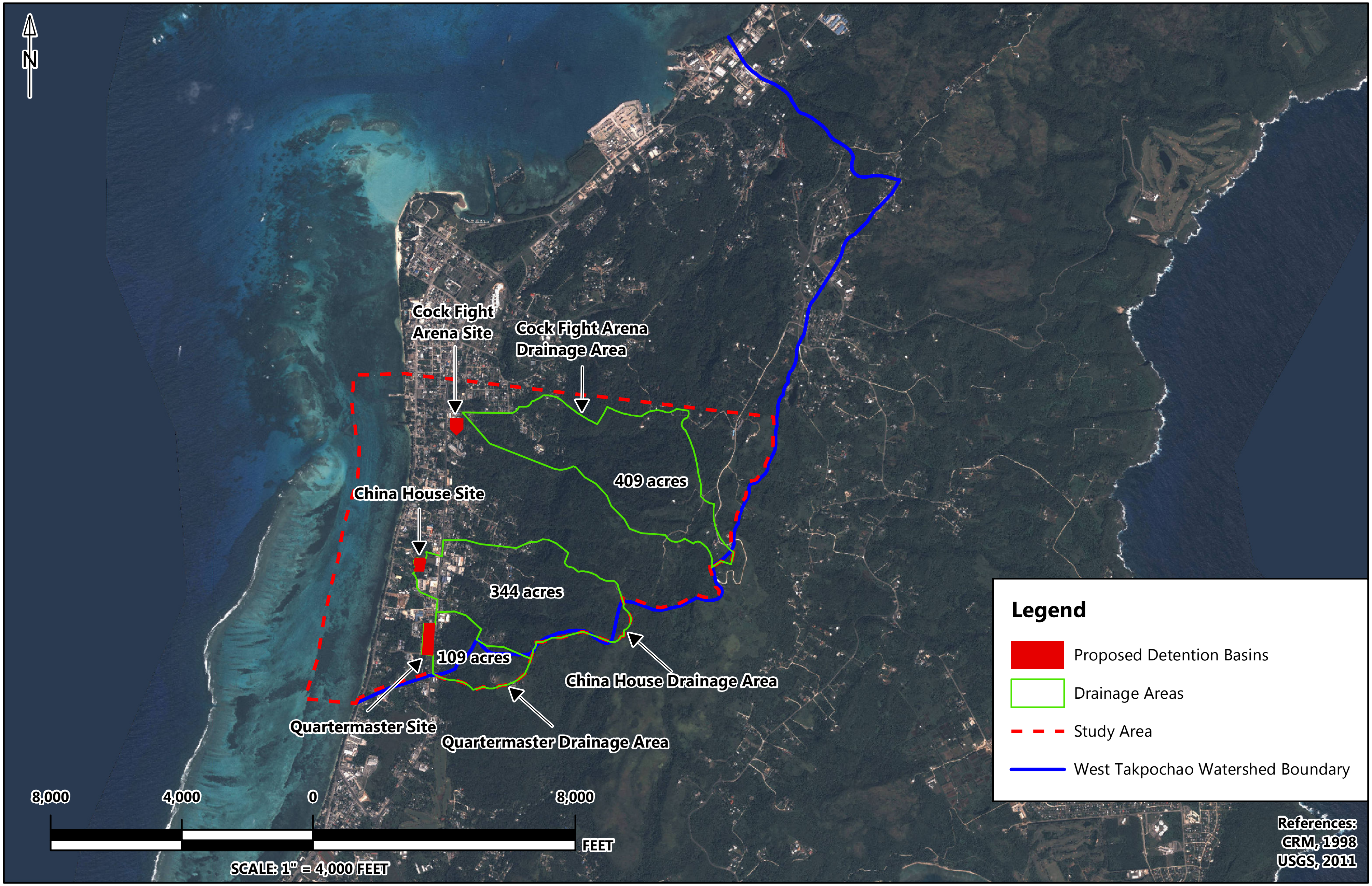
A combination of increasing population and urbanization of the West Takpochao watershed over the past 70 years has led to degradation of the aquatic ecosystem that makes up the Saipan Lagoon.

Degradation of ecosystem function in the Saipan Lagoon is a concern not only because of the deterioration of natural resources supported by the lagoon, but also because degradation has progressed to the point that the aesthetic and recreational utility of the lagoon has been adversely impacted. This is of substantial concern on Saipan because the lagoon is a vital component of the tourism industry that accounts for the majority of the local economy. Indicators of water quality degradation have been investigated and presented in this EA and the ERR (Environet, 2013). These indicators will be discussed briefly in the following sections, together with the desired outcomes of the future restoration activity, and the best possible restoration alternative for the study area.



Environet, Inc.

| | | |
|---|---|---|
| PROJECT NO.: 1057 | ENVIRONMENTAL ASSESSMENT<br>SAIPAN LAGOON AQUATIC ECOSYSTEM RESTORATION STUDY | FIGURE<br>1 |
| DATE: APRIL, 2013 | | |
| DRAWN BY: CB | GENERAL STUDY AREA<br>SAIPAN, CNMI | |
| REVIEWED BY: MA | | |



Environet, Inc.

PROJECT NO.: 1057
DATE: APRIL, 2013
DRAWN BY: CB
REVIEWED BY: MA

ENVIRONMENTAL ASSESSMENT
SAIPAN LAGOON AQUATIC ECOSYSTEM RESTORATION STUDY

PROPOSED DETENTION BASINS AND DRAINAGE AREAS
SAIPAN, CNMI

FIGURE
2

### 1.4.1 Sedimentation

Sedimentation is recognized as one of the most significant problems facing the Saipan Lagoon and is a direct result of the urban development that has taken place within the West Takpochao watershed. Reduction of the sediment load transported to the lagoon would significantly improve the overall function of the aquatic ecosystem.

Sediment transport to lowland areas occurs naturally in Saipan. In the study area, the amount of sediments being transported to the lagoon environment has increased in conjunction with the spreading urbanization of the lowland areas within the watershed. The increased number of roofs, roads, and other paved areas impervious to rain increases the amount of runoff and tends to channel the runoff between properties. Construction activities and clearing of the natural vegetation tend to disturb the natural soils rendering them more susceptible to erosion. A decline in coverage by natural vegetation due to increased urbanization also limits the ability of the substrate to hold rainfall and makes these remaining lands more subject to runoff and erosion. The resulting increased levels of runoff and sedimentation to the lagoon overloads the ability of the natural seagrass community to cope with these pollutants and can damage coral reefs and associated ecosystems.

Damage to coral reef ecosystems can result from direct sedimentation onto coral polyps or from increased nutrient concentrations that may lead to overgrowth by algae species. A shift in reef species towards more nutrient tolerant and less diverse communities will also lead to changes in the fish populations inhabiting the reef. In addition, less diverse communities of coral are more susceptible to damage during natural disasters such as typhoons. Further, any perceived decrease in the quality of the coral reef ecosystem is likely to have adverse impacts on the Saipan tourism economy.

The Soil Conservation Service estimated erosion rates for Saipan soils present in the Kagman Watershed on the eastern side of the island. The average erosion rate from the forested upper watershed is estimated to be about three tons per acre per year while areas under construction may exceed rates of 20 tons per acre per year. The developed homestead area in Kagman, which is situated on a relatively flat limestone plateau, yields between two to five tons of soil per acre per year.

Erosion rates for the soils present within the study area are not available. However, initial observations made during the reconnaissance field visit of eroded gravel roads, obvious sedimentation in storm drain gullies, and occasional lapses in implementation of best management practice (BMP) regulations at construction sites suggest that erosion rates may be high. An attempt to evaluate sedimentation rates within the study area was undertaken by studying deltaic deposits along the shoreline. Three sediment deltas were surveyed five times at three different points from 2001 to 2002 during the wet and dry seasons in an effort to quantify sediment load entering the lagoon via stormwater runoff. The change in sediment delta volume throughout the study interval was notable. The volume of sediment at each survey point fluctuated during the study. The total volume of sediment lost from the three deltas during the study interval was 478 cubic yards. This sediment likely washed into the lagoon. Results of this study are discussed in detail in the ERR (Environet, 2013).

### 1.4.2 Water Quality

Saipan has unique water issues that offer challenges to regulatory agencies such as the CNMI Division of Environmental Quality (DEQ) and the CRMO. Finite freshwater sources and impacts of urban development on surrounding marine environments are of constant concern on an island such as Saipan. This section summarizes general water characteristics on Saipan according to the CNMI DEQ Integrated 305(b) and 303(d) Water Quality Assessment Report, dated November, 2010.

#### Groundwater

Two types of aquifers are dominant on Saipan; isolated limestone aquifers, as well as the more prevalent basal aquifer, which is the predominant source of freshwater on the island. Due to the limited freshwater sources, the location and distribution of these aquifers is of extreme importance in the CNMI. Urban growth and an increase in population have led to several issues that threaten the freshwater aquifers. Increasing demand of freshwater has led to over-pumping of the basal lens aquifer, causing high chloride levels due to saltwater intrusion.

Although most occurrences of groundwater contamination in Saipan have not been linked with a specific identifiable source, the highly suspected sources, in addition to saltwater intrusion, include the following:

- petroleum compounds from underground storage tanks;
- pesticides, halogenated solvents, petroleum compounds, nitrate, metals, bacteria, protozoa, and viruses from disposal activities at landfills;
- nitrate, bacteria, protozoa, and viruses from septic tanks as well as pipelines and sewer lines; and
- halogenated solvents, petroleum compounds, and metals from small-scale manufacturing and repair shops.

Point source and nonpoint source pollution due to heavy urbanization can also threaten ground water sources through infiltration of the study area’s highly permeable top soils.

#### Surface Water

The CNMI has designated two classes of water (AA and A) for marine uses. Class AA represents high-quality waters that are considered to be in a “natural” and “pristine” state. The CNMI Water Quality Standards states that “to the extent practicable, the wilderness character of such areas shall be protected,” and does not permit any discharge of pollutants in class AA waters. Class A waters have been designated in two parts of Saipan, and generally represent a slightly lower quality of water in which some discharges may be permitted, for example, the two sewage treatment plant outfalls on Saipan. Nevertheless, Class A waters must support recreational use and the propagation of fish, shellfish, and wildlife, and strict water quality standards have been set for the protection of these uses in Class A marine waters. Additionally, further protection is afforded through the CNMI Anti-Degradation Policy, which is part of the Water Quality

Standards and protects existing uses and water quality in any waters, despite their classification.

The majority of the coastal marine waters on Saipan are designated as Class AA, including the study area. These waters should remain in their natural pristine state as nearly as possible with an absolute minimum of pollution or alteration of water quality from any human-related sources or actions. The uses protected in these waters are the support and propagation of shellfish and other marine life, as well as the conservation of coral reefs and wilderness areas, oceanographic research, and aesthetic enjoyment and compatible recreation inclusive of whole body contact (e.g., swimming and snorkeling) and related activities.

Both point and non point source pollution are responsible for lowering the quality of the CNMI's surface waters. Sewage out-falls, sewer collection overflows, sedimentation from unpaved roads and development, urban runoff, reverse osmosis discharges from hotel treatment systems, and nutrients from agricultural areas and golf courses are the most significant contributors to the degradation of the CNMI's surface and marine water quality. Surface water quality is difficult to measure and properly assess due to the many variables that affect surface water, including rainfall events, tidal fluctuations, and other atmospheric and oceanographic conditions.

The CNMI Marine Monitoring Team (MMT) was initially established in 1997 to aid in understanding the current conditions of coral reefs and coral reef resources in the CNMI. The MMT consists of members from the CMI DEQ, CRMO, and the CNMI Division of Fish and Wildlife (DFW). It is the goal of the MMT to continue this long-term monitoring program to continually assess reefs and aquatic resources of the CNMI.

According to the CNMI MMT, in order to properly and accurately assess water quality, it is best to couple both marine habitat health data with water quality measurements. Decreased water quality threatens marine environments because coral reefs and other marine systems rely on good water quality for proper function and prosperity. Monitoring and measuring water quality and the health of aquatic ecosystems is the most efficient way to determine marine water quality.

## 1.5 REGULATORY FRAMEWORK

In addressing environmental considerations, USACE is guided by several relevant statutes and Executive Orders (EO) that establish standards and provide guidance on environmental and natural resource management and planning. These statutes and EO include, but are not limited to, the Rivers and Harbors Act, the Coastal Zone Management Act (CZMA), the Endangered Species Act (ESA), the Fish and Wildlife Coordination Act, the Magnuson-Stevens Fishery Conservation and Management Act, the National Historic Preservation Act (NHPA), the Resource Conservation and Recovery Act (RCRA), EO 13089 (Protection of Coral Reefs), EO 12898 (Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations), and EO 13045 (Protection of Children from Environmental Health Risks and Safety Risks). Key provisions of these statutes and EOs are discussed throughout subsequent sections of the EA, and in detail in Section 4 of this EA.

## 1.6 PUBLIC INVOLVEMENT AND AGENCY CONSULTATION

Public participation is organized in the form of public posting (newspaper bulletins and other accessible public media) and agency consultations.

### 1.6.1 Agency Scoping Meetings

A series of small meetings were held with different departments of the Saipan Government from February to August 2002. A brief summary of attendees and topics of discussion are contained in Appendix E. Another series of meetings were held with several CNMI and U.S. federal governmental agencies in October, 2011. Representatives from the following government agencies were briefed and consulted during the meetings:

- CNMI CRMO
- CNMI DPW
- CNMI DEQ
- CNMI Department of Public Lands
- U.S. National Oceanic and Atmospheric Administration (NOAA)

### 1.6.2 Legislative Meetings

Two meetings were conducted with the Saipan Legislature from June through August of 2002. The first meeting was held on June 27, 2002 to introduce the study to the local authorities and the local newspaper. The second meeting was held on August 15, 2002, to brief legislators on the progress of the EA and to discuss issues on acquiring private land for the proposed project. A third meeting was conducted with the CNMI Legislature on October 25, 2011 in order to provide a study update and to consult the CNMI Legislative representatives. Another meeting with the project team and the Governor was held at the Legislature on October 26, 2011 in order to provide updated study information and consult the Governor.

### 1.6.3 Public Meetings

Two articles were printed in the local newspapers on June 29 and July 1st of 2002. An updated public scoping period will be initiated following publication of the Draft EA, including a study update and call for public comments via the local newspaper. Interested members of the public will be able to comment on the draft document and have their comments taken into consideration during preparation of the Final EA.

# 2. DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

This section describes the alternatives, including the Preferred Alternative, that were developed to meet the following objectives:

- Select an environmentally sensitive and economically feasible alternative that would restore the Saipan Lagoon aquatic ecosystem to be self-sustaining in its ecologically modified environment, by examining a range of alternative basin locations and sizes in the West Takpochao watershed. Evaluation criteria used include the amount of freshwater the basin could hold (capacity), the percent of the watershed that would drain into the basin, and the relative amount of sediment, hazardous runoff, and runoff loading the basin would receive compared to the amount produced within the study area, as well as the associated construction costs;
- Construct the selected detention basin facility that meets the engineering and cost considerations;
- Restore the lagoon environment to a more natural state following construction of the proposed detention basin(s).

## 2.1 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM FURTHER ANALYSIS

The following alternatives were considered during the initial alternative formulation process:

- No Action
- Capturing and pumping contaminants offshore
- Erosion control
- Detention basins

The no action alternative was considered to be unresponsive to the needs of the local sponsor and was eliminated from further evaluation. The no action alternative was, however, included in the alternatives analysis in the ICA (concurrently being prepared with this report) as well as the EA as required by the Council of Environmental Quality (CEQ) regulation 40 Code of Federal Regulations (CFR) Section 1502.14(d). Capturing and pumping contaminants offshore was eliminated from further evaluation because CNMI stated that they cannot afford to maintain the mechanical pumps. Erosion control within the upper portion of the watershed was considered but not carried forward for further evaluation since it was not considered to be sufficient in addressing the purpose and need of the project. Construction of detention basins was considered the most cost effective and efficient in addressing the purpose and need of the project; therefore, was carried forward for further evaluation.

Three alternative detention basin sites (China House, Quartermaster, and Cock Fight Arena), that are located in low-lying areas within the West Takpochao watershed, were considered to achieve the overall project goal and evaluated in terms of the amount of freshwater they could hold (capacity), the percent of the watershed that would drain into the basin, and the relative amount of sediment, hazardous runoff, and runoff loading they would receive compared to the amount produced within the entire study area. Three sizes of detention basins were designed for each of the three sites, corresponding to the expected influx of water during a two-year, five-year, and 10-year rainfall event. Each detention basin was characterized in terms of its cost and expected benefits using the cost effectiveness (CE)/incremental cost analysis (ICA) program.

Since the three sites currently flood during heavy rains, all three were determined to be effective in receiving runoff waters and functioning as detention basin sites. Three storm events were evaluated, including two-year, five-year, and 10-year recurrence storms (all one-hour duration events). The watershed analysis for each storm event and site is included in the Preliminary Drainage Design for Aquatic Ecosystem Restoration Study, Saipan Lagoon, Saipan, Northern Mariana Islands (Community Planning & Engineering, Inc., 2012). This report is included as Appendix A.

The CE/ICA program developed by the USACE Institute for Water Resources was used to conduct a CE/ICA for the different alternative sites and design combinations. Economic analysis for environmental planning consists of two analytical processes that together form the CE/ICA. CE analysis identifies the least-cost alternative for each level of environmental output. Following the CE analysis, an ICA was performed to show the incremental change in cost with increasing levels of environmental output. Including the No Action alternative, 19 cost effective least-cost combinations of the three detention basin sites were subjected to an ICA in which only four combinations were retained for the final incremental analysis (Environet, 2013). Each alternative consists of a different combination of detention basins to be constructed in the West Takpochao watershed.

The dollar cost of each alternative, along with the lagoon habitat units (LGHUs) restored for each alternative were key factors in evaluating the feasibility and effectiveness of each alternative considered for analysis. The LGHUs represent the equivalent acres of lagoon area restored by implementing the chosen detention basin design combinations for each alternative. The LGHUs are a derived variable based on acres of lagoon habitat restored by reducing sediment, and contaminant runoff from potentially contaminating activities (PCAs). A PCA is defined as a facility or activity that 1) stores, transmits, uses, or produces contaminants, chemicals or by-products; and 2) has the potential to release contaminants that may impact the quality of the lagoon water (Environet, 2013).

### Alternative Sites Considered

#### China House Site

The proposed China House site is located in the mid-southern portion of the study area about halfway between Middle and Beach Roads, across from the Pizza Hut building and Beach Road, near the China House restaurant (Figure 2). Topographically, the Site is characterized by a natural drainage channel that flows to an outfall located along Beach Road in the center of the proposed Site. The remaining Site area is predominantly flat to slightly sloping toward Beach Road and the lagoon.

The Site currently serves as a natural drainage area for surface water from Middle Road and the upper parts of the Gualo Rai area. Surface water reaches the lagoon through this area via surface sheet flow and through the natural swale. There is currently a storm water catch basin located along Middle Road adjacent to Pizza Hut that collects surface water and diverts it beneath Middle Road and into the proposed detention basin Site. During medium to large storm events, the catch basin is insufficient to handle the volume of runoff and severe flooding occurs along Middle Road at the Pizza Hut location. The topographic nature of this site is conducive to the construction of a detention basin.

Quartermaster Site

The proposed Quartermaster Site is located at the southern-most end of the study area, at the intersection of Quartermaster Road to the south and Middle Road to the east (Figure 2). The Site is currently vacant and overgrown, and generally slopes to the southwest. Several commercial and residential buildings lie adjacent to the proposed Site.

Quartermaster Road, together with adjacent swales, serves as a major drainage route for surface water during rain events. A drainage culvert is located beneath Middle Road at the intersection of Middle and Quartermaster Roads. The contributory area to surface runoff in this area includes Middle Road and areas in the southern portion of the West Takpochao watershed.

This area would be used in a similar manner as the China House site; a detention basin that would act as a settling pond for sediment and contaminants prior to discharging surface water to the lagoon.

Cock Fight Arena Site

The proposed Cock Fight Arena Site is located on the east side of Middle Road at the northern end of the study area (Figure 2). The closest cross street is Commonwealth Road, located approximately 200 feet north of the Cock Fight Arena Site. This Site is characterized by an abandoned quarry pit that occupies roughly one third of the Site, in the southeastern corner. The depression of the pit extends approximately ten feet in depth at its deepest point. The remaining portion of the Site is predominantly flat to slightly sloping in the direction of the quarry depression. The Arena is currently located on the western side of the Site. Commonwealth Road acts as a major channel for surface runoff water from a large contributory area during medium to large flood events. During rain events, surface water streams down Commonwealth Road and into storm drains located at the intersection of Commonwealth and Middle Roads. The storm drain diverts the water north toward Garapan and into a large surface water outfall that enters the lagoon near the Dai Ichi Hotel. The area of restoration for this alternative thus may extend north of the study area indicated on Figure 2. The contributory area for surface flow in this area includes many unpaved areas in the upper reaches of the watershed, leading to large amounts of sediment transport from the upper reaches of the watershed to the lagoon. During medium to large rain events, the current storm drain is insufficient to handle the amount of flow that occurs, resulting in severe flooding at the intersection of Commonwealth and Middle Road and the surrounding areas.

## Alternative Basin Sizes Considered

The numbering sequence for all combinations of alternatives follows the following format:

- Prefix C, Q, or A refers to the China House (C), Quartermaster (Q), or Arena site (A).
- Numeral 0, 1, 2, or 3 refers to the no action (0), two-year (1), five-year (2), or 10-year (3) design level, respectively. Thus C2 is the China House five-year design while Q0 refers to the Quartermaster no action alternative.

Based on the assumptions that any or all of the three sites could be developed concurrently at the no-build, two-year, five-year, or 10-year design level, there were 64 different plan combinations. After conceiving all possible plan combinations, inefficient combinations were eliminated by identifying combinations with identical levels of output and eliminating the one with the higher cost. This process resulted in the identification of 48 least-cost combinations.

The 48 least-cost combinations were then analyzed for CE by identifying and eliminating the combinations that produce a lower level of output for the same or greater cost than another combination. This CE analysis resulted in a set of 18 cost-effective combinations. The 18 cost-effective combinations were then subjected to a preliminary ICA in which combinations with the lowest incremental cost per output for a particular output level was identified. Seven best buy plans (i.e., the plan combinations with the lowest incremental cost per output level) were retained as a result of this preliminary ICA analysis.

Of the seven best buy plans, three combinations with the highest incremental cost were eliminated from further evaluation because the significantly higher cost of these three combinations were not justified by a significant increase in output. In addition, the no action combination, which was considered to be unresponsive to the needs of the local sponsor, was eliminated from further evaluation. Once the final three combinations were identified, they were subjected to an Abbreviated Cost and Schedule Risk Analysis, in which the contingencies were calculated for each alternative. Once the contingencies were calculated, they were placed in the Total Project Cost Summary to determine the total project cost for each alternative. The final ICA was performed on the three combinations using the total project cost instead of the estimated costs that were used for the preliminary ICA. Table 1 summarizes the findings of this alternatives analysis phase.

**Table 1: Summary of Possible Alternative Development Scenarios**

| **ALTERNATIVE** | **Project Location(s)** | **Size(s) of Detention Basin(s)/Storage Capacity** | **Comment** |
|---|---|---|---|
| No Action | none | none | No restoration of lagoon's natural state; continued environmental impact. Does not meet purpose and need. |
| Preferred Alternative (C0Q0A1) | Cock Fight Arena | two-yr design basin/11.85 ac-ft | Beneficial impact on the aquatic ecosystem of the lagoon at a feasible cost. Meets purpose and need. |
| Alternative 3 (C2Q0A1) | China House<br>Cock Fight Arena | five-yr design basin/13.54 ac-ft<br>two-yr design basin/11.85 ac-ft | Beneficial impact on two regions of the lagoon; developmental costs three times higher than the Preferred Alternative. Increase in cost not justified by level of output. |
| Alternative 4 (C2Q2A1) | China House<br>Quartermaster<br>Cock Fight Arena | five-yr design basin/13.54 ac-ft<br>five-yr design basin/4.885 ac-ft<br>two -yr design basin/11.85 ac-ft | Beneficial impact on three regions of the lagoon; much greater cost not justified by level of output. Therefore eliminated from further analysis. |
| Alternative 5 (C2Q3A1) | China House<br>Quartermaster<br>Cock Fight Arena | five-yr design basin/13.54 ac-ft<br>ten-yr design basin/6.92 ac-ft<br>two -yr design basin/11.85 ac-ft | Significantly higher costs not justified by significant increase in output. Therefore eliminated from further analysis. |
| Alternative 6 (C3Q3A1) | China House<br>Quartermaster<br>Cock Fight Arena | 10-yr design basin/15.84 ac-ft<br>10-yr design basin/6.92 ac-ft<br>2-yr design basin/11.85 ac-ft | Significantly higher development costs not justified by significant increase in output. Therefore eliminated from further analysis. |
| Alternative 7 (C3Q3A3) | China House<br>Quartermaster<br>Cock Fight Arena | 10-yr design basin/15.84 ac-ft<br>10-yr design basin/6.92 ac-ft<br>10-yr design basin/14.23 ac-ft | Significantly higher development costs not justified by significant increase in output. Therefore eliminated from further analysis. |

As a result of the final ICA, one combination with the highest output but with the highest incremental cost was eliminated from further evaluation considering the relatively high cost per output that was not matched by its level of output. The remaining two combinations (C0 Q0 A1 and C2 Q0 A1) were retained for further evaluation and underwent a review of their potential benefits and costs. Table 2 summarizes the findings and rankings of the ICE.

**Table 2: Final Incremental Cost Analysis**

| Combination | Average Annual Cost | Average Annual LGHUs (equivalent acres) | Average Annual Cost per LGHU | Incremental Annual Cost | Incremental Annual Output (equivalent acres) | Annual Incremental Cost per Output |
|---|---|---|---|---|---|---|
| C0 Q0 A1 | $300,375 | 4.22 | $71,182 | $300,375 | 4.22 | $71.18 |
| C2 Q0 A1 | $458,532 | 8.82 | $51,991 | $158,157 | 4.60 | $34.38 |
| C2 Q2 A1 | $723,889 | 10.16 | $71,280 | $265,356 | 1.34 | $198.59 |

Of the two combinations retained following the final ICA, it was determined that the second alternative (C2 Q0 A1) was unaffordable, and as a result, the first alternative (C0 Q0 A1) was selected as the Preferred Alternative by the project sponsor (the CNMI CRMO). A detailed analysis of costs associated with the alternatives can be found in the ERR (Environet, 2013).

### The Least Environmentally Damaging Practicable Alternative (LEDPA) Analysis

The project alternatives were analyzed to identify the LEDPA in accordance with 40 CFR Part 230.10(a). Under these guidelines the USACE requires that the LEDPA is considered for implementation as the Preferred Alternative.

Alternatives five through seven would all offer adequate potential ecosystem restoration through improved water quality within the lagoon. However, these alternatives would require the commitment of costs that would not be practical to implement, given the projected output of environmental restoration for these alternatives. Therefore, one two-year detention basin at the Cock Fight Arena site was chosen as the LEDPA, given its projected restoration area and feasible project cost (Table 1).

## 2.2 PREFERRED ALTERNATIVE

The Preferred Alternative is the design and construction of a two-year detention basin at the Cock Fight Arena Site (Figure 3). This scenario results in 70.33 LGHUs of total restoration area in a distinct area of the lagoon. The total project cost of the Preferred Alternative is estimated at 7.896 million dollars. A preliminary design of the required improvements was completed for the Preferred Alternative.

Preliminary designs are discussed in greater detail in the Preliminary Drainage Design Study (Appendix A). Local residents have indicated that during heavy rains, large amounts of sediment are washed away from sloped areas and deposited downstream. Many roads and driveways are not paved and are severely damaged during moderate to heavy rainfall events. It is anticipated from this information that large amounts of sediment may be deposited in the detention basins. For each detention basin design, the outlet pipe is proposed to be wrapped in filter cloth and gravel, and to be located one to three feet above the bottom of the detention basin. This will allow for sediment to settle out in the basin and will require periodic removal of sediment from the basins.

## 2.3 NO ACTION ALTERNATIVE

CEQ regulation 40 CFR Section 1502.14(d) requires an alternatives analysis to include the alternative of no action. Therefore, the No Action alternative will be analyzed in this EA. The No Action alternative calls for no change to the existing infrastructure. No detention basin will be constructed at any site and stormwater runoff will continue to flow directly into the lagoon. The No Action alternative is presented in the EA in order to analyze the environmental conditions that would occur if the proposed detention basins are not implemented within the study area. It also serves as the baseline for comparative analysis of impacts.

Table 3 summarizes total project costs, benefits and environmental acceptability of the Preferred Alternative detention basin design versus the No Action Alternative. A detailed description and breakdown of the total project cost associated with the Preferred Alternative is included in the ERR (Environet, 2013).

**Table 3: Summary Comparison of Alternatives**

| | **No Action Alternative** | **Preferred Alternative (C0 Q0 A1)** |
|---|---|---|
| Water Quality Restoration | No LGHU restoration | Estimated to restore 70.33 LGHUs |
| Environmental Acceptability | No restoration, adverse environmental impact | Beneficial impact on lagoon water quality |
| Required Maintenance | None | Low |
| Total Project Cost | $0.00 | $8,451,000 |

The EA is considering the Preferred Alternative and a discussion of the consequences of taking no action, and is limiting the range of alternatives to action and no action because there are no unresolved conflicts concerning alternative uses of available resources.

The primary considerations for USACE and CNMI in selection of a Preferred Alternative include the purpose and need for the project, environmental impacts of the project, and the overall costs required for development. The No Action alternative has fewer short term environmental impacts compared to the Preferred Alternative; however, the No Action alternative does not meet the purpose and need for the proposed project to allow for the restoration of the natural ecology of Saipan Lagoon.

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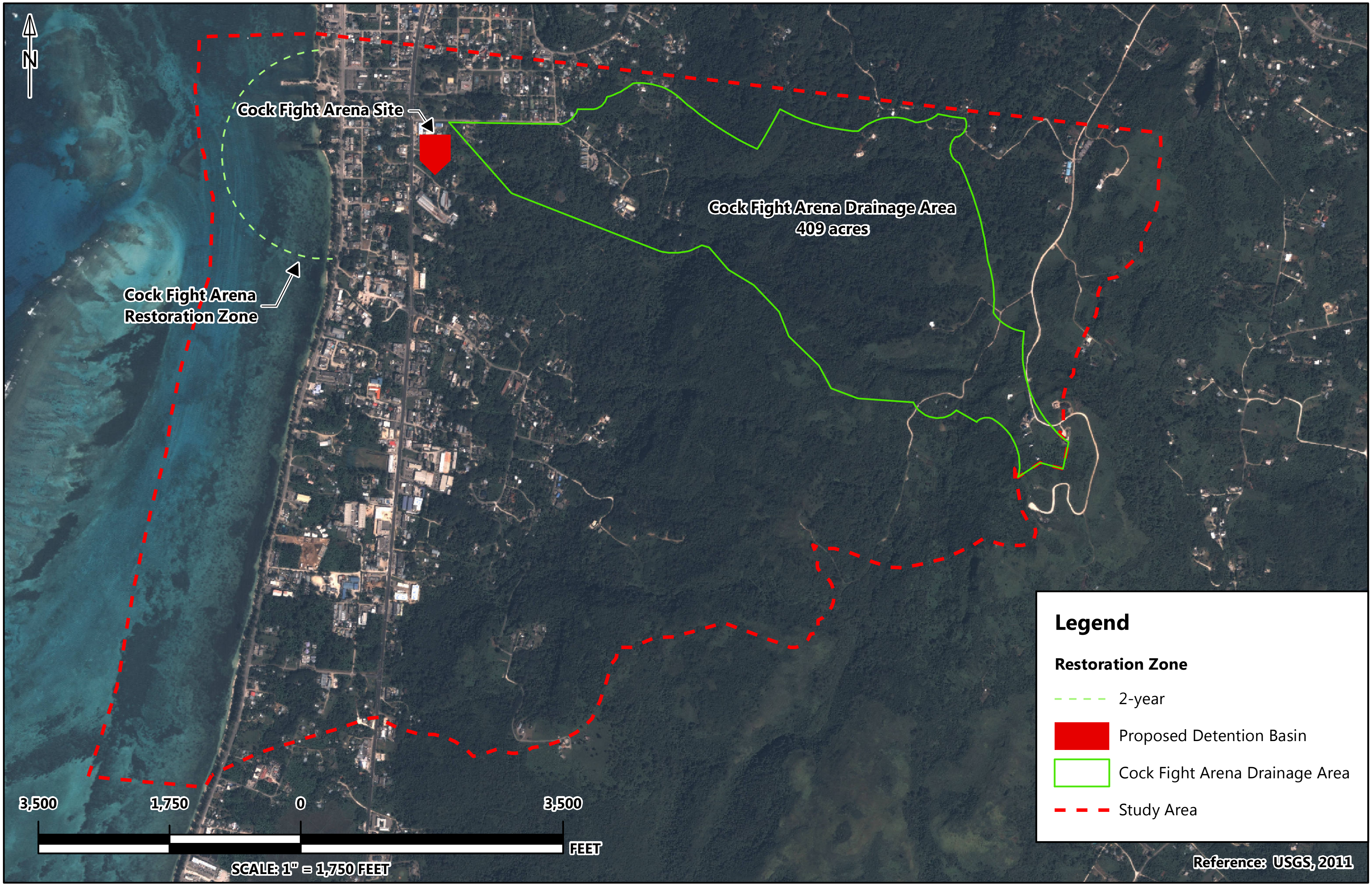


**Legend**

**Restoration Zone**

- - - 2-year

🟥 Proposed Detention Basin

🟩 Cock Fight Arena Drainage Area

- - - Study Area

| Environet, Inc. | PROJECT NO.: 1057<br>DATE: SEPTEMBER 20, 2012<br>DRAWN BY: CB<br>REVIEWED BY: MA | ENVIRONMENTAL ASSESSMENT<br>SAIPAN LAGOON AQUATIC ECOSYSTEM RESTORATION STUDY<br>PREFERRED ALTERNATIVE<br>SAIPAN, CNMI | FIGURE<br>3 |
|---|---|---|---|

# 3. AFFECTED ENVIRONMENT, ENVIRONMENTAL CONSEQUENCES AND MITIGATION

## Environmental Impacts

The CEQ regulations (40 CFR 1508.7 and 1508.8) define the impacts and effects that must be addressed and considered by Federal agencies in satisfying the requirements of the NEPA process, which includes direct, indirect and cumulative impacts.

## Impacts

**Direct Impacts**: are caused by the action and occur at the same time and place.

**Indirect Impacts**: are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect impacts may include growth inducing impacts and other impacts related to induced changes in the pattern of land use, population density or growth rate, and related effects on air, water and other natural systems, including ecosystems.

Impacts include ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historical, cultural, economic, social, or health, whether direct, indirect, or cumulative. Impacts may also include those resulting from actions which may have both beneficial and detrimental effects, even if on balance the agency believes that the effect will be beneficial (40 CFR 1508.8).

## Significance of Environmental Impacts

According to the CEQ regulations (40 CFR 1500-1508), the determination of a significant impact is a function of both context and intensity.

**Context**: This means that the significance of an action must be analyzed in several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality. Significance varies with the setting of the Proposed Action. For instance, in the case of a site-specific action, significance would usually depend upon the effects in the locale rather than in the world as a whole. Both short- and long-term effects are relevant.

**Intensity**: This refers to the severity of impact. Responsible officials must bear in mind that more than one agency may make decisions about partial aspects of a major action. The following should be considered in evaluating intensity:

1. Impacts that may be both beneficial and adverse. A significant impact may exist even if the Federal agency believes that on balance the effect will be beneficial.
2. The degree to which the Proposed Action affects public health or safety.
3. Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.

4. The degree to which the effects on the quality of the human environment are likely to be highly controversial.
5. The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.
6. The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration.
7. Whether the action is related to other actions with individually insignificant but cumulatively significant impacts. Significance exists if it is reasonable to anticipate a cumulatively significant impact on the environment. Significance cannot be avoided by terming an action temporary or by breaking it down into small component parts.
8. The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources.
9. The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973.
10. Whether the action threatens a violation of Federal, State, or local law or requirements imposed for the protection of the environment (40 CFR 1508.27).

To determine significance, the severity of the impact must be examined in terms of the type, quality and sensitivity of the resource involved; the location of the proposed project; the duration of the effect (short or long-term) and other consideration of context. Significance of the impact will vary with the setting of the Proposed Action and the surrounding area (including residential, industrial, commercial, and natural sites).

**Cumulative Impacts**

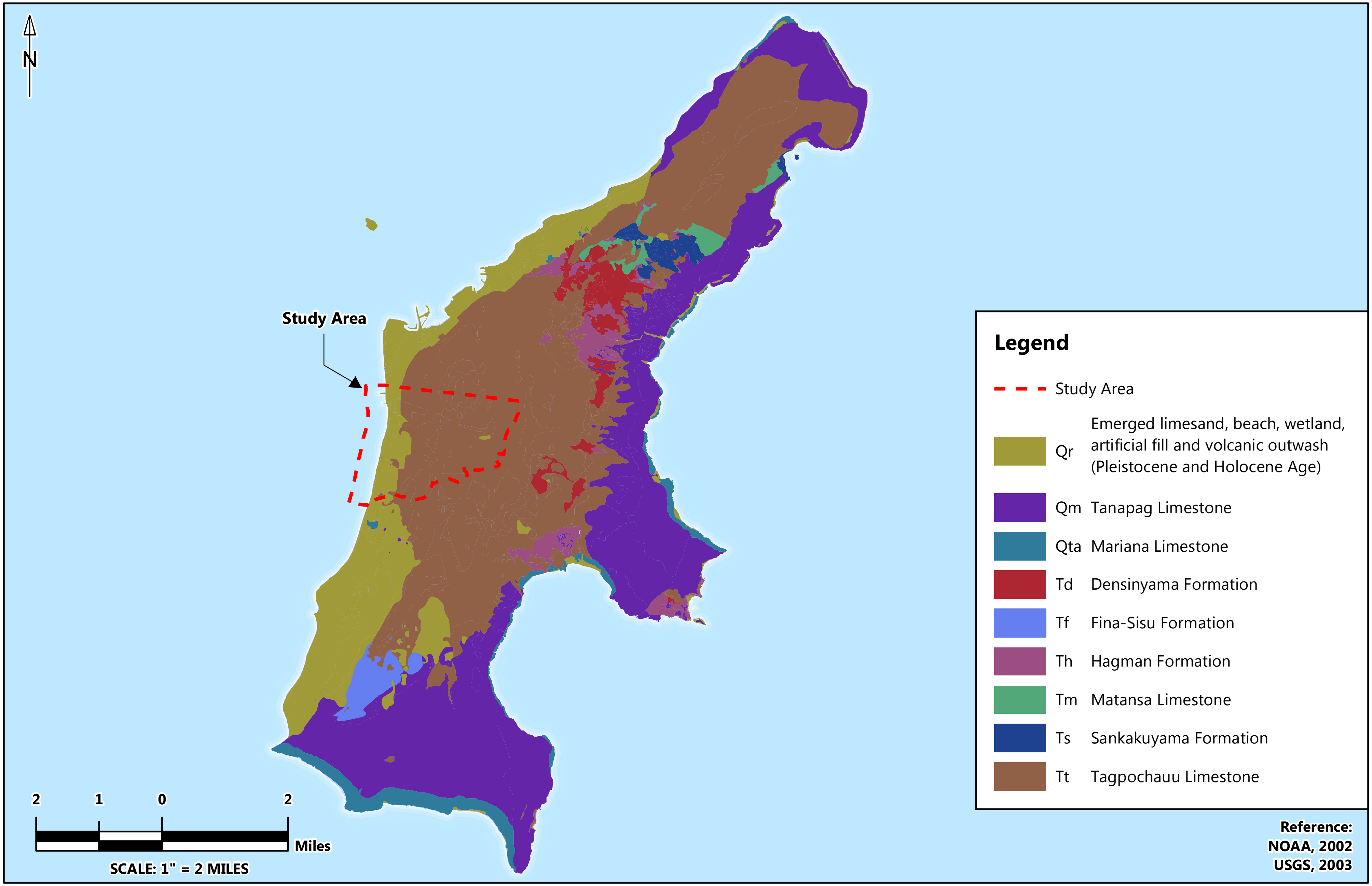
Cumulative impacts are the impacts on the environment which result from the incremental impacts of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

## 3.1 GEOLOGY AND SOILS

### 3.1.1 Existing Conditions

**Geology**

The island of Saipan is composed of a volcanic core upon which a series of discrete limestone formations have been deposited by coral reefs when these sections of the island were below sea level. Roughly 90 percent (%) of the surface of the island is currently mantled with limestone, with the remaining areas chiefly comprising volcanic outcrops and unconsolidated beach or marsh deposits (Figure 4). The aerial distribution of rock



Environet, Inc.

**PROJECT NO.: 1057**
**DATE: APRIL, 2013**
**DRAWN BY: CB**
**REVIEWED BY: MA**

**ENVIRONMENTAL ASSESSMENT**
**SAIPAN LAGOON AQUATIC ECOSYSTEM RESTORATION STUDY**

**SURFACE GEOLOGY OF SAIPAN**
**SAIPAN, CNMI**

**FIGURE**
**4**

type on the island has been created by successive episodes of tectonic uplift resulting from the flexure of the outer edge of the Philippine Plate in response to subduction of the Pacific Plate to the east of Saipan along the Marianas Trench (Karig, 1971). The thick fringing limestone units, which are exposed at elevations of up to 1,540 feet above mean sea level on the summit of Mount Takpochao, have become sub-aerially exposed as a result of these tectonic processes.

The study area is situated in the western central part of the island of Saipan. The area between the shoreline and Middle Road is a slightly to moderately sloping coastal plain composed of unconsolidated limestone derived sediments. The area inland of Middle Road possesses the characteristic geomorphology on the island of Saipan with slightly to moderately sloping topographic plateaus separated by seaward-facing scarps of emergent limestone.

The western half of the island, where the site investigation was conducted, is bordered by a large barrier reef and lagoon. Cloud et al. (1956) show the Garapan coastal plain to be underlain by recently emerged lime sands that overlie competent limestone reef at varying depths.

#### Soils

The characteristics of the surface soils within the study area generally vary from the shoreline to upland areas of the watershed. The lowland areas that extend from the shoreline to directly inland of Middle Road are dominated by soils of the Chinen-Urban Land Map Unit (Young, 1989). These soils are highly porous and account for the lack of natural streambeds or continuous drainage ways across the lowland areas. The areas upland of Middle Road in the vicinity of Gualo Rai are covered by soils of the Kagman-Saipan Map Unit while further inland the land area is dominated by the Takpochao-Chinen-Rock Outcrop Map Unit. The Chinen-Urban Land Map unit in the lowlands between Middle Road and the Beach Road is the soil unit most prone to erosion in the study area. However, the largest percentage of the sedimentation that occurs along the Beach Road drainages appears to come from quarried limestone backfill used for road and lot surfacing, rather than from erosion of the underlying native soils.

### 3.1.2 Potential Impacts and Mitigation

#### No Action

Under the No Action alternative there would be no change to geology and soils within the study area. Soils and sediment would continue to be eroded and deposited within the lagoon by stormwater runoff, leading to cumulative impacts to the lagoon water quality from soil erosion.

#### Preferred Alternative

The Preferred Alternative would have less than significant impacts on affected soils within the study area during the construction period through the institution of appropriate soil erosion control BMPs, such as use of silt fencing. Soils would be excavated in order to construct the detention basin. The excavated soils would be reused or trucked to the

Marpi Landfill in Saipan for disposal. No significant impacts to geology and soils are anticipated from the Preferred Alternative.

## 3.2 SOLID AND HAZARDOUS WASTE

The U.S. Environmental Protection Agency (EPA), under RCRA, regulates the generation and disposal of solid and hazardous waste, as defined in 40 CFR Part 261, Identification and Listing of Hazardous Waste. An integral part of the aquatic ecosystem restoration study is to identify sources that contribute nutrients or contaminants to the lagoon. PCAs that reside within the study area were inventoried and subjected to a susceptibility analysis. The guideline utilized in the analysis is the Source Water Assessment Program (SWAP) that was part of the Safe Drinking Water Act (SDWA) amendment in 1996. The SWAP was used to assess the susceptibility of all drinking water sources to activities that have significant potential to release contaminants to water sources. Although drinking water is not the primary focus of this study, the same principles were applied during the assessment of PCAs that affect the lagoon water. Therefore, for the purpose of this study, a PCA is defined as a facility or activity that 1) stores, transmits, uses, or produces contaminants, chemicals or by-products; and 2) has the potential to release contaminants that may impact the quality of the lagoon water. Results of the study on water contaminants are discussed in greater detail in the ERR (Environet, 2013).

### 3.2.1 Existing Conditions

The areas adjacent to Beach and Middle roads contain numerous commercial, residential and industrial facilities that are all potential sources of pollutants to surface and ground waters which impact the lagoon. PCAs present in this area include gas stations, automobile dealerships, septic systems associated with various residential and commercial properties, and sediment erosion associated with construction and unpaved roads. Additionally, the sewer collection system within the study area along Middle Road is known to overflow, creating contamination from sanitary sewer overflows (SSOs). An inventory and map of PCAs in the study area are included in the ERR (Environet, 2013).

### 3.2.2 Potential Impacts and Mitigation

<u>No Action</u>

Under the No Action alternative there would be no change to the existing environment. Potentially hazardous materials from PCAs collected in stormwater runoff would continue to impact the affected environment.

<u>Preferred Alternative</u>

Beneficial impacts are anticipated under The Preferred Alternative. The Preferred Alternative would utilize detention basins to trap PCA runoff water prior to its transport to the lagoon. With proper control and treatment, the runoff water will contain less contaminants before entering the lagoon compared to the No Action alternative. The Preferred Alternative would have insignificant impacts within the study area during the construction period due to the use of construction equipment utilizing petroleum products. The institution of construction BMPs, including frequent equipment and vehicle inspections to assure proper function, would mitigate any releases of potentially hazardous materials or petroleum products from construction equipment into the environment.

## 3.3 NOISE

Determination of noise levels are based on 1) sound pressure level generated (decibels [dBA] scale), 2) distance of listener from source of noise, 3) attenuating and propagating effects of the medium between the source and the listener, and 4) period of exposure.

### Regulatory Setting

The average exterior noise level generally considered acceptable for projects receiving federal assistance is 65 day-night sound levels (DNL). The DNL represents the 24-hour average sound level for day, with nighttime noise levels increased by 10 dBA. The CNMI does not have specific established noise level standards, and utilizes U.S. federal noise level recommendations when necessary.

The EPA has identified a range of yearly DNL standards that are sufficient to protect public health and welfare from the effects of environmental noise (EPA, 1977). The EPA has established a goal to reduce exterior environmental noise to a DNL not exceeding 65 dBA and a future goal to further reduce exterior environmental noise to a DNL not exceeding 55 dBA. Additionally, the EPA states that these goals are not intended as regulations as it has no authority to regulate noise levels, but rather they are intended to be viewed as levels below which the general population will not be at risk from any of the identified effects of noise.

The U.S. Occupational Safety and Health Administration (OSHA) has established acceptable noise levels for workers. Table 4 shows permissible noise levels for varying exposure times.

**Table 4: OSHA Permissible Noise Exposures**

| Duration per day-hours | Sound level dBA slow response |
|---|---|
| 8 | 90 |
| 6 | 92 |
| 4 | 95 |
| 3 | 97 |
| 2 | 100 |
| 1.5 | 102 |
| 1 | 105 |
| 0.5 | 110 |
| 0.25 or less | 115 |

Source: OSHA, 2012

The Noise Control Act of 1972 (42 U.S.C. 4901 to 4918) establishes a national policy to promote an environment for all Americans free from noise that jeopardizes their health and welfare. To accomplish this, the Act establishes a means for the coordination of Federal research and activities in noise control, authorizes the establishment of Federal noise emissions standards for products distributed in commerce, and provides information to the public respecting the noise emission and noise reduction characteristics of such products (42 U.S.C. 4901). The Act authorizes and directs that Federal agencies, to the fullest extent consistent with their authority under Federal laws administered by them, carry out the programs within their control in such a manner as to further the policy declared in 42 U.S.C. 4901.

### 3.3.1 Existing Conditions

The study area is located along a developed transportation corridor (Middle Road). The primary existing noise sources in the study area include traffic noise from Middle Road, as well as from other smaller feeder roads in the area. Other noise sources in the area include common noises from businesses along Middle Road, as well as residences in the area.

A-weighted sound level, measured in dBA is one measurement of noise. The human ear can perceive sound over a range of frequencies, which varies for individuals. In using the A-weighted scale for measurement, only the frequencies heard by most listeners are considered. This gives a more accurate representation of the perception of noise. Using this scale, the DNL of an urban/residential area, similar to conditions within the study area, can be estimated as approximately 70 dBA. Normal conversational speech at a distance of five to ten feet is approximately 70 dBA. The decibel scale is logarithmic, so, for example, sound at 90 dBA would be perceived to be twice as loud as sound at 80 dBA. Passenger vehicles, motorcycles, and trucks use the roads in the vicinity of the study area. Noise levels generated by vehicles vary based on a number of factors including vehicle type, speed, and level of maintenance. Intensity of noise is attenuated with distance. Some estimates of noise levels from vehicles are listed in Table 5 (Cavanaugh and Tocci 1998).

**Table 5: Typical Noise Sources**

| Source | Distance (feet) | Noise Level (dBA) |
|---|---|---|
| Auto, 40 mph | 50 | 72 |
| Automobile Horn | 10 | 95 |
| Light Auto Traffic | 100 | 50 |
| Truck, 40 mph | 50 | 84 |
| Heavy Truck or Motorcycle | 25 | 90 |

Source: Cavanaugh and Tocci, 1998.

### 3.3.2 Potential Impacts and Mitigation

No Action

Under the No Action alternative no construction activities would occur in the study area, therefore there would be no additional impacts to existing noise receptors within the study area.

Preferred Alternative

The Preferred Alternative would have less than significant impacts within the study area from temporary noise impacts from construction equipment and vehicles during the construction period. The institution of BMPs and properly scheduled work times would further mitigate noise impacts. There would be no long term noise impacts associated with the operation of the proposed detention basin.

## 3.4 CLIMATE AND AIR QUALITY

### Regulatory Background

The CNMI utilizes the National Ambient Air Quality Standards (NAAQS) regulated by the EPA to provide established sets of ambient air quality standards to protect human health and welfare.

CNMI Administrative Code DEQ Chapter 65-10: Air Pollution Regulations establish standards to insure that air resources are protected against pollution and do not constitute a health hazard. Section 65-10-101 of the Code states that “a permit shall be required for the construction and operation of all new sources or modifications of major sources of emissions” (CNMI DEQ 65-10-101, p. 8).

### Climate Change

The impact of new development on climate has been a growing concern. Greenhouse gases (GHGs) trap heat in the earth’s atmosphere. Both naturally occurring and anthropogenic (man-made) GHGs include water vapor, carbon dioxide, methane, nitrous oxide, and ozone. According to guidance from the CEQ, during an analysis of direct effects, it is appropriate to: (1) quantify cumulative emissions over the life of the project; (2) discuss measures to reduce GHG emissions, including consideration of reasonable alternatives; and (3) qualitatively discuss the link between such GHG emissions and climate change. However, it is not currently useful for the NEPA analysis to attempt to link specific climatological changes, or the environmental impacts thereof, to the particular project or emissions, as such direct linkage is difficult to isolate and to understand. The estimated level of GHG emissions can serve as a reasonable proxy for assessing potential climate change impacts, and provide decision makers and the public with useful information for a reasoned choice among alternatives (CEQ, 2010).

EC 1165-2-212 seeks discussion related to how Climate Change may mean continued or accelerated global warming for the 21st Century which may contribute to continued or accelerated rise in global mean sea-level.

### 3.4.1 Existing Conditions

The climate in Saipan is warm and humid throughout the year and is classified as tropical marine, with an average temperature of 75 to 80 degrees Fahrenheit (Vander Brug, 1985). Rainfall in the study area is seasonal and averages about 75 to 80 inches per year. The wet season usually extends from July through November, followed by a dry season from December through June. Saipan experienced drought-like conditions during 1998, when the rainfall between January and November totaled roughly 41 inches, or roughly half the annual mean.

The dominant winds in the Northern Marianas are trade winds, which blow from the east or northeast. These winds are strongest and most constant during the dry season, when wind speeds of 15 to 25 miles per hour are common. During the rainy season, the trade winds often cease, and on some days the weather may be dominated by westerly moving storm systems that bring heavy showers or steady, at times torrential, rains. These episodic, heavy rainfall events contribute the majority of the sediment and surface water runoff that reaches the nearshore lagoon environment. Some of these heavy rainfall events occur during typhoons.

According to the EPA, “the air quality in American Samoa, Guam, and CNMI is generally pristine, due to the wet climate, strong prevailing winds, and distance from any pollution sources” (EPA, 2006). The air quality within the study area was reported as generally good in a November, 2003 letter from the CRMO (Appendix D).

### 3.4.2 Potential Impacts and Mitigation

No Action

Under the No Action alternative there would be no additional impact to air quality within the study area.

Preferred Alternative

The Preferred Alternative would have less than significant impacts to air quality during construction activities (i.e., fugitive dust emissions and GHG emissions from motorized equipment exhaust). Potential impacts would be mitigated by utilizing BMPs during the construction process, including proper maintenance and function of construction equipment. There would be no long term impacts to air quality from the operation of the proposed detention basin.

Additionally, there is no indication that sea level rise or ocean acidification would impact the preferred action. The basin would be far above the existing shoreline and therefore would not contribute to acidification because it would detain sediment from entering the lagoon.

## 3.5 HYDROLOGY AND WATER QUALITY

The watershed within the study area is predominately underlain by the Mariana Limestone unit. This limestone unit is composed mostly of finely to coarsely fragmented, commonly coralliferous, algal, and, in part, clayey limestone (Cloud et al., 1956). The Mariana Limestone typically is white to gray colored, moderately to cavernously porous, and non-bedded to indistinctly bedded. In the coastal portions of the study area, the land surface is typically covered by recent alluvium derived from erosion of the upland limestone areas.

Residents of the island of Saipan are almost entirely dependent on groundwater as a drinking water source. Historically, limited amounts of generally brackish water have been exploited by dug wells along the coastal portion of the watershed. Potable water is extracted from deep wells (the Gualo Rai well field) located in the inland portions of the watershed.

### Regulatory Background

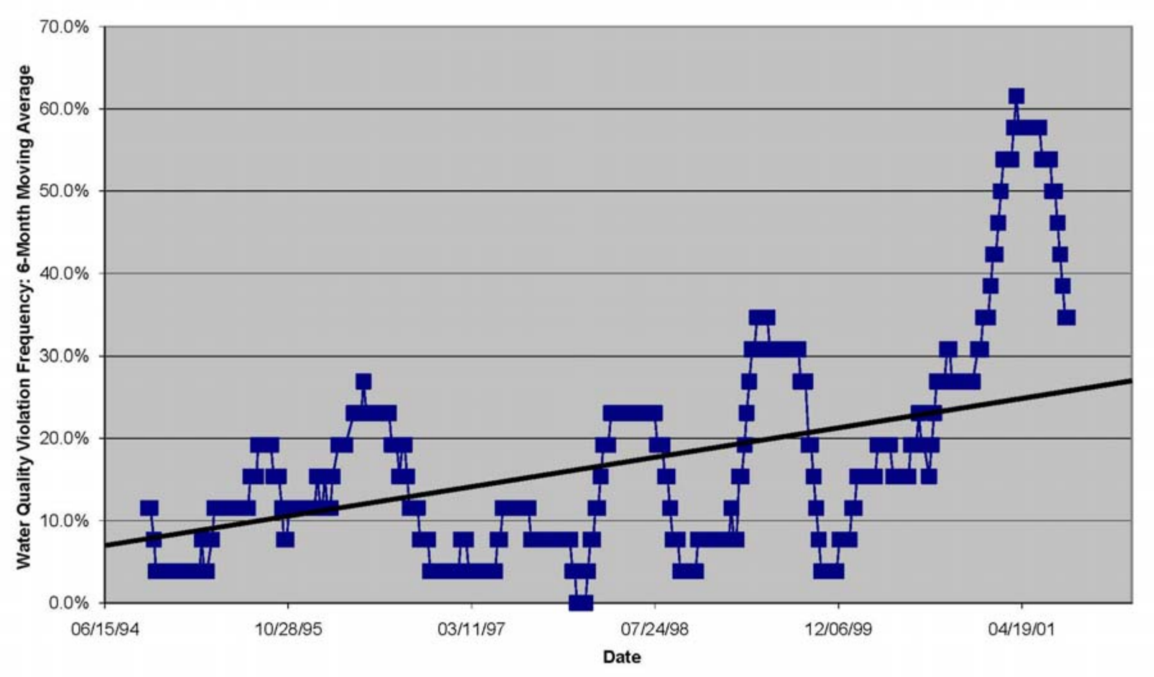
The CNMI has designated two classes of water (AA and A) for marine uses. Class AA represents high-quality waters that are considered to be in a “natural” and “pristine” state. The CNMI Water Quality Standards states that “to the extent practicable, the wilderness character of such areas shall be protected,” and does not permit any discharge of pollutants in Class AA waters. Class A waters have been designated in two parts of Saipan, and generally represent a slightly lower quality of water in which some discharges may be permitted, for example, the two sewage treatment plant outfalls on Saipan. Nevertheless, Class A waters must support recreational use and the propagation of fish, shellfish, and wildlife, and strict water quality standards have been set for the protection of these uses in Class A marine waters. Additionally, further protection is afforded through the CNMI Anti-Degradation Policy, which is part of the Water Quality Standards and protects existing uses and water quality in any waters, despite their classification.

## 3.5.1 Existing Conditions

### Surface Water

The lagoon water within the study area is designated as Class AA waters. However, beach closures due to high levels of microbiological contamination are becoming increasingly frequent along the west coast of Saipan. An interpretation of water quality data collected by CNMI DEQ over an eight-year period indicates that there is a significant trend of increasing microbiological contamination (enterococci bacteria) detections exceeding water quality standards. Figure 5 shows the increasing incidence of water quality violations at Garapan Fishing Dock located at the northern end of the study area.

**Figure 5: Water Quality Violation Frequency at Garapan Fishing Dock, 1994-2002**

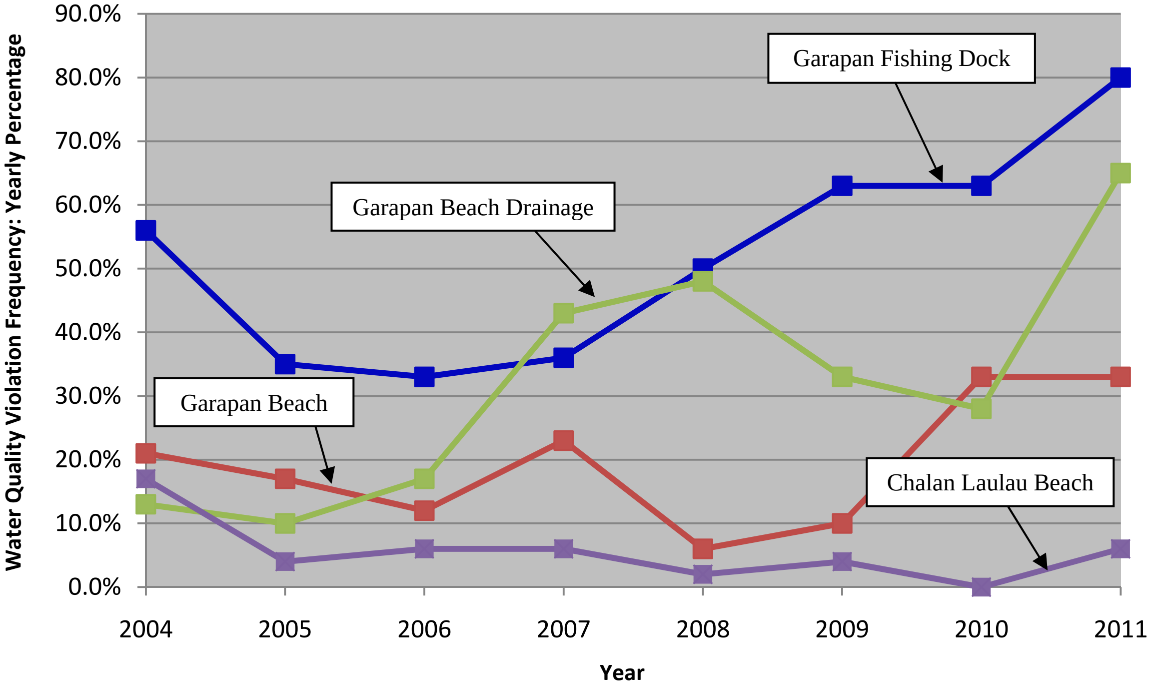


Source: DEQ, 2010

This increase in bacteriological contamination is a direct result of an increase in non point source pollution associated with urbanization and population growth. Non-point source contamination occurs predominantly from surface runoff and sediments transported by runoff, solid and human waste disposal, and agricultural activities.

Water quality data from 38 fixed stations along Saipan's most commonly used west coast beaches collected during more recent years by the CNMI DEQ indicate that sampling sites within the West Takpochau (Central) Watershed continue to consistently experience a significant number of water quality violations, leading to multiple "impaired" (violation frequency exceeds 10 %) or "significantly impaired" (violation frequency exceeds 25 %) listings (DEQ, 2010). Beach advisories notifying the public that the beach waters within 300 feet of the sampling point are not safe for swimming are triggered when either the single sample maximum (SSM) or geometric mean for the most recent four sampling events exceeds the CNMI water quality criteria. Figure 6 shows the yearly percentage of water quality violations from 2004 to 2011 at four of the CNMI DEQ sampling stations that fall within the study area. Three stations (Garapan Fishing Dock, Garapan Beach, and Garapan Beach Drainage) occur at the northern end of the study area whereas Chalan Laulau Beach occurs within the southern portion of the study area.

**Figure 6: Water Quality Violation Frequency at Monitoring Stations within Study Area, 2004-2011**



Notes:
1. Contaminant: Enterococci
2. Violation frequencies are based on the number of samples (either the SSM or geometric mean where sampling data exists for four previous sampling events) that exceeded the CNMI water quality criteria.
Source: DEQ, 2010

Water quality violation frequency over the past eight years at the three stations located at the northern end of the study area show an overall increasing trend, which is likely due to the more densely populated and urbanized areas within the northern part of the study area. On the other hand, water quality violations at Chalan Laulau Beach in the West Takpochao (South) Watershed, where less population and urbanization is observed, peaked in 2004 at 17%, and have subsequently decreased to 0-6%. The CNMI has proposed to delist the West Takpochao (South) segment from the impaired listing due to enterococci contamination because of the improvement in water quality within this segment. However, listing of the CNMI waters specific to aquatic life lists the West Takpochau (South) watershed as impaired, total maximum daily load (TMDL) required, and medium priority. The impaired listing is attributable to dissolved oxygen (DO), biocriteria, and orthophosphate from sanitary sewer overflows, urban runoff, and sedimentation. The West Takpochau (Central) Watershed is listed as impaired, TMDL required, and high priority. The impaired listing is specific to aquatic life, fish consumption, and recreation due to enterococci, mercury, DO, biocriteria, and orthophosphate from sanitary sewer overflows, urban runoff, and sedimentation (DEQ, 2010). Water quality data collected within the study area as well as the impairing listings of the watershed area that falls within the study area indicate that degradation of the water quality within the lagoon due to anthropogenic activities on land remain an issue and continued close monitoring of the lagoon water quality is necessary.

**Groundwater**

Groundwater in the western portion of Saipan occurs as an unconfined fresh to brackish water lens that overlies saltwater. The top of the aquifer is thus bound by the water table surface. Groundwater flows at a moderate gradient towards the ocean, becoming more brackish near the ocean. The base of the aquifer in the inland portions of the watershed is the westward plunging contact between volcanic basement and overlying coralline deposits. The depth to the volcanic basement in the coastal portions of the study area is unknown. The regional aquifer at the subject site is made up of the coral and coral-derived material of the Marianas Formation. Due to the high permeability of this limestone unit, the water levels within this aquifer fluctuate with ocean tides.

Two types of aquifers are dominant on Saipan, isolated limestone aquifers and the more prevalent basal aquifer, the predominant source of freshwater on the island. Due to the limited freshwater sources, the location and distribution of these aquifers is of extreme importance in the CNMI. Urban growth and an increase in population have led to several issues that threaten the freshwater aquifers. Increasing demand of freshwater has led to over-pumping of the basal lens aquifer, causing high chloride levels due to saltwater intrusion. Point source and nonpoint-source pollution due to heavy urbanization can also threaten ground water sources through infiltration of the study area’s highly permeable top soils.

### 3.5.2 Potential Impacts and Mitigation

No Action

Under the No Action alternative there would be significant cumulative impacts to the lagoon water quality. Sediment, nutrients and other pollutants entrained in stormwater would continue to flow into the lagoon. As a result, the lagoon water quality could continue to fall below water quality standards set by the CNMI.

Preferred Alternative

The Preferred Alternative would result in beneficial impacts to the lagoon water quality since sediment and other suspended solids would be filtered from the stormwater at the proposed detention basin site. The Preferred Alternative would beneficially impact 70.33 LGHUs within the lagoon.

## 3.6 TRAFFIC AND CIRCULATION

Vehicular traffic data was supplied by traffic count reports from the CNMI DPW conducted in 2007. Several intersections were chosen within the study area for 24-hour monitoring sessions. The traffic data supplied by the CNMI DPW is included in Appendix B.

### 3.6.1 Existing Conditions

Beach Road and Middle Road are the primary transportation corridors on the western coast of the island. They run north and south along the coast and are main thoroughfares for the urbanized areas along the low land coastal area. Within the study area boundaries, Gualo Rai Road and Quartermaster Road run perpendicular east and west. The results of the 2007 CNMI DPW traffic count report at key intersections affecting the study area are shown in Table 6. Peak a.m. traffic within the study area roadway network ranges from 106 to 846 cars per hour. Peak p.m. traffic within the study area roadway network ranges from 132 to 991 cars per hour.

**Table 6: Traffic Count Survey**

| Monitoring Location | Weekly a.m. peak traffic count (time) | Weekly p.m. peak traffic count (time) | Average a.m. traffic counts (7:00-11:00) | Average p.m. traffic counts (12:00-17:00) |
|---|---|---|---|---|
| Middle Road South of Navy Road | 649 (7:00) | 664 (13:00) | 368.50 | 352.08 |
| Beach Road South of Micro Beach | 344 (11:00) | 400 (17:00) | 259.08 | 256.56 |
| Quartermaster Road between Beach and Middle Road | 106 (7:00) | 132 (14:00) | 35.18 | 51.44 |
| Beach Road north of Quartermaster Road | 548 (11:00) | 784 (17:00) | 300.33 | 442.78 |
| Middle Road north of Quartermaster Road | 846 (11:00) | 991 (14:00) | 450.58 | 609.36 |
| Middle Road south of Sugar King Road | 686 (11:00) | 768 (13:00) | 418.40 | 506.32 |

### 3.6.2 Potential Impacts and Mitigation

No Action

Under the No Action alternative no significant impacts to traffic are anticipated since the existing site conditions would remain unchanged.

Preferred Alternative

The Preferred Alternative would result in less than significant traffic circulation impacts that would occur during the construction phase from additional vehicle trips to and from the proposed detention basin site via the local roadway network. These impacts would be mitigated to a level of insignificance by proper forward planning utilizing BMPs, including a traffic control plan to be approved by the CNMI DPW before commencement of work. With these mitigation measures in place, impacts to the existing roadway network would be less than significant.

## 3.7 BIOLOGICAL RESOURCES

The U.S. Fish and Wildlife Coordination Act (FWCA) requires all Federal agencies to consult with and give strong consideration to the views of the U.S. Fish and Wildlife Service (USFWS), the National Marine Fisheries Service (NMFS), and State wildlife agencies regarding the fish and wildlife impacts of projects that propose to impound, divert, channel, or otherwise alter a body of water. USACE initiated consultation with USFWS and NMFS in August 2003 and continued in October 2011. Copies of correspondence are included in Appendix D. Resource agencies indicated that no critical habitat are designated or proposed in the project area, and no candidate species are known to exist in the Saipan area.

### 3.7.1 Existing Conditions

The terrestrial habitat within and adjacent to the study area is dominated by urban landscaping and bird species. Other than birds, there are few terrestrial animals, such as the introduced marine toads (*Bufo marinus*), African land snails (*Achatina fulica*), and domesticated farm animals in Saipan. Of the abundant avifaunal species monitored on the island, there tends to be a negative correlation between the density of native species and urbanization. Highly urbanized areas retain more exotic species.

The Saipan Lagoon nearshore environment is generally composed of a sand and sand/silt/rubble substrate covered by thick stands of seagrass and algae with only an occasional coral head or limestone outcropping. Heavy input of freshwater (groundwater and surface water runoff) into the nearshore environment is conducive to dense beds of large bladed, tall (up to three feet) seagrass (*Enhalus acoroides*) which are found in a 10 to 50 meter-wide band along the shoreline. Freshwater and nutrients are known to enhance the growth of *Enhalus*, but excessive nutrients are believed to promote abundant macro-algal growth that can have an adverse impact on corals and the function of the marine ecosystem. Intermixed between stands of *Enhalus* and extended further out into the lagoon, often to the reef, is the very common short seagrass *Halodule uninervis*, which covers 20 to 70% of the benthic substrate in the lagoon between the Enhalus beds and the coral reef. Macroalgae species are abundant (especially near-shore) including *Halimeda*, *Padina*, *Caulerpa*, *Laurencia*, *Acanthophora* and *Dictyota* as the most common genera. In areas of high nutrient influx, such as the northern end of the study area near Garapan, two types of rapid growth macroalgae are dominant; *Enteromorpha* and *Cladophora*. The green, hair-like *Enteromorpha* and the pale hair-like *Cladophora* have become nuisance algae because of their undesirable appearance and abundance along beaches and in the near-shore lagoon that are used for tourist activities.

Corals in the inshore zone are very sparse and are characterized by scattered, small colonies of *Porites lutea* and *Pocillopora damicornis*. Live coral cover is less than one % overall, but some areas may support colonies of *Porites* and *Pocillopora* at densities up to five percent. Invertebrates present in the inshore zone include the common sea cucumber genera *Holothuria*, *Actinopyga*, and *Bohadschia*, the large starfish *Linckia laevigata*, and the clam known locally as “Amsum”. Lagoon fish resources include rabbitfish (Siganus), mullet (Mugilidae), goatfish (Mullidae), snappers (Lutjanidae), the emperor fish (*Lethrinus harak*), and silversides (Atherinidae).

Juveniles of many species may be found in the seagrass beds and occasional predatory species such as groupers, jacks and barracuda may also be present. This resource is utilized by local fishermen for subsistence and sport. It is of common opinion that the inshore fisheries are in decline, and information from the CNMI DLNR supports this contention (DLNR, 1998). Specific habitat units have been identified and delineated by the MMT. Additionally, fish surveys conducted by the University of Guam revealed a major decline in abundance of some of the major food fish groups between 1979 and 1996 in Saipan Lagoon (Starmer et al., 2008).

An island-wide market survey in 2009 documented the continued decline of nearshore fisheries (Houk, 2010). Initial consultation with NOAA staff indicated that no designated critical habitats for terrestrial species are listed in the study area. Further consultation was conducted with the CNMI DLNR, DFW in October, 2011. The CNMI DLNR DFW responded to consultation in October, 2011 in a letter with a list of species of concern for the CNMI. The letter stated that a biological survey would be completed during the construction permitting process in order to identify any species of concern within the study area (Appendix D).

The following marine mammals under the protection of the Marine Mammal Protection Act that have been identified in the region (NOAA, 2012):

- Bryde's whale (*Balaenoptera edent*);
- Cuvier's beaked whale (*Ziphius cavirostris*);
- Pygmy sperm whale (*Kogia breviceps*);
- Melon-headed whale (*Peponocephala electra*);
- Pygmy killer whale (*Pseudorea crassidens*);
- Killer whale (*Oreinus orea*);
- Short finned pilot whale (*Globicephaia macrorhynchus*);
- Spinner dolphin (*Stenella longirostris*);
- Striped dolphin (*Stenella coeruleoalba*);
- Pantropical spotted dolphin (*Stenella attenuate*);
- Common dolphin (*Delphinus delphis*); and
- Risso's dolphin (*Grampus griseus*)

Listed species under the National Marine Fisheries Service do not have designated critical habitats in Saipan. Identified aquatic endangered species in the CNMI include the Green Sea Turtle and the Hawksbill Sea Turtle (USFWS, 2011). Further, several coral species known to exist within the Saipan lagoon are being considered for addition to the threatened or endangered species list by NOAA (NOAA, 2012).

CNMI DFW indicates that several species of concern and federally listed endangered species exist in the CNMI. However, none of the listed species habitats are known to exist within the study area. The following species were identified in a letter from CNMI DFW (October, 2011):

- Nightingale Reed Warbler (*Acrocephalus luscinia*);
- Mariana Common Moorhen (*Gallinula chloropus guami*);
- Micronesian Megapode (*megapodius laperouse*);
- Mariana Fruit Bat (*Pteropus mariannus*);
- Mariana Swiftlet (*Aerodrames bartschi*);
- Rota Bridled White-eye (*Zosterops rotensis*); and
- Mariana Crow (*Corvus kubaryi*)

Listed species under the National Marine Fisheries Service do not have designated critical habitats in Saipan.

### 3.7.2 Potential Impacts and Mitigation

No Action

Under the No Action alternative there would be cumulative impacts to lagoon habitats from the continued uncontrolled runoff from the study area. There would be no controls implemented to address the degraded ecosystem within the lagoon. Biological resources within the lagoon would continue to be impacted from sedimentation and other pollutants suspended in runoff waters.

Preferred Alternative

Subsection 2(h) of FWCA-Exempt Project Activities. FWCA exempts surface water impoundments less than 10 acres. "The provisions of the Act shall not be applicable to...projects for the impoundment of water where the maximum surface area...is less than 10 acres" (Water Resources Development Under the Fish and Wildlife Coordination Act, November 2004).

The proposed action does not include work in streams nor any body of waters; channelization; diversion of streams or storm drains etc. All work shall be done on urban land determined to be absent of fish and wildlife. However, USACE conducted consultation with USFWS and NMFS in an effort to consider the range of alternatives as part of the ecosystem restoration project.

Terrestrial and Aquatic Biological Resources

Due to the apparent absence of threatened or endangered species, critical habitat or candidate species in the project area, no mitigation measures are proposed. There would be indirect beneficial impacts to aquatic biological resources within the Saipan lagoon under the Preferred Alternative. The proposed detention basin would help to reduce sediment runoff into the lagoon, improving the water quality. Improved water quality would help to restore degraded lagoon habitats.

## 3.8 HISTORICAL AND CULTURAL RESOURCES

### 3.8.1 Existing Conditions

Section 106 of the NHPA consultation conducted February 18, 2003 and October 30, 2012 with the CNMI Department of Community and Cultural Affairs indicated that the Cock Fight Arena site consisted of an abandoned modern-day quarry prior to its current use. A two person USACE, Honolulu District (USACE POH) pedestrian reconnaissance level survey was conducted at a 10 meter transect spacing of the entire area of potential effect in August, 2003. No cultural resources were located. Based on the 2003 survey of the study area and research conducted, the Cock Fight Arena site has a low probability for having historical or archeological resources. The reconnaissance level surface survey of the area identified no archaeological or cultural resources, as documented in the staff archaeologist's project file in the Environmental Programs Branch, USACE, Honolulu District, Fort Shafter, Hawaii.

Background research, consultation with CNMI Historic Preservation Office (HPO), and a pedestrian two-person reconnaissance level survey helped conclude that the Cockfight Arena site is a low probability area for historical or archaeological resources (refer to letters in Appendix D). USACE has determined that the undertaking will result in no historic properties affected as indicated in its letter to CNMI HPO dated October 30, 2012. Copies of all correspondence documenting the Section 106 consultation conducted are included in Appendix D.

### 3.8.2 Potential Impacts and Mitigation

No Action

Under the No Action alternative there would be no disturbance to the proposed project area, therefore there would be no change to the existing environment. There would be no impacts to historical or cultural resources.

Preferred Alternative

The Preferred Alternative would have no adverse effect to historic properties. However, prior to the start of any ground breaking construction activities associated with this project, an AMP shall be completed by a qualified archaeologist and submitted to the CNMI HPO for review and comments before its finalization prior to groundbreaking activities. Further, monitoring by a qualified archeologist is recommended for any earthmoving activities to ensure proper treatment of any possible subsurface historical, cultural and/or archeological resources encountered. A full archaeological report documenting the results of the archaeological monitoring activities shall also be submitted at the end of all construction activities to the CNMI HPO for the agency's library and files. Based on USACE POH Archaeological evaluation of the project area, it is concluded that the presence of a qualified archaeologist during construction will ensure the protection of potentially significant cultural resources including human burial remains that may be present subsurface within the project's area of potential effect. USACE POH has concluded that with the presence of a qualified archaeologist monitor during all new ground breaking construction activities as well as the submittal of a final AMP and post-monitoring archaeological report to CNMI HPO, a determination can be made that the Preferred Alternative shall have no adverse effect to historic properties.

## 3.9 LAND USE

### 3.9.1 Existing Conditions

The study area is located just south of the urbanized area of Garapan, and is characterized as medium density in the north and low density within the southern portion of the study area (Figure 7). The proposed detention basin site is zoned Mixed Commercial and Rural. The Mixed Commercial "district provides for a broad spectrum of commercial development that requires a moderate to high level of vehicular access and for low to moderate density residential development" (CNMI, 2008). The primary purpose of Rural lands is to "maintain rural character and control development sprawl" (CNMI, 2008). The detention basin site is located within an urbanized strip of land located adjacent to Middle Road. Development in this area consists of light industrial, commercial, retail and residential uses. The Gualo Rai residential area lies upslope and inland of Middle Road. Many of the small side roads and lots are unpaved. There are stormwater drains along Middle Road and Beach Road, but there is no comprehensive collection and conveyance system designed to control storm water within the developed areas in the Guala Rai district and between Middle and Beach Roads.

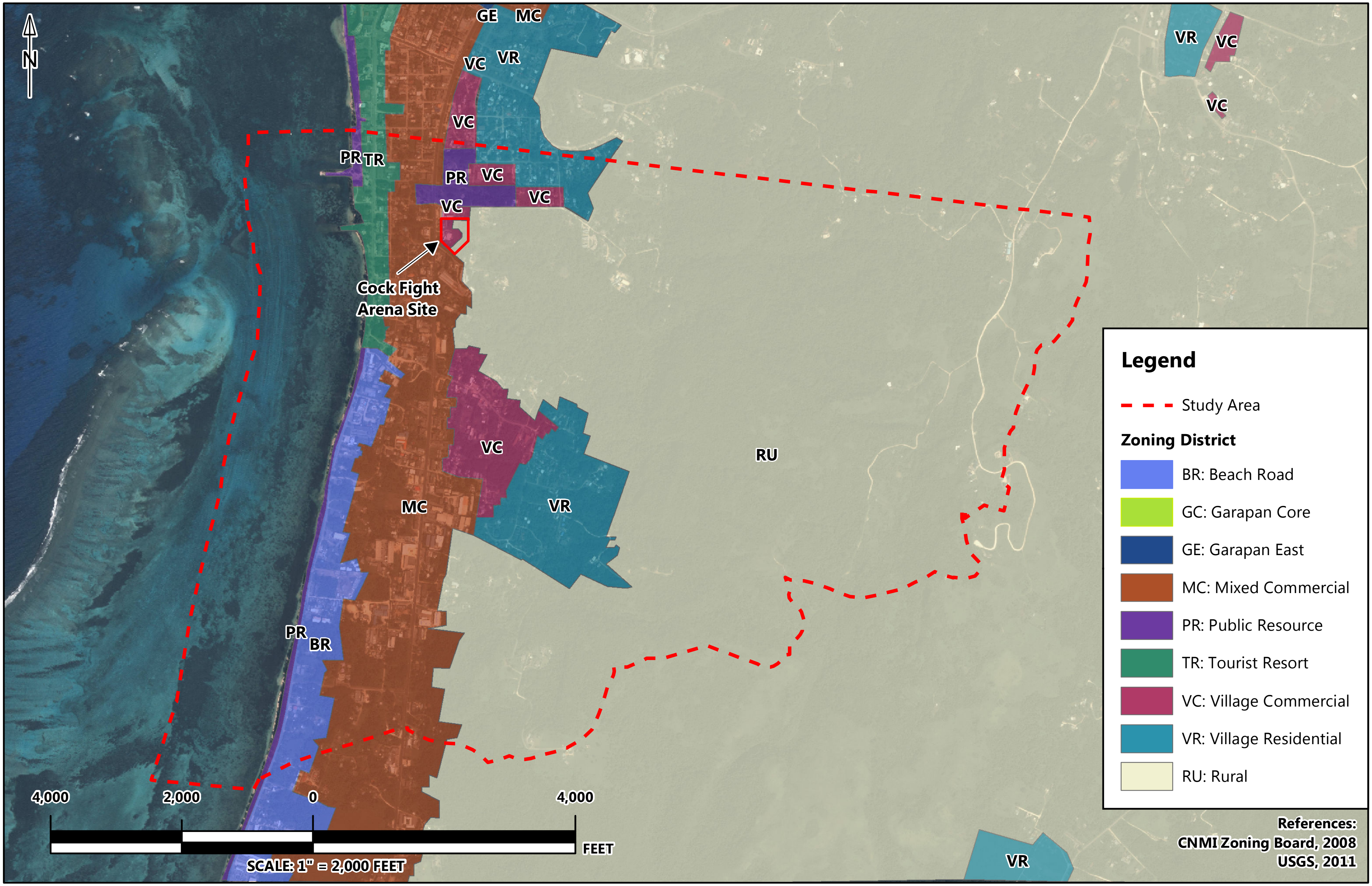
### 3.9.2 Potential Impacts and Mitigation

<u>No Action</u>

Under the No Action alternative no changes to current land uses would occur. Therefore, there would be no impact to land use within the study area.

<u>Preferred Alternative</u>

The Preferred Alternative would have insignificant impacts on land use within the study area. The proposed detention basin would represent a change in land use from periodic recreational use to public lands used as a detention basin. Since the proposed detention basin site is only used periodically for recreational use as a Cock Fight Arena, and since the proposed action would benefit the public and the surrounding environment, there would not be significant impacts to land use.



| Environet, Inc. | PROJECT NO.: 1057<br>DATE: APRIL, 2013<br>DRAWN BY: CB<br>REVIEWED BY: MA | ENVIRONMENTAL ASSESSMENT<br>SAIPAN LAGOON AQUATIC ECOSYSTEM RESTORATION STUDY<br>LAND USE PLAN REFERENCE MAP<br>SAIPAN, CNMI | FIGURE<br>7 |
|---|---|---|---|

## 3.10 VISUAL AESTHETICS

### 3.10.1 Existing Conditions

The study area is moderately urbanized, but retains the visitor quality of the urban center of Garapan with a mixture of quaint stores surrounded by pristine scenic views of mountains to the east, vast ocean to the west, and undeveloped coastal land stretching north and south.

The study area is located in a coastal lowland strip that stretches north and south along the west side of the island. The coast is fronted by a barrier reef on the west, and to the east the island is characterized by a mountainous interior. The study area is composed of clustered buildings and residences surrounded by lush vegetation. Scenic locations remain along the coast and in the less developed areas of the island.

### 3.10.2 Potential Impacts and Mitigation

No Action

Under the No Action alternative there would be no change to visual and aesthetic resources within the study area. Therefore, there would be no impact to visual and aesthetic resources.

Preferred Alternative

The Preferred Alternative would result in insignificant impacts to visual and aesthetic resources within the study area during the construction period. The presence of construction equipment and activity at the proposed detention basin site would be visible to the surrounding environment. However, since the construction period would be temporary, impacts would be insignificant. The proposed detention basin would be a low-lying structure, most of which would be a below-grade depression that would not create significant visual impacts.

## 3.11 RECREATION/RESOURCE USE

### 3.11.1 Existing Conditions

Recreational activities in Saipan consist of both terrestrial and water-based activities associated with the tourism industry, as well as local participation. The Garapan region is located north of the study area, and is the largest resort/tourism center on the island. The Saipan Lagoon provides a large, calm, and relatively shallow area of water that is used for a variety of aquatic recreational activities including swimming, windsurfing, surfing, fishing, jet skiing, kayaking, snorkeling, scuba diving, and water skiing. Terrestrial recreational activities for both tourists and residents include shopping, indoor shooting ranges, and a variety of restaurants, night clubs and bars. A recreational, paved beach path stretches south from Garapan approximately two miles and provides a scenic, protected area for walking, bike riding, and jogging.

Golfing, mountain biking and hiking are also popular recreational activities in Saipan. There are also several shoreline grottos on the northern end of the island that are popular scuba diving destinations for numerous tour companies on the island.

### 3.11.2 Potential Impacts and Mitigation

No Action

Under the No Action alternative there would be no impacts to recreation or resource use since there would be no use of additional recreational areas or resources.

Preferred Alternative

Under the Preferred Alternative, the Cock Fight Arena would be impacted because it would no longer be used for recreational purposes. However, since the site is not used on a regular basis, and could be relocated, impacts would be less than significant. The Preferred Alternative would require the commitment of natural resources such as aggregate for concrete and petroleum products to fuel construction equipment. The amount of resources needed to complete the detention basin would not represent a significant commitment of resources. Therefore, impacts to recreation and resource use would be insignificant.

## 3.12 ECONOMIC AND SOCIAL RESOURCES

### 3.12.1 Existing Conditions

Table 7 shows selected social and economic information for the CNMI.

**Table 7: CNMI Social and Economic Characteristics**

| | |
|---|---|
| Population | 53,833 |
| Median Age | 33.4 |
| **Ethnic Origin or Race (% of total population)** | |
| Native Hawaiian and other Pacific Islander | 34.9 |
| Asian | 49.9 |
| Other Race | 15.2 |
| Total Households | 16,035 |
| Average Household Size | 3.80 |
| Labor Force | 27,968 |
| Unemployment Rate | 8.1 % |
| **Industry or Trade(% of total workforce)** | |
| Arts, Entertainment, Recreation, and Accommodation and Food Services | 22.2 |
| Educational Services, and Health Care and Social Assistance | 12.4 |
| Retail Trade | 10.7 |
| Other Services, except Public | 10.3 |

**Table 7: CNMI Social and Economic Characteristics**

| | |
|---|---|
| Administration | |
| Public Administration | 9.7 |
| Construction | 7.2 |
| Other Industry | 27.5 |

Source: American Fact Finder, 2010.

As shown in Table 7, arts, recreation and accommodation and food services offer the greatest number of jobs to residents, followed by education, health care and social assistance. The unemployment rate in the CNMI is 8.1 %.

### 3.12.2 Potential Impacts and Mitigation

No Action

Under the No Action alternative there would be no impact to economic and social resources. There would be no jobs created or lost, or any action resulting in an impact to social systems or services.

Preferred Alternative

Under the Preferred Alternative there would be beneficial impacts to economic and social resources from added construction employment, as well as ongoing employment associated with the operation and maintenance of the proposed detention basin.

## 3.13 CUMULATIVE IMPACTS ASSOCIATED WITH THE PREFERRED ALTERNATIVE

Cumulative impacts are two or more individual effects which, when considered together, compound or increase the overall impact. Cumulative impacts can arise from the individual effects of a single action or from the combined effects of past, present, or future actions. Thus, cumulative impacts can result from individually minor but collectively significant actions taken over a period of time. The cumulative impacts of the proposed action along with past and reasonably foreseeable future projects proposed were assessed based upon available information.

CNMI Office of the Secretary of Public Works (DPW) plans to improve Route 33 (Beach Road) by repairing or reconstructing the existing pavement structure, improving surface drainage conditions, and incorporating pedestrian and bike lane features where warranted. Drainage improvements are proposed for the roadway improvement project and are not expected to result in any adverse cumulative impacts when implemented in conjunction with the Preferred Alternative. BMPs implemented in conjunction with construction activities under the Preferred Alternative are not expected to result in cumulative adverse impacts. No other projects are known to be planned in the surrounding area that would compound or increase the impact of the Preferred Alternative.

The Preferred Alternative would not lead to any adverse cumulative impacts. The proposed detention basin under the Preferred Alternative would lead to beneficial cumulative impacts to water quality in surface water and the Saipan Lagoon. The detention basin would remove sediment and other suspended solids from stormwater runoff within the study area. This would lead to a reduction in sediment loads and other pollutants entering the lagoon, which would improve water quality within the affected area of the lagoon. An improvement in water quality could lead to ecosystem restoration for lagoon habitats.

# 4. RELATIONSHIP TO ENVIRONMENTAL REGULATIONS

## 4.1 FEDERAL CLEAN WATER ACT

The Clean Water Act (CWA) establishes the basic structure for regulating discharges of pollutants into the waters of the U.S. and regulating quality standards for surface waters. The federal CWA prohibits the discharge of dredged or fill material into waters of the U.S. without authorization from the USACE. Because construction BMPs would be implemented under the Preferred Alternative, construction related runoff of any soil or fill material would be controlled. There would be no discharge of dredged or fill material, and a CWA authorization under Section 404 would not be required.

## 4.2 FEDERAL CLEAN AIR ACT (CAA)

The federal CAA (42 USC 7401) requires the adoption of national ambient air quality standards to protect public health, safety, and welfare from known or anticipated effects of air pollution. The CNMI utilizes the NAAQS regulated by the EPA to provide established sets of ambient air quality standards to protect human health and welfare. Administrative Code DEQ Chapter 65-10: Air Pollution Regulations establishes standards to insure that air resources are protected against pollution and do not constitute a health hazard. Since impacts to air quality from the Preferred Alternative would only include exhaust emissions from construction equipment and vehicles during the construction of the proposed detention basins, there would be less than significant impacts to air quality.

## 4.3 EXECUTIVE ORDER (EO) – PROTECTION OF CORAL REEFS

EO 13089 states that “all Federal agencies whose actions may affect U.S. coral reef ecosystems shall: (a) identify their actions that may affect U.S. coral reef ecosystems; (b) use their programs and authorities to protect and enhance the conditions of such ecosystems; and (c) to the extent permitted by law, ensure that any actions they authorize, fund or carry out will not degrade the conditions of such ecosystems.” Potential adverse impacts from construction runoff under the Preferred Alternative would be mitigated by the institution of BMPs, including silt fences and other engineering controls. The proposed detention basin would remove sediments and other suspended solids from runoff waters before entering the lagoon. This would contribute to improved coral health. Therefore, there would be beneficial impacts to coral reefs within the study area under the Preferred Alternative.

## 4.4 COASTAL ZONE MANAGEMENT ACT (CZMA)

The CZMA of 1972, as amended (16 USC 1451 et seq.), is administered in Saipan by the CNMI CRMO. The CZMA affects all projects on federal lands and/or involving federal agencies and requires federal agencies to conduct their planning, management, development and regulatory activities in a manner consistent with the state’s coastal zone management (CZM) program. The CZM program objectives and policies are to provide coastal recreational opportunities; preserve and protect historic, scenic and coastal ecosystem resources; provide economic uses; reduce coastal hazards; improve public awareness in coastal zone management; and manage development within the coastal zone. The entire island of Saipan is located within the coastal zone. The CNMI CRMO is the lead sponsor for the proposed project, the purpose of which is to reduce the amount of sediment and other suspended solids from entering the lagoon via stormwater runoff. Therefore, the Preferred Alternative would comply with the CRMO Regulation 15-10; Coastal Resources Rules and Regulations, and would have a beneficial impact on coastal resources.

## 4.5 THE ENDANGERED SPECIES ACT (ESA)

The ESA of 1973, Section 7 requires federal agencies to conduct consultation to determine effects of an action on threatened and endangered species or their designated habitats.

The USFWS and the CNMI DLNR DFW have jurisdiction over endangered and threatened terrestrial flora, fauna, and birds. NOAA, through the National Marine Fisheries Service has jurisdiction over marine mammals and fish.

The CNMI DLNR DFW provided a list of species of concern that exist within the CNMI. Once the specific areas for development are delineated during the permit process, the CNMI DLNR DFW will complete a biological survey of the proposed development sites and determine the need for any mitigation measures if any species of concern are found to exist within the development areas. With these mitigation measures in place there would be no impacts to biological resources under the Preferred Alternative.

## 4.6 FISH AND WILDLIFE COORDINATION ACT

The U.S. Fish and Wildlife Coordination Act and its amendments require Federal agencies to consult with and give equal consideration to other water resources development programs regarding the fish and wildlife impacts of projects that propose to impound, divert, channel, or otherwise alter a body of water.

The USFWS has conducted various biological surveys in Saipan, including the Final Coordination Act Report for the Garapan Flood Control Study and the Biological Opinion Study for Chalan Laulau. These reports are included in Appendix C. An inshore lagoon area seagrass and associated fauna survey was conducted in the study area in May of 2002 by the MMT, and a study of seagrass and macroalgal assemblages in Saipan Lagoon was also conducted in 2010 (Houk, and R. Camacho, 2010). A wetlands conservation plan for the CNMI was completed by the CNMI Department of Lands Natural Resources (DLNR) in 1989 (DLNR, 1989). A wetland site assessment conducted by CRMO personnel in November of 2003 found no evidence of wetlands within the affected portions of the study area.

Subsection 2(h) of FWCA-Exempt Project Activities. FWCA exempts surface water impoundments less than 10 acres. "The provisions of the Act shall not be applicable to projects for the impoundment of water where the maximum surface area is less than 10 acres." The proposed action does not include work in streams nor any body of waters; channelization; diversion of streams and storm drains etc. All work shall be done on urban land determined to be absent of fish and wildlife.

Water-diversion structures in the form of a retention basin are included in the proposed construction activities for this EA. However, the construction of the retention basin would ultimately reduce the discharge of pollutants into the lagoon ecosystem. As a result, the Preferred Alternative would have an indirect beneficial impact on the fish and wildlife that exist within the lagoon ecosystem.

## 4.7 MARINE MAMMAL PROTECTION ACT (MMPA)

The Marine Mammal Protection Act (MMPA) was enacted in 1972 in order to prohibit the "take" of marine mammals within U.S. waters, the "take" of marine mammals by U.S. citizens on the high seas, and the importation of marine mammals and marine mammal products into the U.S. No marine mammals will be "taken" incidental to the implementation of the Preferred Alternative. In addition, marine mammals are not known to frequent the lagoon ecosystem. If marine mammals did inhabit the lagoon ecosystem they would benefit from the restorative impacts that the retention basins would provide. As a result, the proposed construction activities in this EA should not be a concern regarding the MMPA.

## 4.8 MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

The Magnuson-Stevens Fishery Conservation and Management Act was created in 1976 and amended twice in 1996 and 2006. The Act was enacted to serve the following seven purposes:

- acting to conserve fishery resources;
- supporting enforcement of international fishing agreements;
- promoting fishing in line with conservation principles;
- providing for the implementation of fishery management plans which achieve optimal yield;
- establishing Regional Fishery Management Councils to steward fishery resources through the preparation, monitoring, and revising of plans which enables stakeholders to participate in the administration of fisheries and consider social and economic needs;
- developing underutilized fisheries; and
- protecting essential fish habitats.

The detention basin proposed in this EA will serve to improve the lagoon ecosystem. As a result, the Preferred Alternative would have a beneficial impact on the local fishery centered in the study area.

## 4.9 COASTAL RESOURCE MANAGEMENT ACT

This act requires that parties proposing anthropogenic activities affecting or which may affect the coastal resources of the CNMI apply for a CRMO Permit. A wetland site assessment conducted by CRMO personnel in November of 2003 found no evidence of wetlands in the proposed detention basin site. No other Areas of Particular Concern (APCs) were identified within the boundaries of the study area.

## 4.10 EXECUTIVE ORDER (EO) 13089 ON COASTAL REEF PROTECTION

EO 13089 directs all Federal agencies to protect and manage U.S. coral reef ecosystems by identifying actions that may affect these ecosystems, and to protect and enhance them to the extent permissible by law. As the objective of the project is to restore the ecosystem of the lagoon, the Preferred Alternative would not adversely impact the existing coral reef ecosystem and may enhance its condition over time.

## 4.11 SECTION 106 NATIONAL HISTORIC PRESERVATION ACT

Section 106 of the NHPA seeks to accommodate historic preservation concerns with the needs of Federal endeavors through consultation among the agency official, CNMI Historic Preservation Officer, and other parties with an interest in the effects of the project on cultural, archaeological and historic resources and properties. The purpose of consultation is to identify cultural, archaeological and historic resources and properties potentially affected by the project, assess its effects and seek ways to avoid, minimize or mitigate any adverse effects on known resources.

Pursuant to Section 106 of the NHPA of 1966 (as amended) and its implementing regulations (36 CFR 800), project alternatives which might affect properties listed or eligible for listing on the National Register of Historic Places are subject to the provisions of this Act.

USACE and CNMI Archeological staff had meetings and field visits pertaining to the study area as well as a formal archaeological investigation in August, 2003. The Preferred Alternative would have no adverse effect to historic properties. However, prior to the start of any ground breaking construction activities associated with this project, an AMP shall be completed by a qualified archaeologist and submitted to the CNMI HPO for review and comments before its finalization prior to groundbreaking activities. Further, monitoring by a qualified archeologist is recommended for any earthmoving activities to ensure proper treatment of any possible subsurface historical, cultural and/or archeological resources encountered. A full archaeological report documenting the results of the archaeological monitoring activities shall also be submitted at the end of all construction activities to the CNMI HPO for the agency's library and files. Based on USACE POH Archaeological evaluation of the project area, it is concluded that the presence of a qualified archaeologist during construction will ensure the protection of potentially significant cultural resources including human burial remains that may be present subsurface within the project's area of potential effect. USACE POH has concluded that with the presence of a qualified archaeologist monitor during all new ground breaking construction activities as well as the submittal of a final AMP and post-monitoring archaeological report to CNMI HPO, a determination can be made that the Preferred Alternative shall have no adverse effect to historic properties.

## 4.12 EO 12898 – ENVIRONMENTAL JUSTICE IN MINORITY POPULATIONS AND LOW-INCOME POPULATIONS AND EO 13045 – PROTECTION OF CHILDREN FROM ENVIRONMENTAL HEALTH AND SAFETY RISKS

EO 12898 states that "each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental impacts of its programs, policies, and activities on minority populations and low-income populations in the United States and its territories and possessions, the District of Columbia, the Commonwealth of Puerto Rico, and the CNMI."

No significant adverse environmental impacts are anticipated as a result of the Preferred Alternative. The Preferred Alternative involves a public infrastructure project to reduce the amount of sediment and other harmful constituents from reaching the Saipan lagoon. There would be no significant adverse impacts to minority and low-income populations in Saipan. No disproportionate adverse effects on children are expected to result from implementation of the Preferred Alternative. The Preferred Alternative would result in beneficial impacts to public health and safety, and the environment.

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# *Appendix A*
# *Preliminary Drainage Design Report*

# PRELIMINARY DRAINAGE DESIGN
# FOR
# AQUATIC ECOSYSTEM RESTORATION STUDY
# SAIPAN LAGOON
# SAIPAN, NOTHERN MARIANA ISLANDS

Prepared for:
U.S Army Corps of Engineers
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January 2012

# *Table of Contents*

# *List of Figures*

# *Appendix A*

# Section 1 Hydrology

Three low-lying areas in the West Takapochao watershed were selected for evaluation as possible drainage detention basins. These sites include vacant land adjacent to Quartermaster Road, the China House, and the Cockfight Arena; see Figure 1. These three areas currently flood during heavy rains.

During heavy rains the initial rainfall will produce the most sediment, nutrients and pollutants, known as the “first flush.” In order to represent this “first flush” a one-hour intensity storm over a one hour duration has been applied to the analyses. Three storm events were evaluated in this report; 2-year, 5-year, and 10-year recurrence storms. Storm event data were utilized from the “Rainfall – Frequency Study, Saipan Commonwealth of Northern Marianas Islands, Contract No. DACA83-01-D-0014”, prepared by Environet, Incorporated, dated April 2003.

Table 1: Saipan International Airport Rainfall Data – 60 minute Duration Storm Events

| Return Frequency | Cumulative Rainfall (inches) | Rainfall Intensity (inches/ hour)[1] |
|---|---|---|
| $X_{10}$ | 3.06 | 3.06 |
| $X_5$ | 2.61 | 2.61 |
| $X_2$ | 1.93 | 1.93 |

[1] From Table 4-6 and Table 4-7 in the “Rainfall – Frequency Study”

The watershed analysis for each storm and site was performed using the computer software program Hydrologic Modeling System HEC-HMS, version 3.5 and can be found in Appendix A. The Soil Conservation Service (now the Natural Resource Conservation Service) curve number was applied to the analyses along with the SCS unit hydrograph to symbolize the direct runoff over the watersheds. The lag time for the unit hydrograph was assumed to equal the time of concentration. No baseflow is assumed in the analyses. The simulations were ran over a 24-hour time period.

# *Section 2 Hydraulics*

HEC-HMS version 3.5 was also used to perform the analysis on the proposed detention basins. Elevation-area functions were used to specify the storage relationships. The outlet structure routing method was used to perform the reservoir routing. The simulations were routed through reinforced concrete outlet pipes (RCP) that were sized according to the analysis and existing site conditions. The RCP outlet pipes are to be wrapped in filter cloth and gravel, and are to be located 1’-2’ above the bottom of the detention basin. This will allow sediment to settle out in the basin and will require periodic removal of sediment from the basins. The simulations were ran over a 24-hour time period.

Each watershed was analyzed separately for the three storm events. A preliminary design of the required improvements was completed for each event and each site. The preliminary designs are further explained in detail in the following sections. Each design is based upon 100% of the design storm runoff passing through the detention basin. The analysis assumes that the topographic conditions and existing drainage facilities adequately convey storm flows to the proposed detention basins. Detailed as-built information and condition surveys about existing storm drain systems were not available; nor were detailed surveys of the proposed sites. This information will be necessary for implementation of the final design of the proposed detention basins. For the purposes of preliminary design and comparison, assumptions were made regarding the sites and existing drain systems. These assumptions are identified in the following sections and/or on the figures. It should also be noted that the Quartermaster Site and the Cock Fight Arena are currently on private property. This report does not address acquiring such properties and that it is assumed that all lands used for the proposed detention basins can or will be acquired by the CNMI Government.

# *Section 3 Quartermaster Site*

## *3.1 Existing Conditions*

The Quartermaster Site is located at the northwest corner of the intersection of Quartermaster Road and Middle Road. The site is currently vacant and overgrown with vegetation. The site generally slopes to the southwest corner at approximately 4-5%.

The watershed which is tributary to the site is approximately 109 acres. The wtershed is mostly undeveloped, mountainous terrain. The bottom of the watershed, adjacent to Middle Road is more moderately sloped and developed with residential and commercial buildings, roads, and associated improvements. The watershed has an average slope of approximately 23%.

The storm runoff concentrates along the east side of Middle Road at a low point on the northern side of the Quartermaster Road intersection. There is an existing catch basin at this location which will continue to be utilized.

Condition of existing drainage facilities is unknown and may require repair or replacement. Existing facilities were assumed as shown on figures 2.1, 2.2 and 2.3.

## *3.2 2-Year Storm Event*

The 2-year storm event will produce a peak runoff of approximately 20.8 cfs. The runoff will be routed through a proposed detention basin providing approximately 1.52 ac-ft of storage from elevations 23 feet - 32 feet. Discharge from the detention basin will enter an existing swale via an 18 inch RCP outlet and flow along the north side of Quartermaster Road running westward toward Beach Road and the Lagoon. Figure 2.1 depicts the required improvements to the Quartermaster site to detain the 2-year storm event. With the proposed improvements, the detention basin will pond approximately to elevation 26.8 feet, and the peak discharge from the detention basin will be approximately 7.7 cfs.

## *3.3 5-Year Storm Event*

The 5-year storm event will produce a peak runoff of approximately 75.0 cfs. The runoff will be routed through a proposed detention basin providing approximately 4.89 ac-ft of storage from elevations 23 feet – 32 feet. Discharge from the detention basin will enter an existing swale via an 18 inch RCP outlet and flow along the north side of Quartermaster Road running westward toward Beach Road and the Lagoon. Figure 2.2 depicts the required improvements to the Quartermaster site to detain the 5-year storm event. With the proposed improvements, the detention basin will pond approximately to elevation 27.9 feet, and the peak discharge from the detention basin will be approximately 12.4 cfs.

## 3.4 10-Year Storm Event

The 10-year storm event will produce a peak runoff of approximately 118.5 cfs. The runoff will be routed through a proposed detention basin providing approximately 6.92 ac-ft of storage from elevations 23 feet – 32 feet. Discharge from the detention basin will enter an existing swale via an 18 inch RCP outlet and flow along the north side of Quartermaster Road running westward toward Beach Road and the Lagoon. Figure 2.3 depicts the required improvements to the Quartermaster site to detain the 10-year storm event. With the proposed improvements, the detention basin will pond approximately to elevation 28.9 feet, and the peak discharge from the detention basin will be approximately 14.5 cfs.

# *Section 4 China House Site*

## *4.1 Existing Conditions*

The China House Site is located near the China House Restaurant and the driving range, about halfway between Middle Road and Beach Road. The site is currently undeveloped and overgrown with vegetation. However there are abandoned structures on the property which will need to be demolished. The site generally slopes to the west at approximately 3.5%.

The watershed which is tributary to the site is approximately 344 acres. The watershed is mixed between undeveloped, mountainous terrain and areas developed with residential and commercial buildings, roads, and associated improvements. The watershed has an average slope of approximately 16%.

The storm runoff concentrates along the east side of Middle Road at a low point in the road. There is an existing catch basin at this location which will continue to be utilized. Each storm event requires improvements starting at this existing catch basin, which are further detailed in the following sections.

Condition of existing drainage facilities is unknown and may require repair or replacement. Existing facilities were assumed as shown on figures 3.1, 3.2 and 3.3.

## *4.2 2-Year Storm Event*

The 2-year storm event will produce a peak runoff of approximately 51.9 cfs. The runoff will be routed through a proposed detention basin providing approximately 4.77 ac-ft of storage from elevations 20 feet – 29 feet. An 18 inch RCP outlet will discharge from the detention basin to an existing double 30 inch culvert under Beach Road, discharging to the Lagoon. Figure 3.1 depicts the required improvements to the China House site to detain the 2-year storm event. With the proposed improvements, the detention basin will pond approximately to elevation 24.4 feet, and the peak discharge from the detention basin will be approximately 15.0 cfs.

## *4.3 5-Year Storm Event*

The 5-year storm event will produce a peak runoff of approximately 178.6 cfs. The runoff will be routed through a proposed detention basin providing approximately 13.54 ac-ft of storage from elevations 19 feet – 29 feet. An 18 inch outlet pipe will discharge from the detention basin to an existing double 30 inch culvert under Beach Road, discharging to the Lagoon. Figure 3.2 depicts the required improvements to the China House site to detain the 5-year storm event. With the proposed improvements, the detention basin will pond approximately to elevation 26.8 feet, and the peak discharge from the detention basin will be approximately 15.6 cfs.

## 4.4 10-Year Storm Event

The 10-year storm event will produce a peak runoff of approximately 284.0 cfs. The runoff will be routed through a proposed detention basin providing approximately 15.84 ac-ft of storage from elevations 18 feet – 30 feet. A 36 inch outlet pipe will discharge from the detention basin to an existing double 30 inch culvert under Beach Road, then discharging to the Lagoon. Figure 3.3 depicts the required improvements to the China House site to detain the 10-year storm event. With the proposed improvements, the detention basin will pond approximately to elevation 27.9 feet, and the peak discharge from the detention basin will be approximately 91.1 cfs.

# *Section 5 Cock Fight Arena Site*

## *5.1 Existing Conditions*

The Cock Fight Arena Site is located on the east side of Middle Road, surrounding the existing Cock Fight Arena. The site is currently developed as a Cock Fight Arena, and portions were utilized as a quarry. The site generally slopes to the quarry pit.

The watershed which is tributary to the site is approximately 413 acres. The watershed is mainly undeveloped, mountainous terrain with some minor areas developed with residential and commercial buildings, roads, and associated improvements. The watershed has an average slope of approximately 12%.

Condition of existing drainage facilities is unknown and may require repair or replacement. Existing facilities were assumed as shown on figures 4.1, 4.2 and 4.3.

## *5.2 2-Year Storm Event.*

The 2-year storm event will produce a peak runoff of approximately 20.9 cfs. The runoff will be routed through a proposed detention basin providing approximately 11.85 ac-ft of storage from elevations 37 feet – 45 feet. An 18 inch outlet pipe will discharge from the detention basin to the Lagoon following existing paved roadways. Figure 4.1 depicts the required improvements to the Cock Fight Arena site to retain the 2-year storm event. The pit is currently sufficiently sized to accommodate the 2-year storm event; however, inlet improvements are required and outlet improvements are recommended. With the proposed improvements, the detention basin will pond approximately to elevation 40.3 feet, and the peak discharge from the detention basin will be approximately 4.4 cfs.

Based upon the minimal topographic information provided, it appears that the Cock Fight Arena's finish floor is approximately 43 feet in elevation. Additional investigation of the Arena and the pit should be performed to verify that ponding will not flood the Arena.

## *5.3 5-Year Storm Event*

The 5-year storm event will produce a peak runoff of approximately 95.9 cfs. The runoff will be routed through a proposed detention basin providing approximately 11.85 ac-ft of storage from elevations 37 feet – 45 feet. An 18 inch outlet pipe will discharge from the detention basin to the Lagoon following existing paved roadways. Figure 4.2 depicts the required improvements to the Cock Fight Arena site to detain the 5-year storm event. The pit is currently sufficiently sized to accommodate the 5-year storm event; however, inlet and outlet improvements are required. With the proposed improvements, the detention basin will pond approximately to elevation 43.4 feet, and the peak discharge from the detention basin will be approximately 14.0 cfs.

Based upon the minimal topographic information provided, it appears that the Cock Fight Arena's finish floor is approximately 43 feet in elevation. Additional investigation of the Arena and the pit should be performed to verify that ponding will not flood the Arena. If flooding will occur, modifications can be made to the pit, or outlet structures. Alternatively, the Arena may be demolished.

## *5.4 10-Year Storm Event.*

The 10-year storm event will produce a peak runoff of approximately 164.7 cfs. The runoff will be routed through a proposed detention basin providing approximately 14.23 ac-ft of storage from elevations 37 feet – 45 feet. A 24 inch outlet pipe will discharge from the detention basin to the Lagoon following existing paved roadways. Figure 4.3 depicts the required improvements to the Cock Fight Arena site to detain the 10-year storm event. Improvements to the pit will include some grading at the base of the existing pit, the walls of the pit and limits of the pit will not require expansion. In addition, inlet and outlet improvements are required. With the proposed improvements, the detention basin will pond approximately to elevation 44.6 feet, and the peak discharge from the detention basin will be approximately 30.3 cfs.

Based upon the minimal topographic information provided, it appears that the Cock Fight Arena's finish floor is approximately 43 feet in elevation. Additional investigation of the Arena and the pit should be performed to verify whether ponding will flood the Arena. It appears likely that the Arena will need to be demolished, or additional modifications will need to be made to the pit, or outlet structures.

# *Section 6 Conclusion*

For each of the alternatives the detention basins were designed to provide adequate storage, detention times and outlet design to reduce outflow and improve water quality.

In addition to the detention basins, each site will include a perimeter fence and a paved access driveway to the bottom of each basin for safety and maintenance.

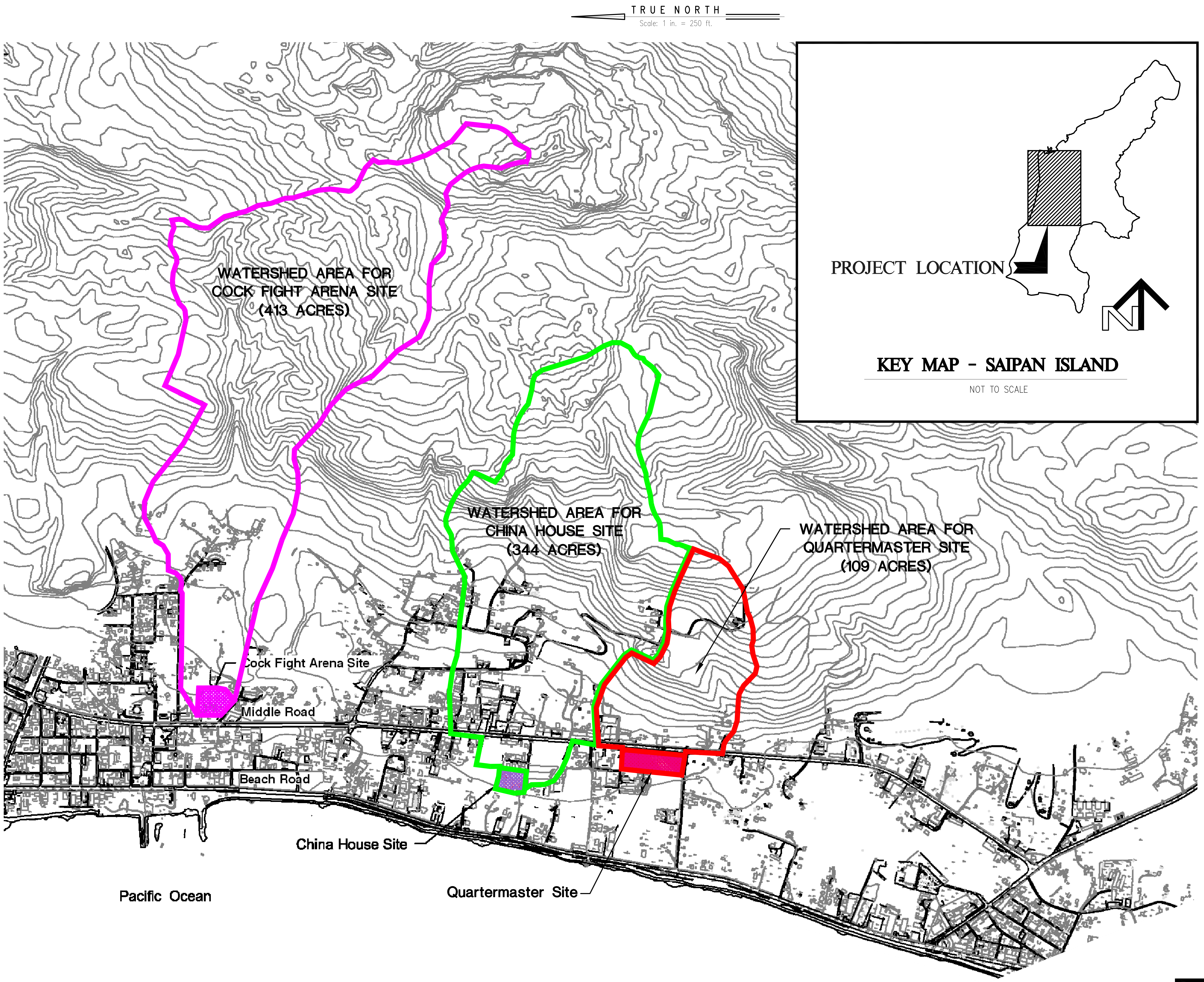
Additional topographic information will be required to finalize actual designs for any selected sites. Condition assessments of existing drainage facilities should also be performed.

The analysis provided herein along with the preliminary designs proposed, provide the U.S. Army Corps of Engineers (USACOE) with information to prepare cost-benefit analysis of the proposed sites and each of the storm event situations.

# Section 7 References

EI, 2003. Rainfall-Frequency Study, Saipan, Commonwealth of Northern Marianas Islands. Report prepared for U.S. Army Corps of Engineers, dated April 2003.

# Figures



## OVERALL PLAN

SCALE: 1" = 250'

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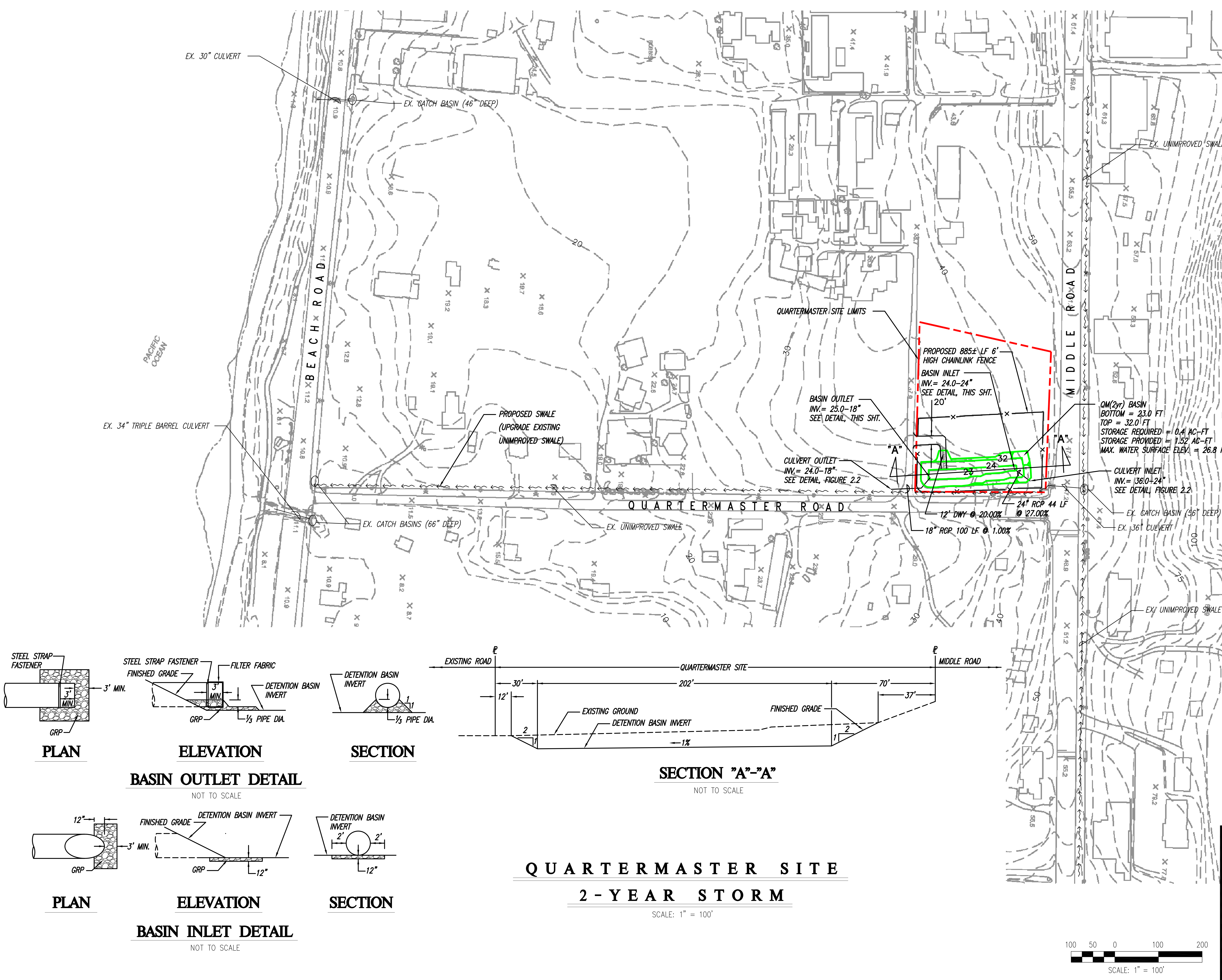
PRELIMINARY DRAINAGE DESIGN FOR AQUATIC ECOSYSTEM RESTORATION STUDY, SAIPAN LAGOON
SAIPAN, NORTHERN MARIANA ISLANDS

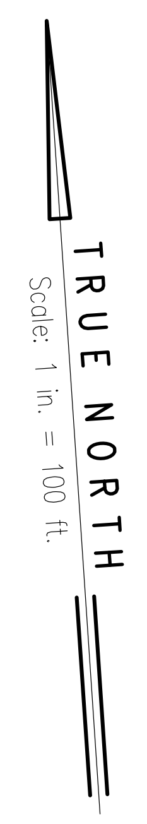
FIGURE 1 - OVERALL PLAN AND KEY MAP



QUARTERMASTER SITE

2-YEAR STORM

SCALE: 1" = 100'



**EARTHWORK QUANTITIES**

**(FOR ESTIMATION PURPOSES ONLY)**

AREA TO BE MASS GRADED ______ 0.38 ACS

EXCAVATION ______ 3,157 C.Y

EMBANKMENT ______ 0 C.Y

**NOTE:** *QUANTITIES ARE BASED ON TOPOGRAPHY PROVIDED*

**LEGEND**

| | |
|---|---|
| ⇝ ⇝ ⇝ ⇝ | *EXISTING UNIMPROVED SWALE* |
| 🟥 — — — | *SITE LIMITS* |
| 🟩 —23— | *FINISHED CONTOUR* |
| — 50 — | *EXISTING CONTOUR* |
| ℄ | *PROPERTY LINE* |
| —×—×—×— | *CHAINLINK FENCE* |

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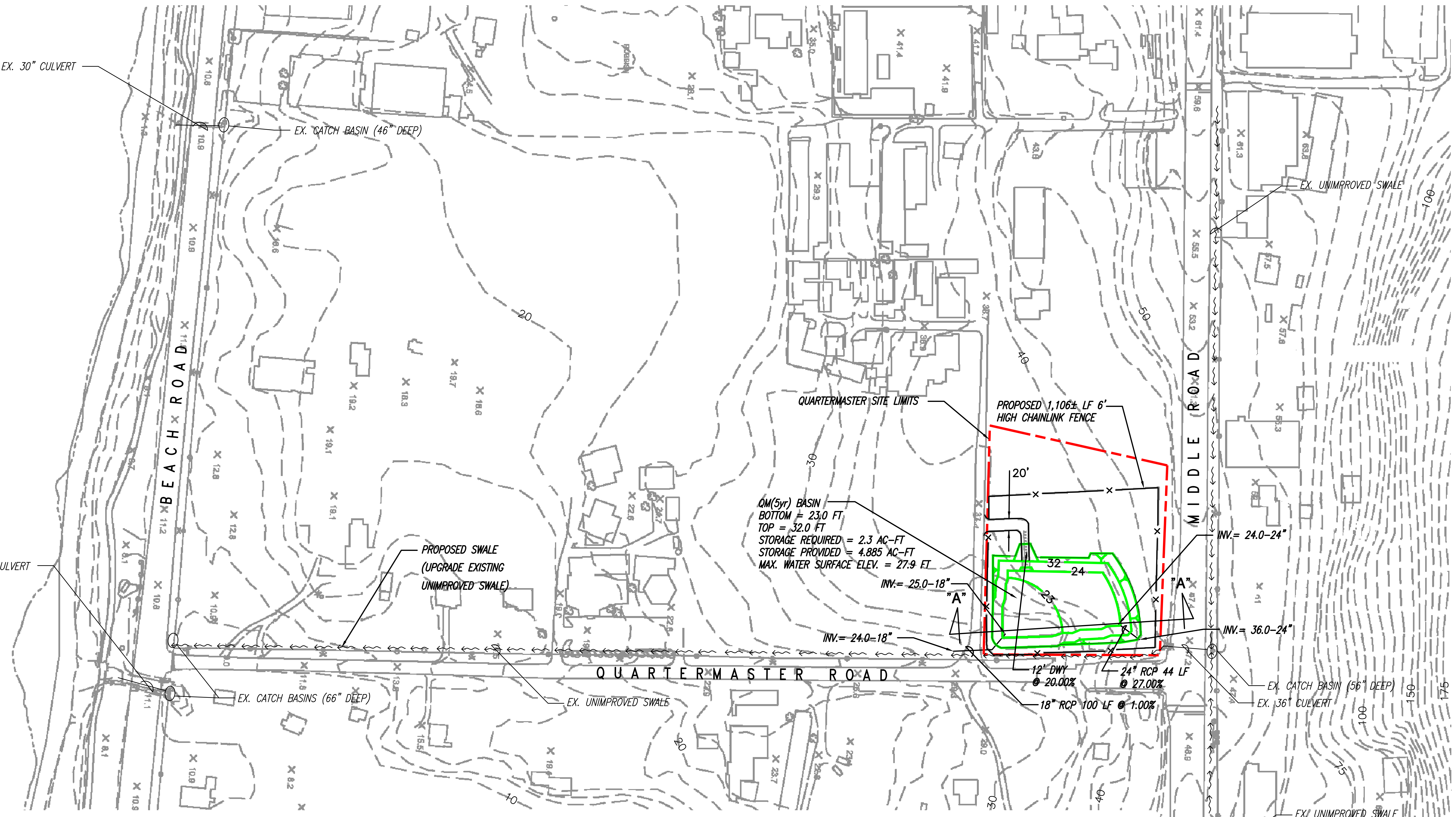
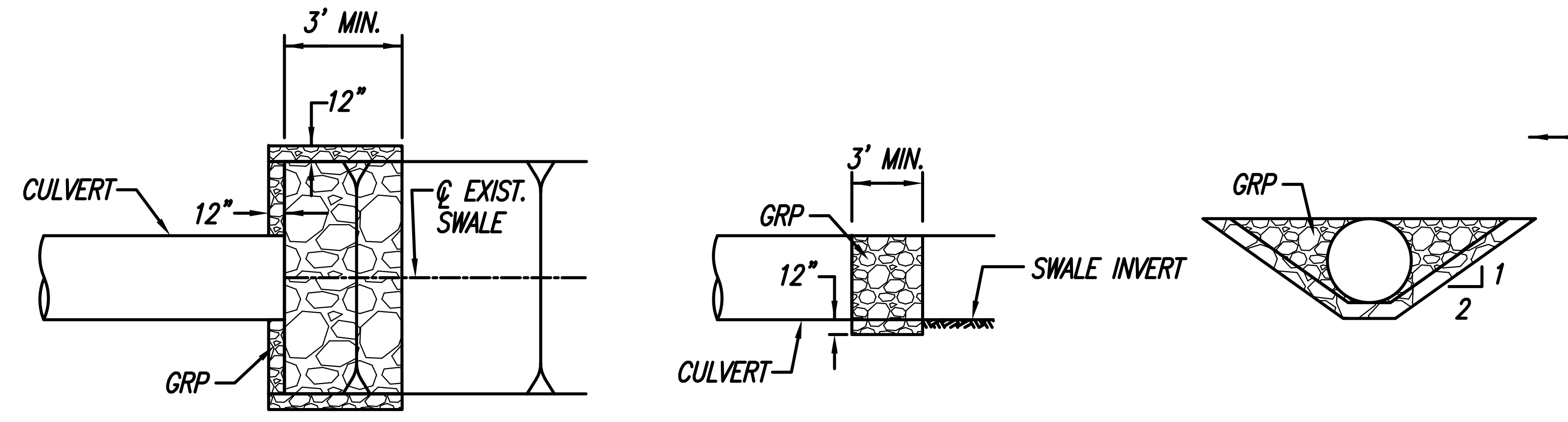
# PRELIMINARY DRAINAGE DESIGN FOR AQUATIC ECOSYSTEM RESTORATION STUDY, SAIPAN LAGOON

SAIPAN, NORTHERN MARIANA ISLANDS

FIGURE 2.1 - QUARTERMASTER SITE
2 YEAR STORM EVENT PRELIMINARY DESIGN

TRUE NORTH
Scale: 1 in. = 100 ft.





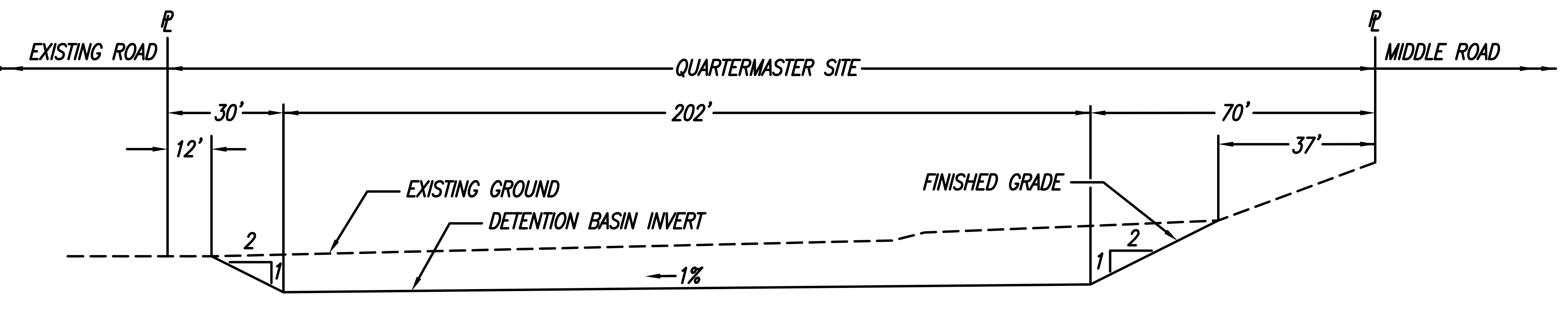
PLAN

ELEVATION

SECTION

## CULVERT INLET/OUTLET DETAIL

NOT TO SCALE



## SECTION "A"-"A"

NOT TO SCALE

# QUARTERMASTER SITE

# 5-YEAR STORM

SCALE: 1" = 100'

100 50 0 100 200
SCALE: 1" = 100'

## EARTHWORK QUANTITIES

(FOR ESTIMATION PURPOSES ONLY)

| | |
|---|---|
| AREA TO BE MASS GRADED | 0.83 ACS |
| EXCAVATION | 11,452 C.Y |
| EMBANKMENT | 0 C.Y |

**NOTE:** *QUANTITIES ARE BASED ON TOPOGRAPHY PROVIDED*

## LEGEND

| | |
|---|---|
| ⤳ ⤳ ⤳ ⤳ | *EXISTING UNIMPROVED SWALE* |
| — – – — | *SITE LIMITS* |
| ——23—— | *FINISHED CONTOUR* |
| — —50— — | *EXISTING CONTOUR* |
| ℄ | *PROPERTY LINE* |
| —×——×——×— | *FENCE* |

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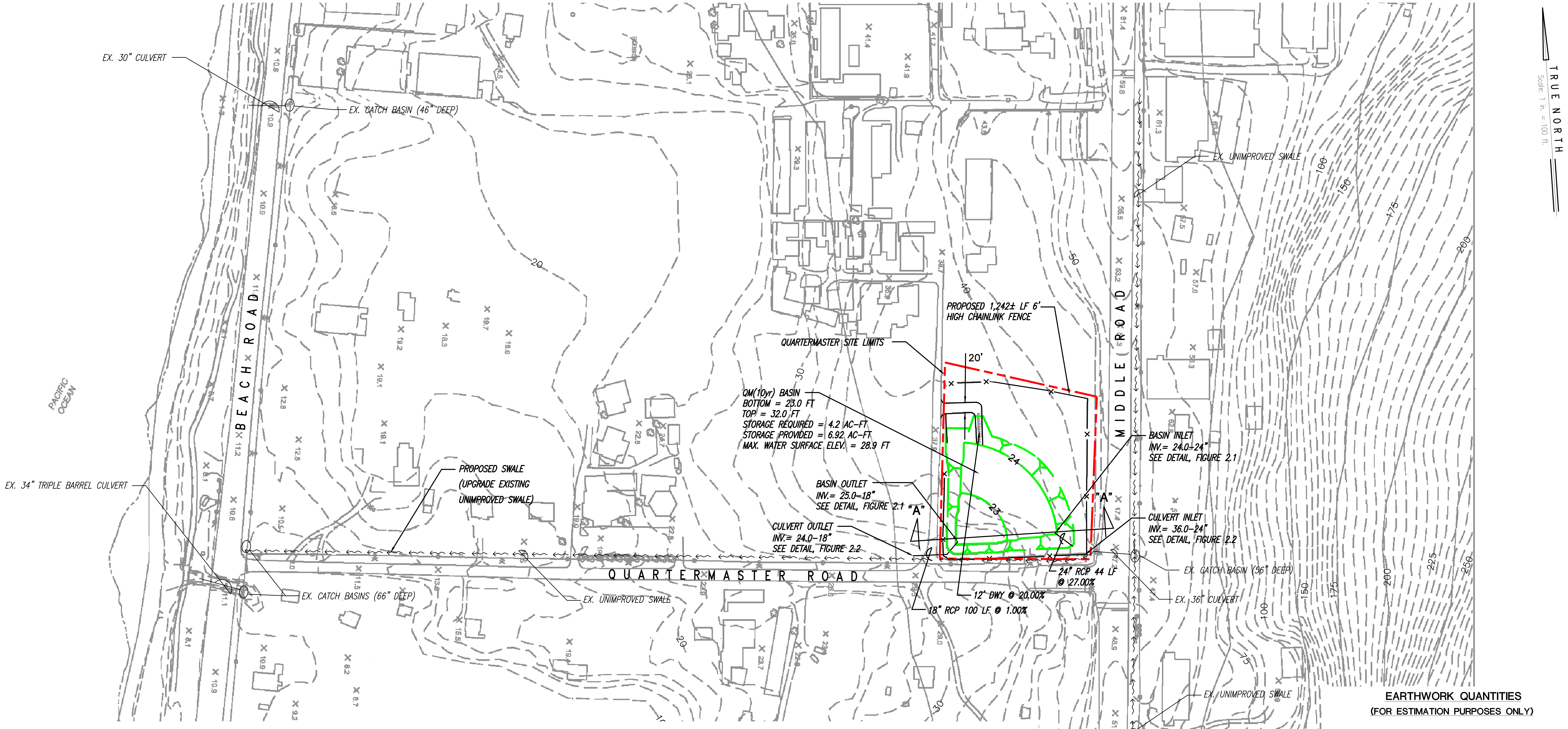
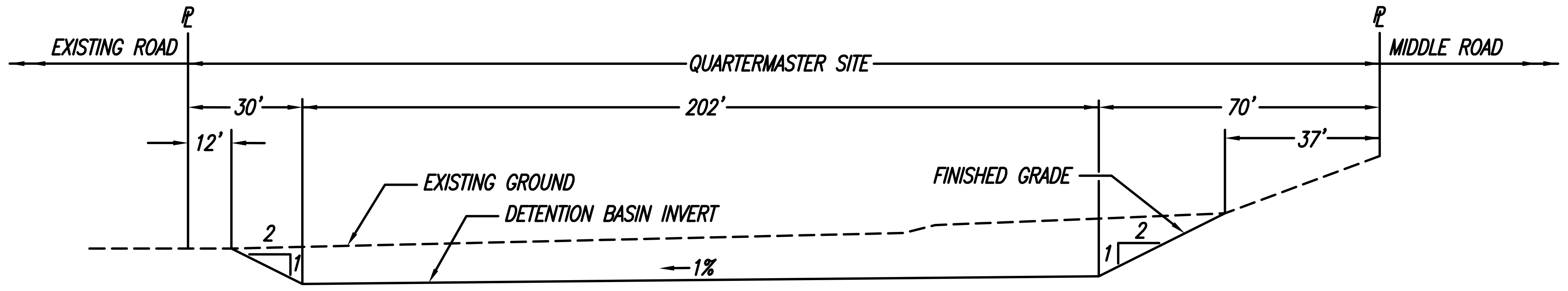
# PRELIMINARY DRAINAGE DESIGN FOR AQUATIC ECOSYSTEM RESTORATION STUDY, SAIPAN LAGOON

SAIPAN, NORTHERN MARIANA ISLANDS

FIGURE 2.2 - QUARTERMASTER SITE
5 YEAR STORM EVENT PRELIMINARY DESIGN





## SECTION "A"-"A"

NOT TO SCALE

| EARTHWORK QUANTITIES<br>(FOR ESTIMATION PURPOSES ONLY) | |
|---|---|
| AREA TO BE MASS GRADED | 1.16 ACS |
| EXCAVATION | 18,732 C.Y |
| EMBANKMENT | 0 C.Y |

**NOTE:** *QUANTITIES ARE BASED ON TOPOGRAPHY PROVIDED*

### LEGEND

| | |
|---|---|
| ⤳ ⤳ ⤳ ⤳ | EXISTING UNIMPROVED SWALE |
| — - — - — | SITE LIMITS |
| ——23—— | FINISHED CONTOUR |
| — —50— — | EXISTING CONTOUR |
| ℄ | PROPERTY LINE |
| —×—×—×— | FENCE |

## QUARTERMASTER SITE
## 10-YEAR STORM

SCALE: 1" = 100'

100 50 0 100 200

SCALE: 1" = 100'

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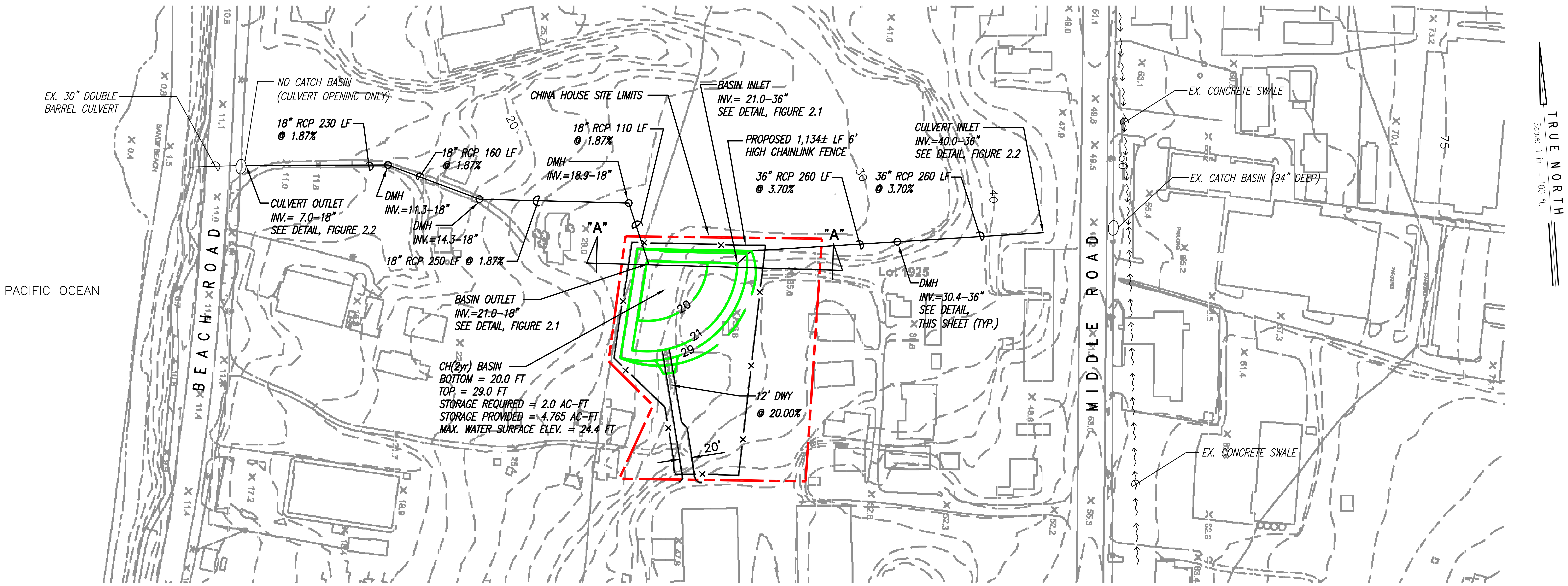
## PRELIMINARY DRAINAGE DESIGN FOR AQUATIC ECOSYSTEM RESTORATION STUDY, SAIPAN LAGOON

SAIPAN, NORTHERN MARIANA ISLANDS

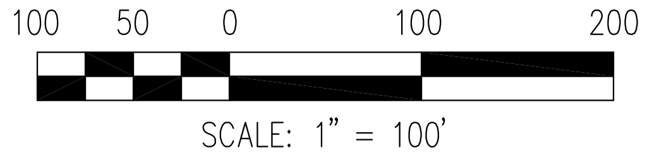
FIGURE 2.3 - QUARTERMASTER SITE
10 YEAR STORM EVENT PRELIMINARY DESIGN



# CHINA HOUSE SITE

## 2-YEAR STORM

SCALE: 1" = 100'



### EARTHWORK QUANTITIES

(FOR ESTIMATION PURPOSES ONLY)

| | |
|---|---|
| AREA TO BE MASS GRADED | 0.79 ACS |
| EXCAVATION | 7,939 C.Y |
| EMBANKMENT | 0 C.Y |

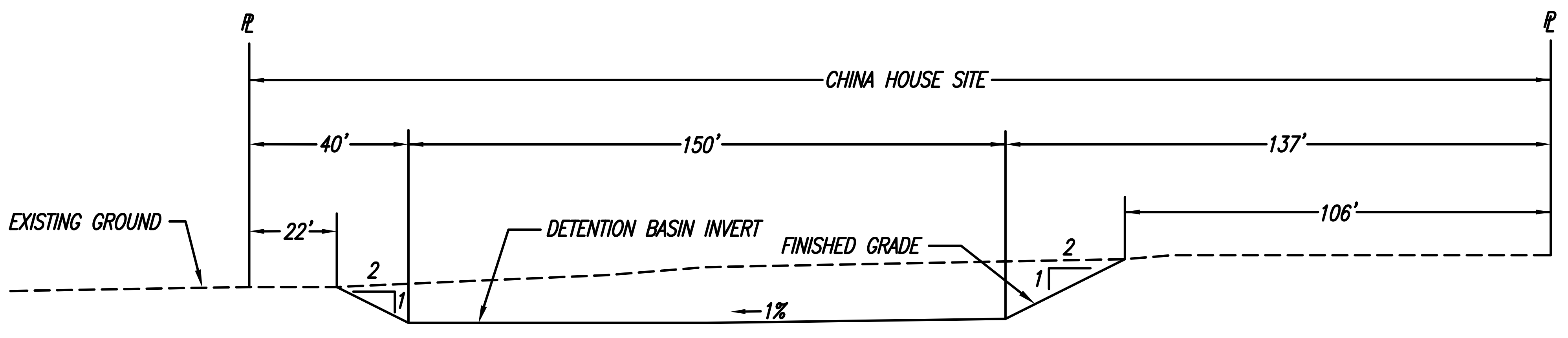
**NOTE:** *QUANTITIES ARE BASED ON TOPOGRAPHY PROVIDED*

### NOTE

*DRAIN LENGTH MAY BE SHORTENED IF DITCH ON ADJACENT PROPERTY IS NEAR SITE.*

### LEGEND

| | |
|---|---|
| 〰 〰 〰 〰 | *EXISTING UNIMPROVED SWALE* |
| — — — | *SITE LIMITS* |
| —23— | *FINISHED CONTOUR* |
| —50— | *EXISTING CONTOUR* |
| ℄ | *PROPERTY LINE* |
| —×—×— | *FENCE* |

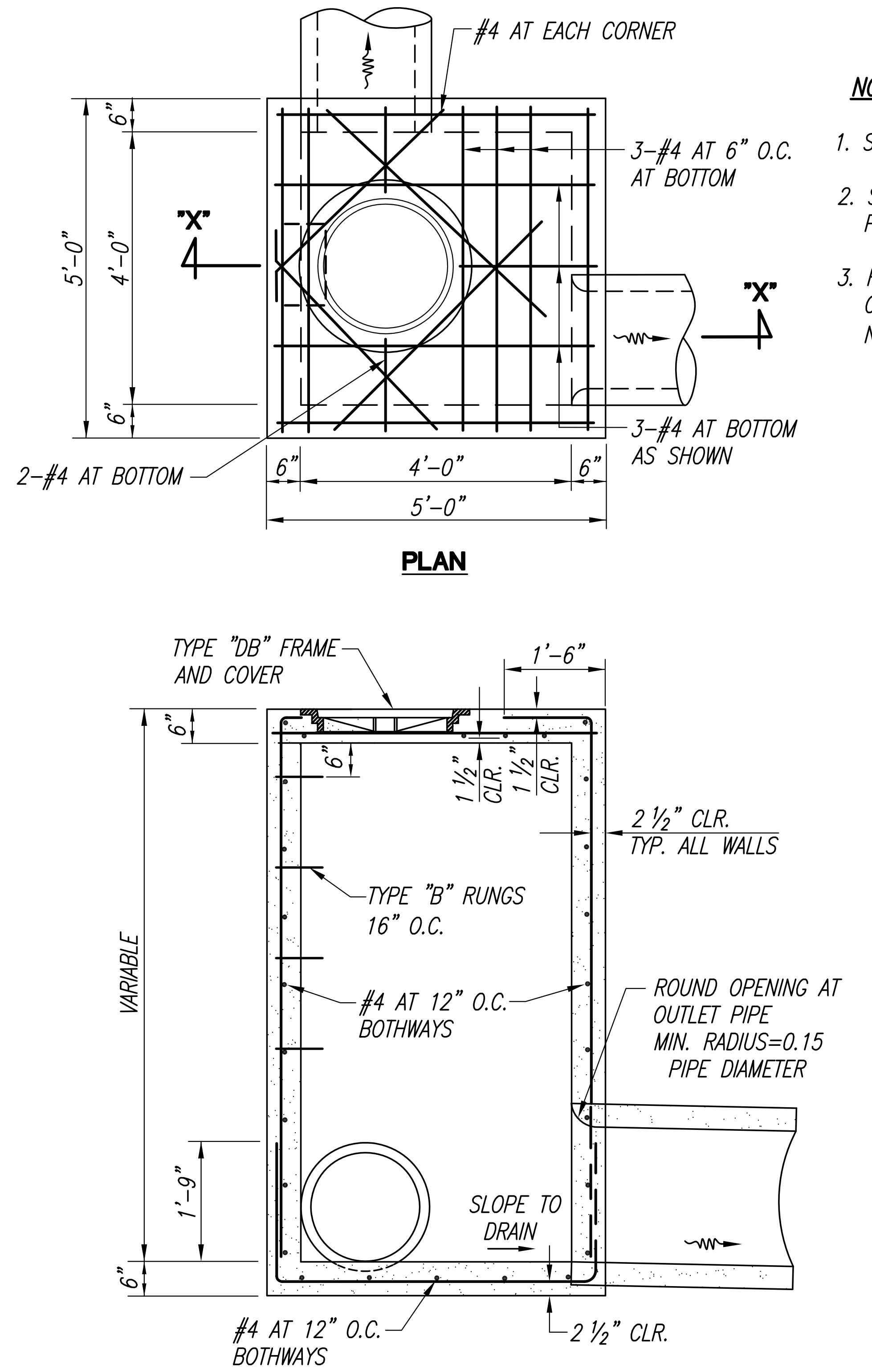


**SECTION "A"-"A"**

NOT TO SCALE

*NOTES:*

1. *SEE THIS SHEET FOR CHANNELIZING DETAIL.*
2. *SEE THIS SHEET FOR REINFORCEMENT AT PIPES AND AT CORNERS.*
3. *RUNGS SHALL NOT BE INSTALLED OVER A PIPE CONNECTION AND THE LOWEST RUNG SHALL BE NOT MORE THAN 2'-0" ABOVE THE INVERT.*

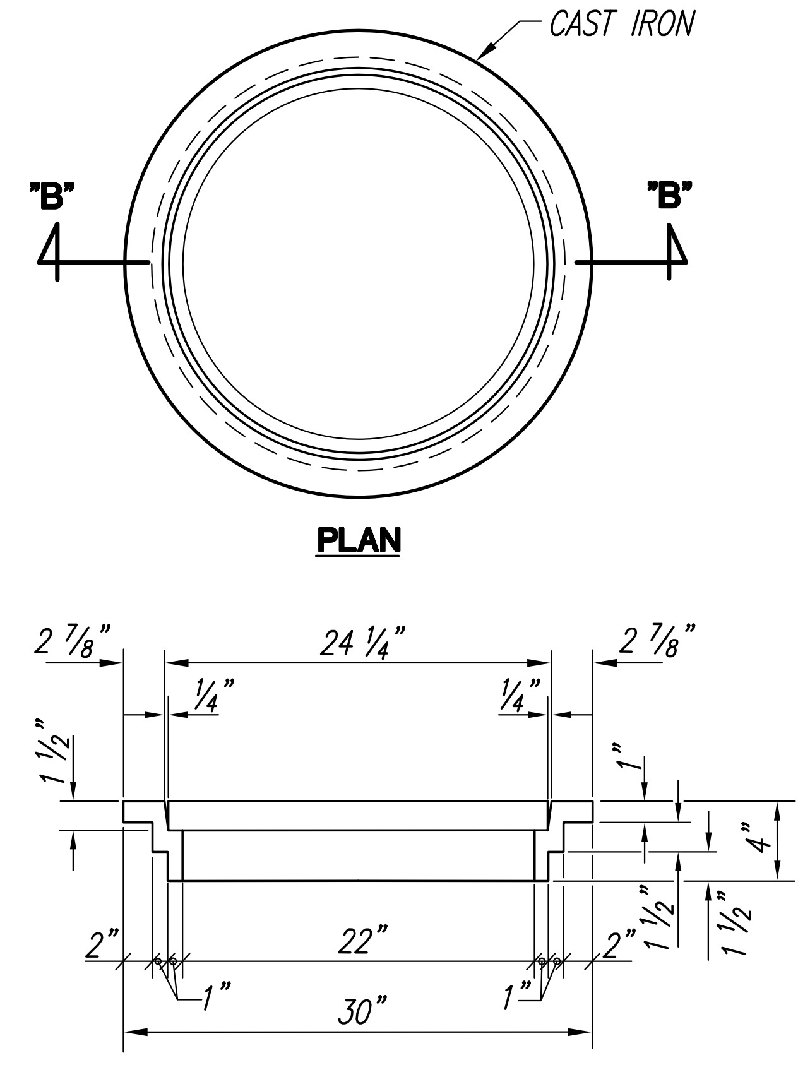


**PLAN**

**SECTION "X"-"X"**

**DRAIN MANHOLE**

NOT TO SCALE

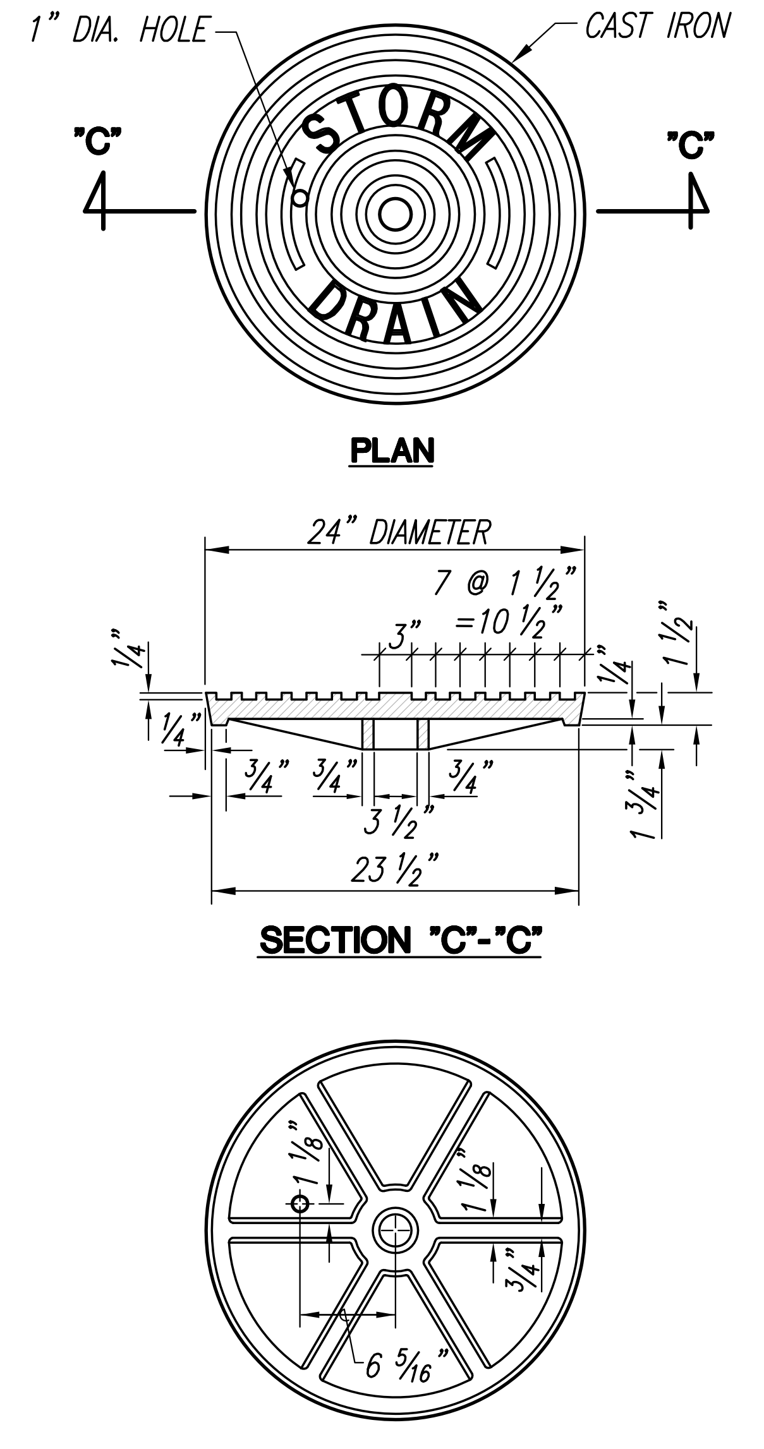


**PLAN**

**SECTION "B"-"B"**

**TYPE "DB" FRAME FOR MANHOLE**

NOT TO SCALE



**PLAN**

**SECTION "C"-"C"**

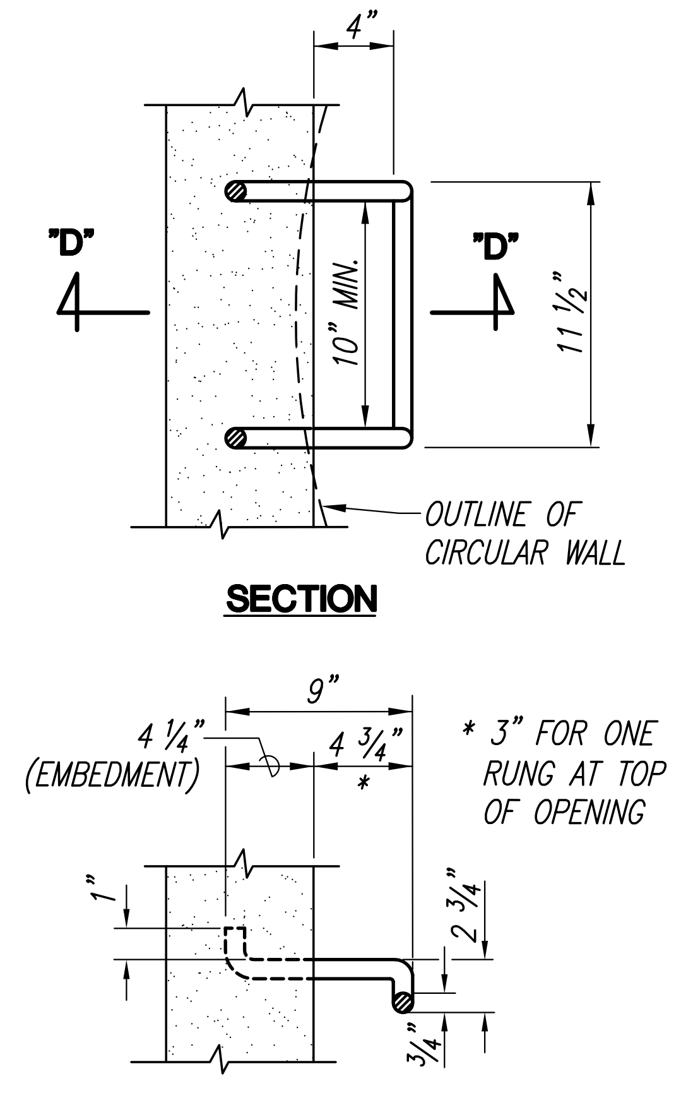
**BOTTOM VIEW OF COVER**

**MANHOLE COVER**

NOT TO SCALE

*NOTE:*

*RUNGS SHALL BE ¾" DIAMETER WROUGHT IRON OR ASTM A36 STEEL RODS AND SHALL BE HOT-DIPPED GALVANIZED OR CADMIUM PLATED AFTER BENDING.*

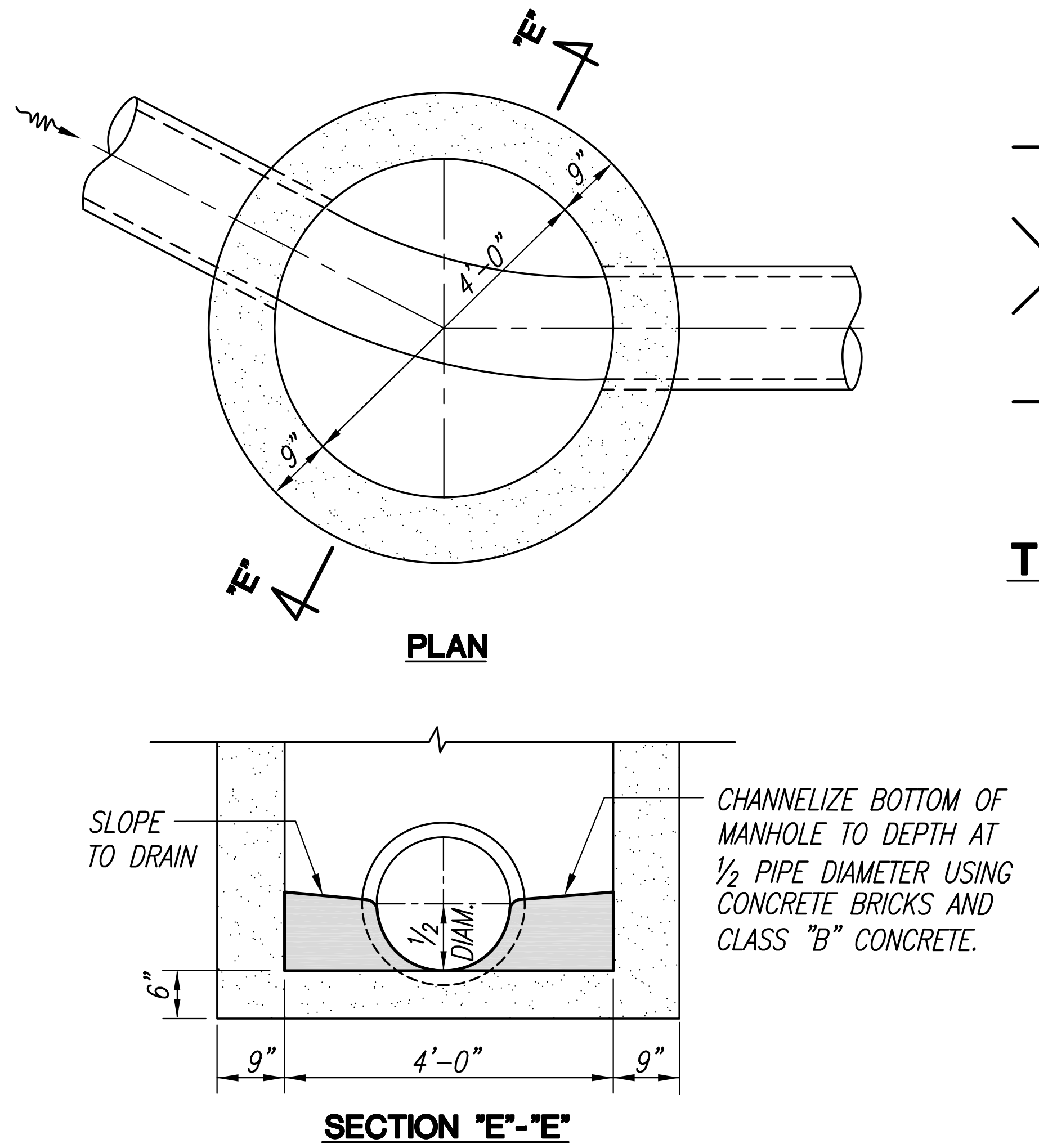


**SECTION**

**SECTION "D"-"D"**

**RUNGS FOR CATCH BASINS AND MANHOLES**

NOT TO SCALE



**PLAN**

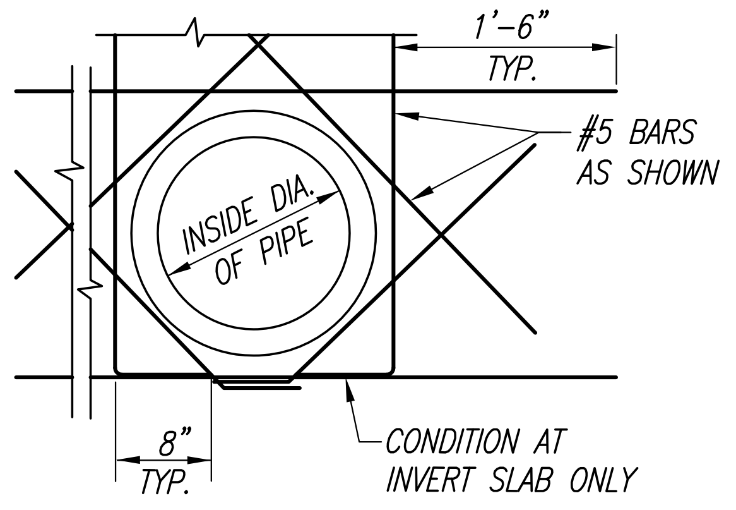
**SECTION "E"-"E"**

**CHANNELIZING DETAILS FOR DRAIN MANHOLE**

NOT TO SCALE

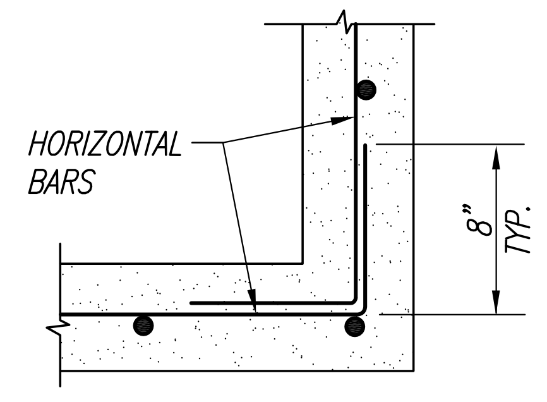
*NOTE:*

*1" CLEARANCE BETWEEN PIPE AND STEEL.*



**TYPICAL REINFORCEMENT AT PIPES**

NOT TO SCALE



**TYPICAL CORNER REINFORCEMENT LAPPING**

NOT TO SCALE

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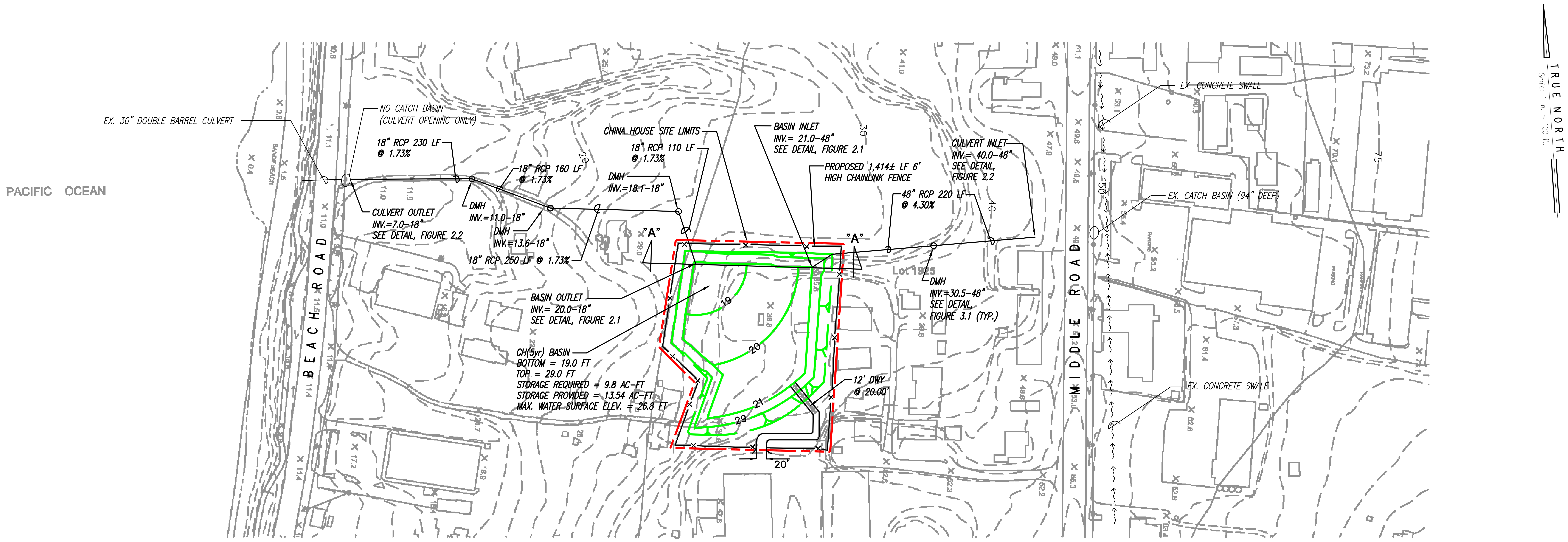
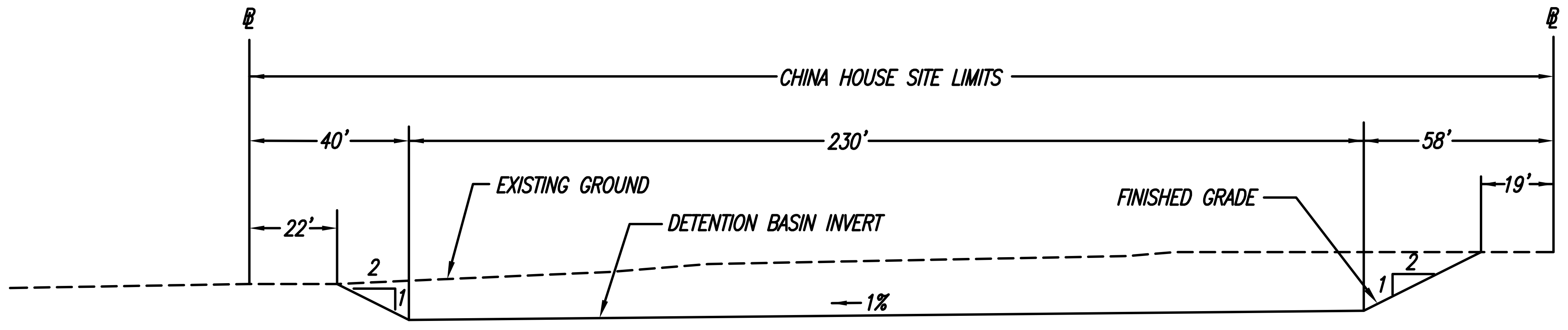
PRELIMINARY DRAINAGE DESIGN FOR
AQUATIC ECOSYSTEM RESTORATION
STUDY, SAIPAN LAGOON
SAIPAN, NORTHERN MARIANA ISLANDS

FIGURE 3.1 - CHINA HOUSE SITE
2 YEAR STORM EVENT PRELIMINARY DESIGN





## SECTION "A"-"A"

NOT TO SCALE

## EARTHWORK QUANTITIES

(FOR ESTIMATION PURPOSES ONLY)

AREA TO BE MASS GRADED ____ 2.06 ACS

EXCAVATION ____ 29,129 C.Y

EMBANKMENT ____ 0 C.Y

**NOTE:** *QUANTITIES ARE BASED ON TOPOGRAPHY PROVIDED*

## NOTE

*DRAIN LENGTH MAY BE SHORTENED IF DITCH ON ADJACENT PROPERTY IS NEAR SITE.*

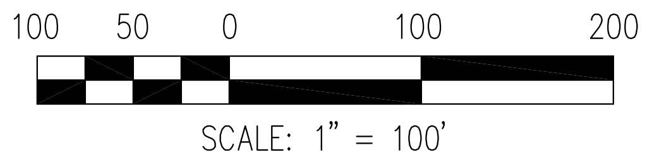
## LEGEND

| | |
|---|---|
| ⤳ ⤳ ⤳ ⤳ | EXISTING UNIMPROVED SWALE |
| 🟥 — — 🟥 | SITE LIMITS |
| ——23—— | FINISHED CONTOUR |
| — —50— — | EXISTING CONTOUR |
| ℄ | PROPERTY LINE |
| —×——×——×— | FENCE |

# CHINA HOUSE SITE

# 5-YEAR STORM

SCALE: 1" = 100'



SCALE: 1" = 100'

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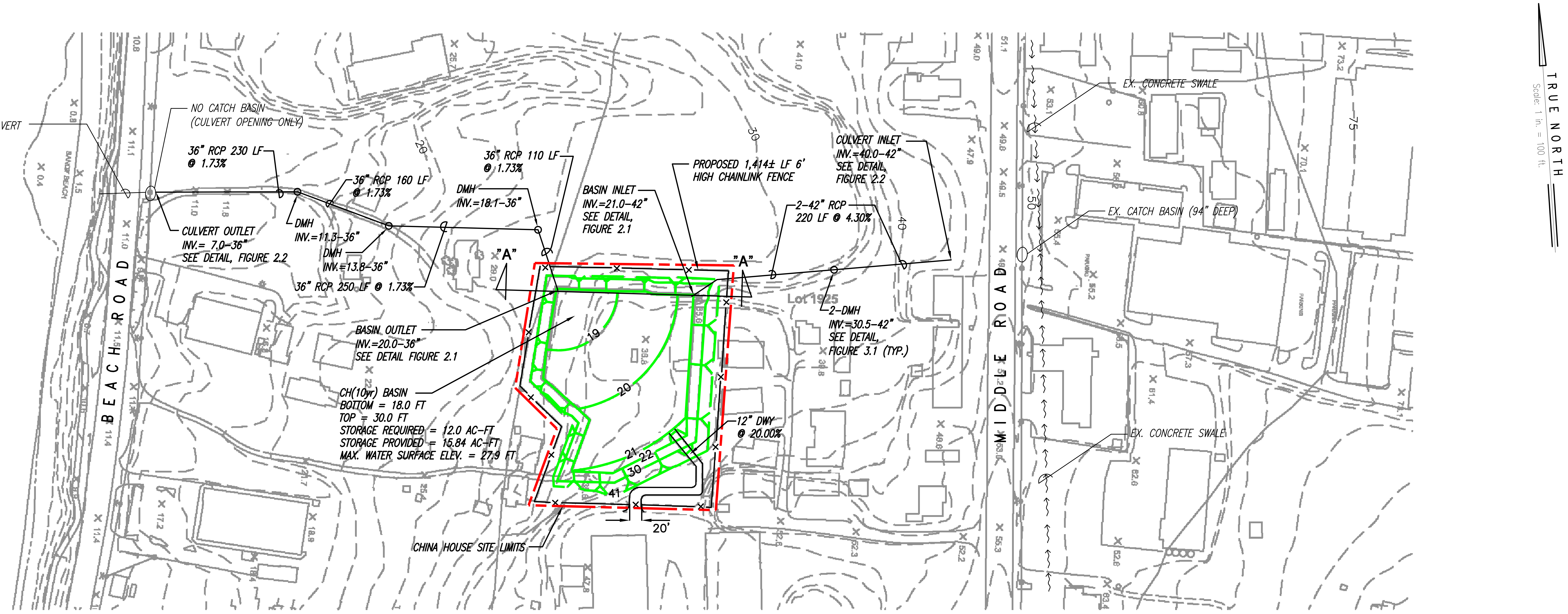
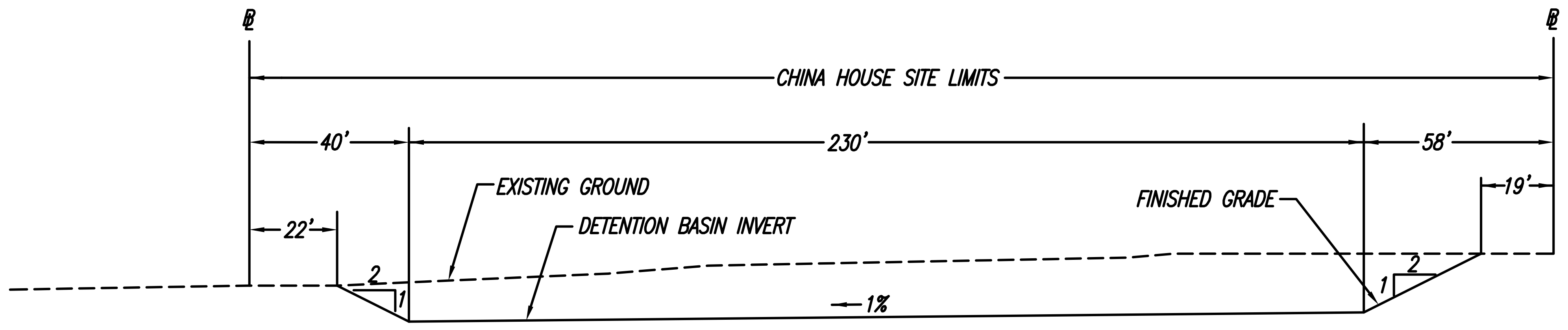
FIGURE 3.2 - CHINA HOUSE SITE
5 YEAR STORM EVENT PRELIMINARY DESIGN





## SECTION "A"–"A"

NOT TO SCALE

### EARTHWORK QUANTITIES

(FOR ESTIMATION PURPOSES ONLY)

| | |
|---|---|
| AREA TO BE MASS GRADED | 2.12 ACS |
| EXCAVATION | 29,392 C.Y |
| EMBANKMENT | 0 C.Y |

**NOTE:** *QUANTITIES ARE BASED ON TOPOGRAPHY PROVIDED*

### NOTE

*DRAIN LENGTH MAY BE SHORTENED IF DITCH ON ADJACENT PROPERTY IS NEAR SITE.*

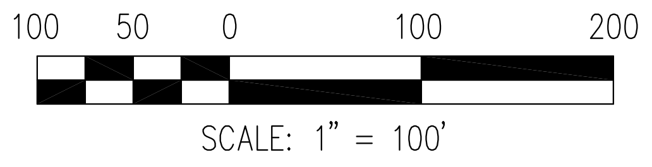
### LEGEND

| | |
|---|---|
| ⤳ ⤳ ⤳ ⤳ | *EXISTING UNIMPROVED SWALE* |
| 🟥 — — — | *SITE LIMITS* |
| —23— | *FINISHED CONTOUR* |
| — —50— — | *EXISTING CONTOUR* |
| ℄ | *PROPERTY LINE* |
| —×—×—×— | *FENCE* |

## CHINA HOUSE SITE

## 10-YEAR STORM

SCALE: 1" = 100'



SCALE: 1" = 100'

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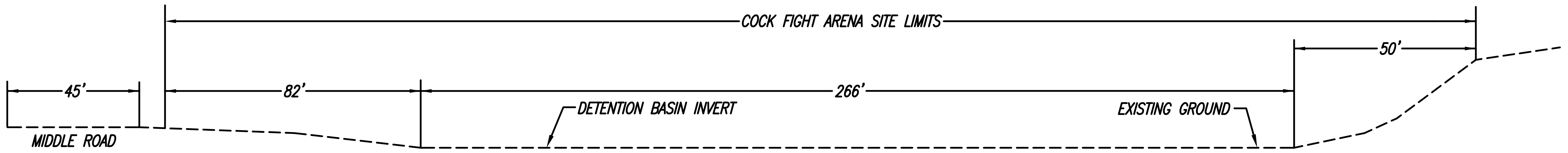
SAIPAN, NORTHERN MARIANA ISLANDS

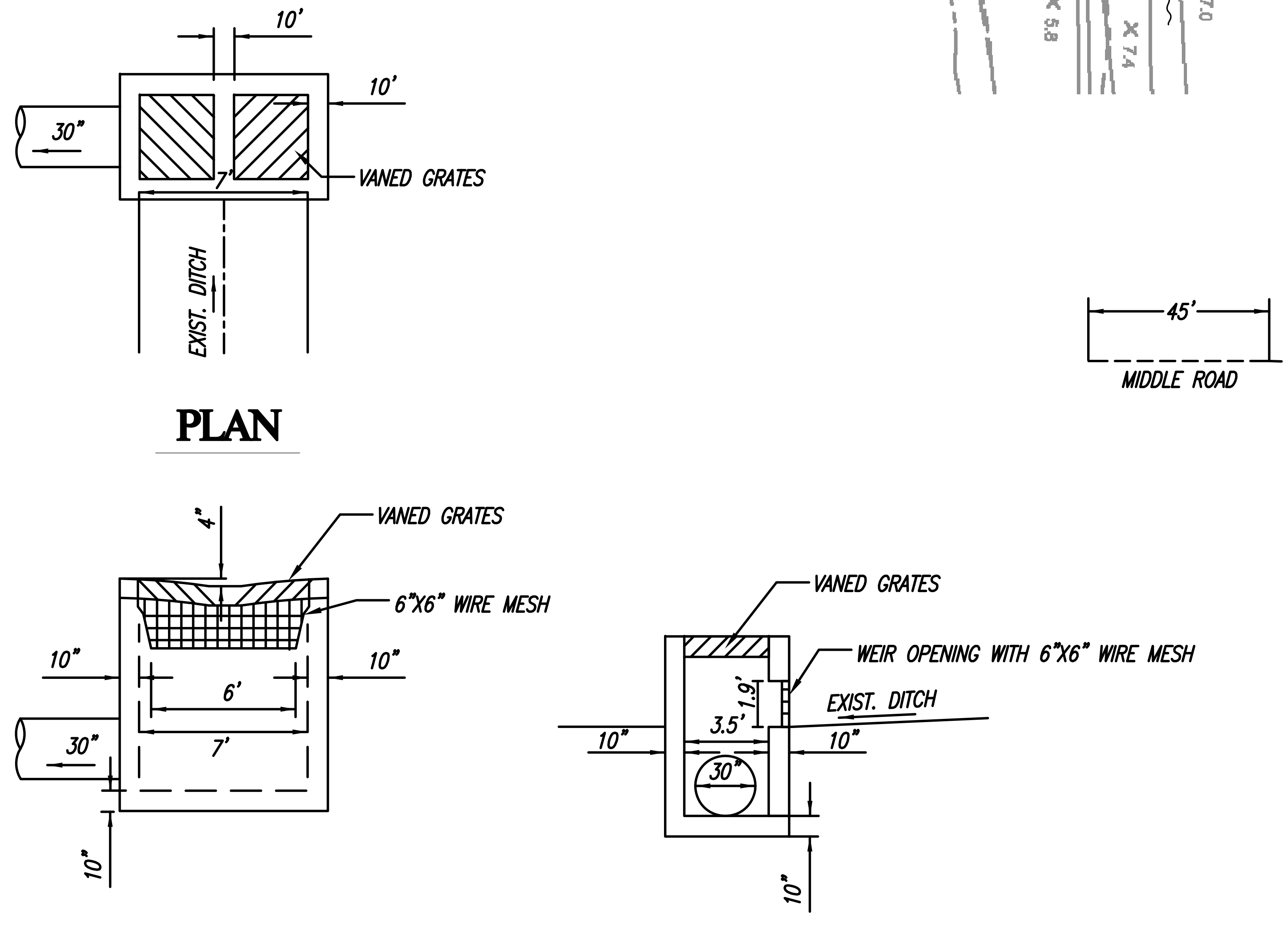
FIGURE 3.3 – CHINA HOUSE SITE
10 YEAR STORM EVENT PRELIMINARY DESIGN

TRUE NORTH
Scale 1 in. = 100 ft.



SECTION "A"-"A"

NOT TO SCALE



PLAN

ELEVATION

SECTION

## DIVERSION STRUCTURE DETAIL

NOT TO SCALE

# COCK FIGHT ARENA SITE

# 2-YEAR STORM

SCALE: 1" = 100'

### EARTHWORK QUANTITIES
(FOR ESTIMATION PURPOSES ONLY)

AREA TO BE MASS GRADED________________0 ACS

EXCAVATION________________________0 C.Y

EMBANKMENT_______________________0 C.Y

**NOTE:** *QUANTITIES ARE BASED ON TOPOGRAPHY PROVIDED*

### NOTES

1. *OUTLET PIPE NOT REQUIRED FOR BASIN CAPACITY, BUT SHOULD BE PROVIDED FOR EMERGENCY OVERFLOW PURPOSES.*
2. *NO ADDITIONAL EXCAVATION REQUIRED IN EXISTING PIT.*

### LEGEND

| | |
|---|---|
| ⤳ ⤳ ⤳ ⤳ | *EXISTING UNIMPROVED SWALE* |
| —— – – —— | *SITE LIMITS* |
| ——23—— | *FINISHED CONTOUR* |
| — —50— — | *EXISTING CONTOUR* |
| ℄ | *PROPERTY LINE* |
| —×——×——×— | *FENCE* |

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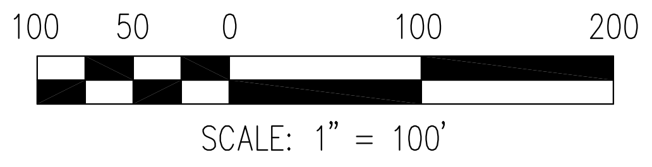
## PRELIMINARY DRAINAGE DESIGN FOR AQUATIC ECOSYSTEM RESTORATION STUDY, SAIPAN LAGOON

SAIPAN, NORTHERN MARIANA ISLANDS

FIGURE 4.1 - COCK FIGHT ARENA SITE
2 YEAR STORM EVENT PRELIMINARY DESIGN

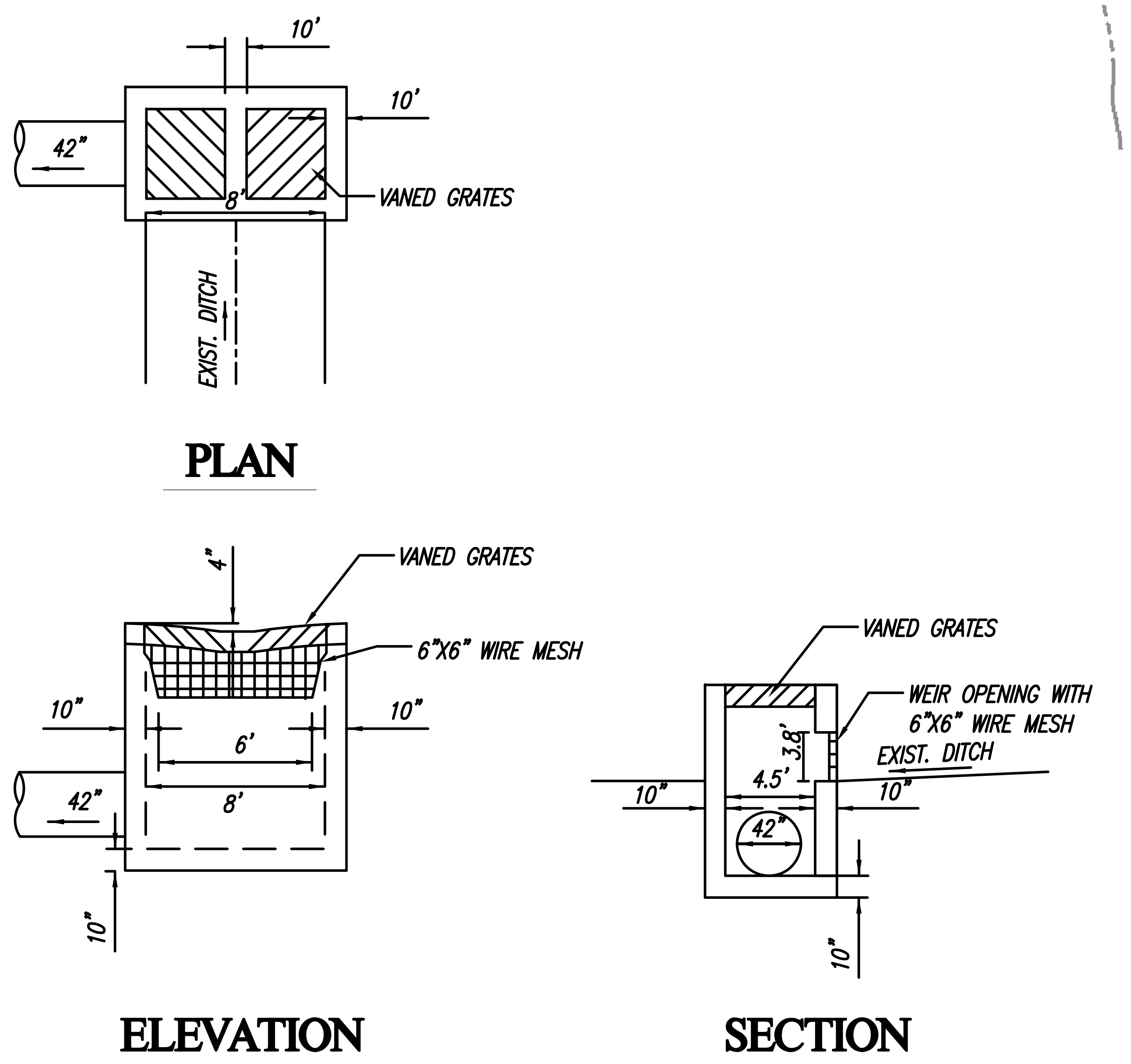


SCALE: 1" = 100'

# COCK FIGHT ARENA SITE

## 5-YEAR STORM

SCALE: 1" = 100'



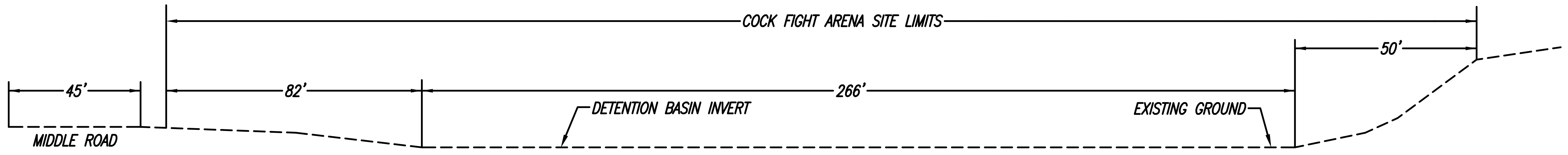
PLAN

ELEVATION

SECTION

DIVERSION STRUCTURE DETAIL

NOT TO SCALE



SECTION "A"-"A"

NOT TO SCALE

EARTHWORK QUANTITIES

(FOR ESTIMATION PURPOSES ONLY)

AREA TO BE MASS GRADED ______ 0 ACS

EXCAVATION ______ 0 C.Y

EMBANKMENT ______ 0 C.Y

**NOTE:** QUANTITIES ARE BASED ON TOPOGRAPHY PROVIDED

NOTE

NO ADDITIONAL EXCAVATION REQUIRED IN EXISTING PIT.

LEGEND

| | |
|---|---|
| ⤳ ⤳ ⤳ ⤳ | EXISTING UNIMPROVED SWALE |
| 🟥 — — — | SITE LIMITS |
| —23— | FINISHED CONTOUR |
| — —50— — | EXISTING CONTOUR |
| ℘ | PROPERTY LINE |
| —x—x—x— | FENCE |

100 50 0 100 200

SCALE: 1" = 100'

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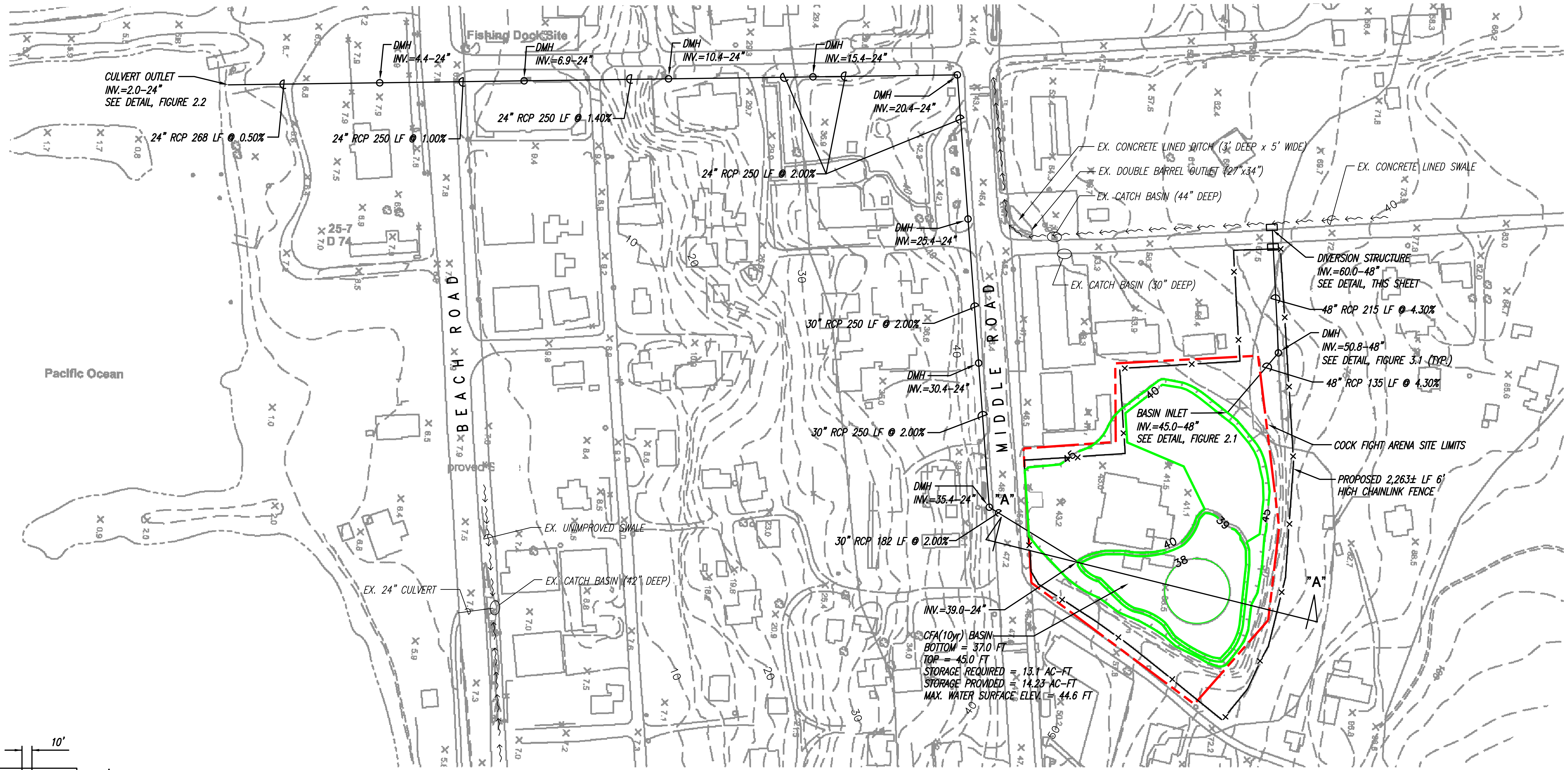
Engineering Design | Construction Management | Infrastructure Planning

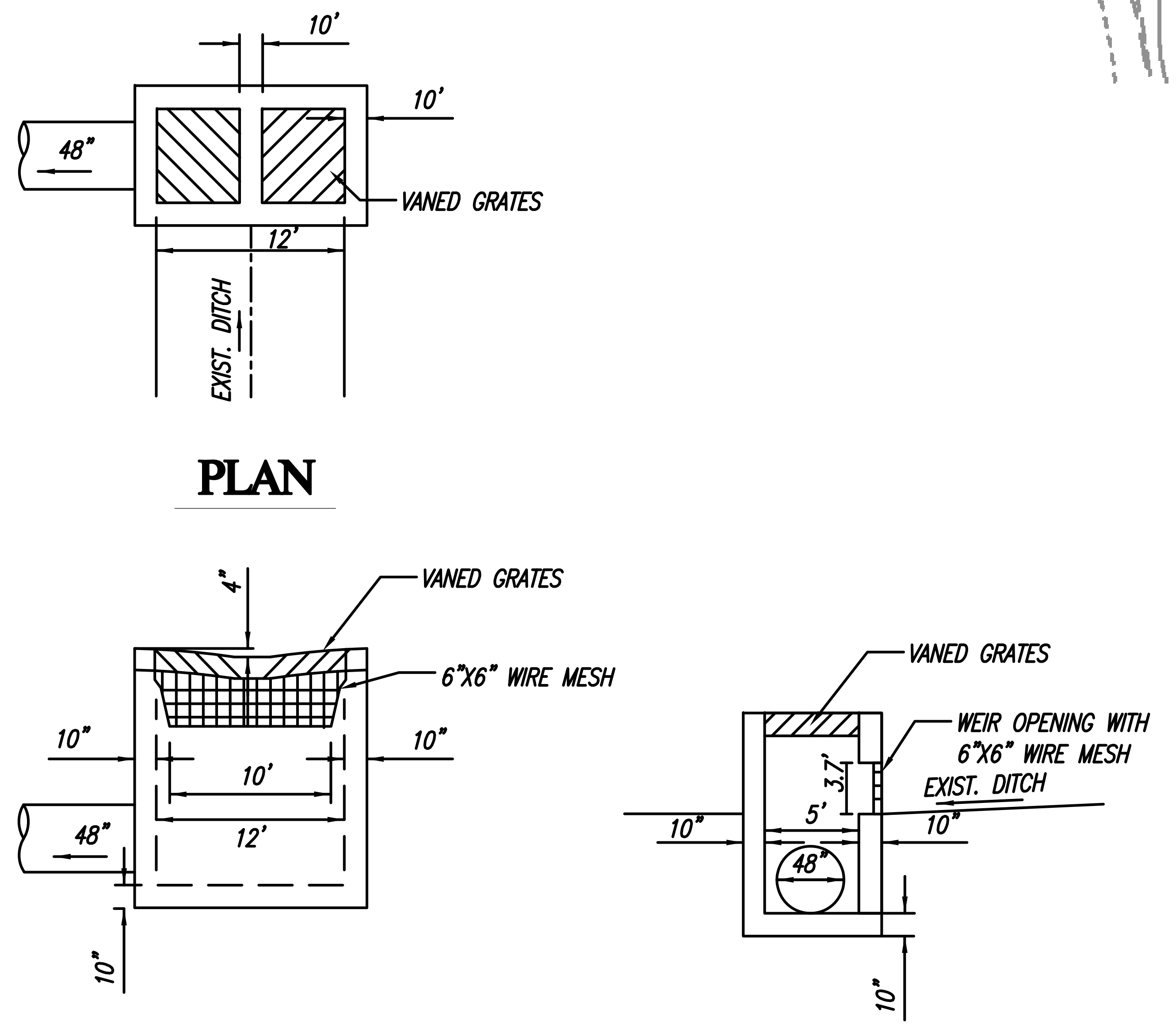
1100 Alakea Street, Sixth Floor Honolulu, Hawaii

PRELIMINARY DRAINAGE DESIGN FOR AQUATIC ECOSYSTEM RESTORATION STUDY, SAIPAN LAGOON

SAIPAN, NORTHERN MARIANA ISLANDS

FIGURE 4.2 - COCK FIGHT ARENA SITE 5 YEAR STORM EVENT PRELIMINARY DESIGN





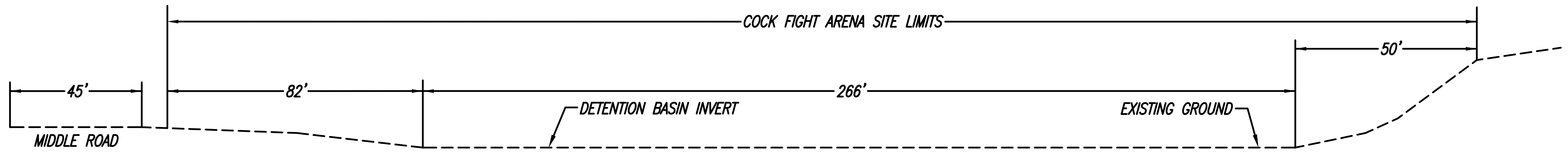
**PLAN**

**ELEVATION**

**SECTION**

## DIVERSION STRUCTURE DETAIL

NOT TO SCALE



## SECTION "A"-"A"

NOT TO SCALE

## COCK FIGHT ARENA SITE

## 10-YEAR STORM

SCALE: 1" = 100'

100 50 0 100 200

SCALE: 1" = 100'

### EARTHWORK QUANTITIES

(FOR ESTIMATION PURPOSES ONLY)

AREA TO BE MASS GRADED__________3.17 ACS

EXCAVATION__________2,328 C.Y

EMBANKMENT__________0 C.Y

**NOTE:** *QUANTITIES ARE BASED ON TOPOGRAPHY PROVIDED*

### NOTE

*NO ADDITIONAL EXCAVATION REQUIRED IN EXISTING PIT.*

### LEGEND

| | |
|---|---|
| ⤳ ⤳ ⤳ ⤳ | *EXISTING UNIMPROVED SWALE* |
| 🟥 — — — | *SITE LIMITS* |
| 🟩 —23— | *FINISHED CONTOUR* |
| — —50— — | *EXISTING CONTOUR* |
| PL | *PROPERTY LINE* |
| —×—×—×— | *FENCE* |

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Honolulu, Hawaii

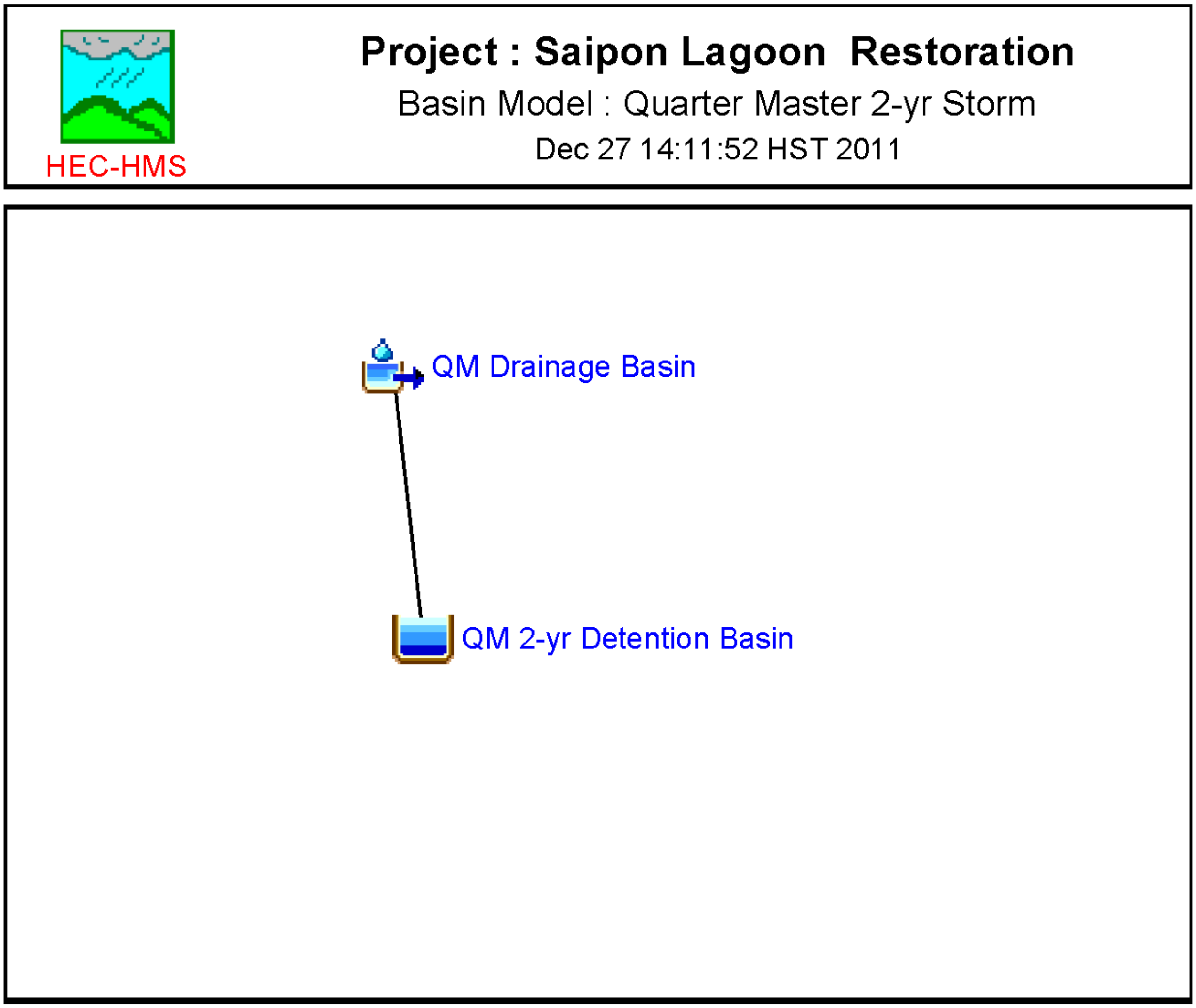
## PRELIMINARY DRAINAGE DESIGN FOR AQUATIC ECOSYSTEM RESTORATION STUDY, SAIPAN LAGOON

SAIPAN, NORTHERN MARIANA ISLANDS

## FIGURE 4.3 - COCK FIGHT ARENA SITE 10 YEAR STORM EVENT PRELIMINARY DESIGN

# Appendix A

# 1. *Quartermaster Site: 2-Year Storm Event*



**Project : Saipon Lagoon  Restoration**
Basin Model : Quarter Master 2-yr Storm
Dec 27 14:11:52 HST 2011

# A.Quartermaster Drainage Basin:

## A.1 Basin Model:

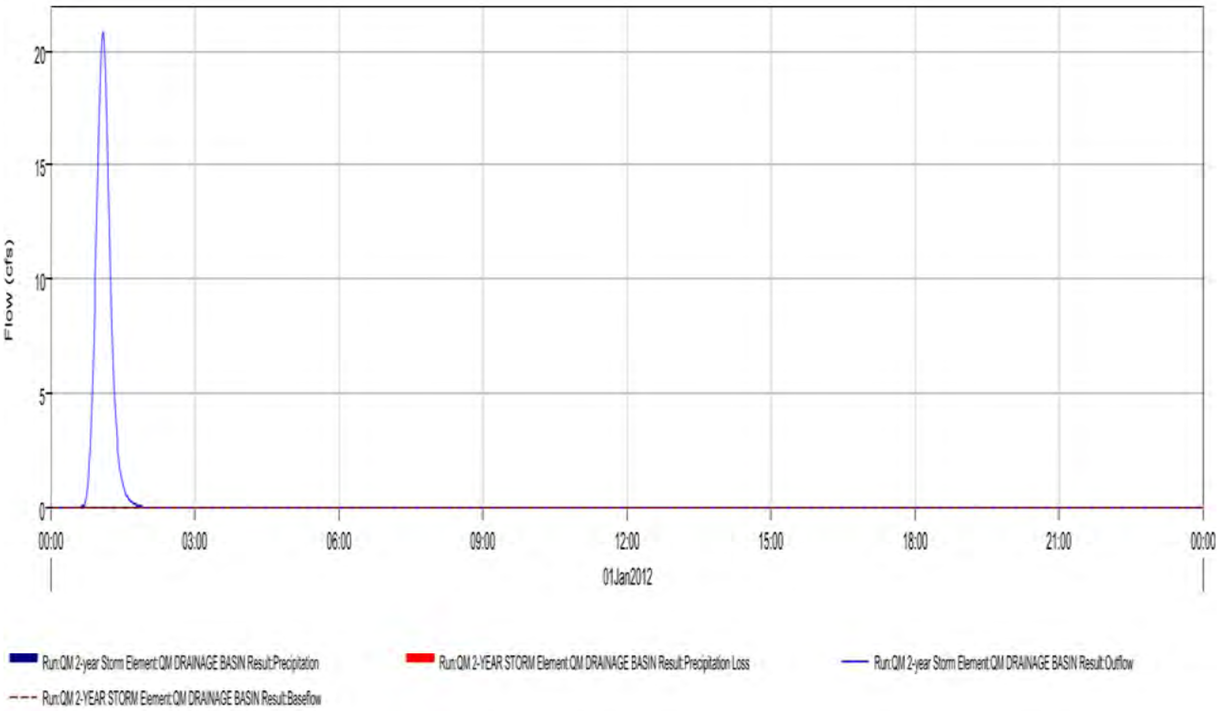
| | |
|---|---|
| Area: | 109 ac (0.1703 $mi^2$) |
| CN: | 65 |
| Tc: | 10.7 min |
| Rainfall 2-year/1 hour: | 1.93 in |
| Loss Method: | SCS Curve Number |
| Transform Method: | SCS Unit Hydrograph |

## A.2 HEC-HMS Simulation Results:

| | |
|---|---|
| Simulation Run: | QM 2-year Storm |
| Subbasin: | QM Drainage Basin |
| Meteorologic Model: | 2-year / 1 hour Storm |
| Control Specification: | Control -24-hour |

| Computed Results | | | |
|---|---|---|---|
| **Peak Discharge:** | **20.8 (cfs)** | **Time of Peak Discharge:** | **01:06** |
| **Total Precipitation:** | **15.4 (ac-ft)** | **Total Direct Runoff:** | **0.6 (ac-ft)** |
| **Total Loss:** | **14.8 (ac-ft)** | **Total Baseflow:** | **0.0 (ac-ft)** |
| **Total Excess:** | **0.6 (ac-ft)** | **Discharge:** | **0.6 (ac-ft)** |

## A3. Hydrograph



# B. Quartermaster 2-Year Detention Basin:

## B.1 Detention Basin Design:

| Elevation (ft) | Surf. Area (ac) | Increment Storage (ac-ft) | Cumulative Storage (ac-ft) |
|---|---|---|---|
| 23.00 | 0.050 | 0.000 | 0.000 |
| 24.00 | 0.090 | 0.070 | 0.070 |
| 25.00 | 0.110 | 0.100 | 0.170 |
| 26.00 | 0.130 | 0.120 | 0.290 |
| 28.00 | 0.180 | 0.310 | 0.600 |
| 30.00 | 0.230 | 0.410 | 1.010 |
| 32.00 | 0.280 | 0.510 | 1.520 |

## B.2 Outlet Design:

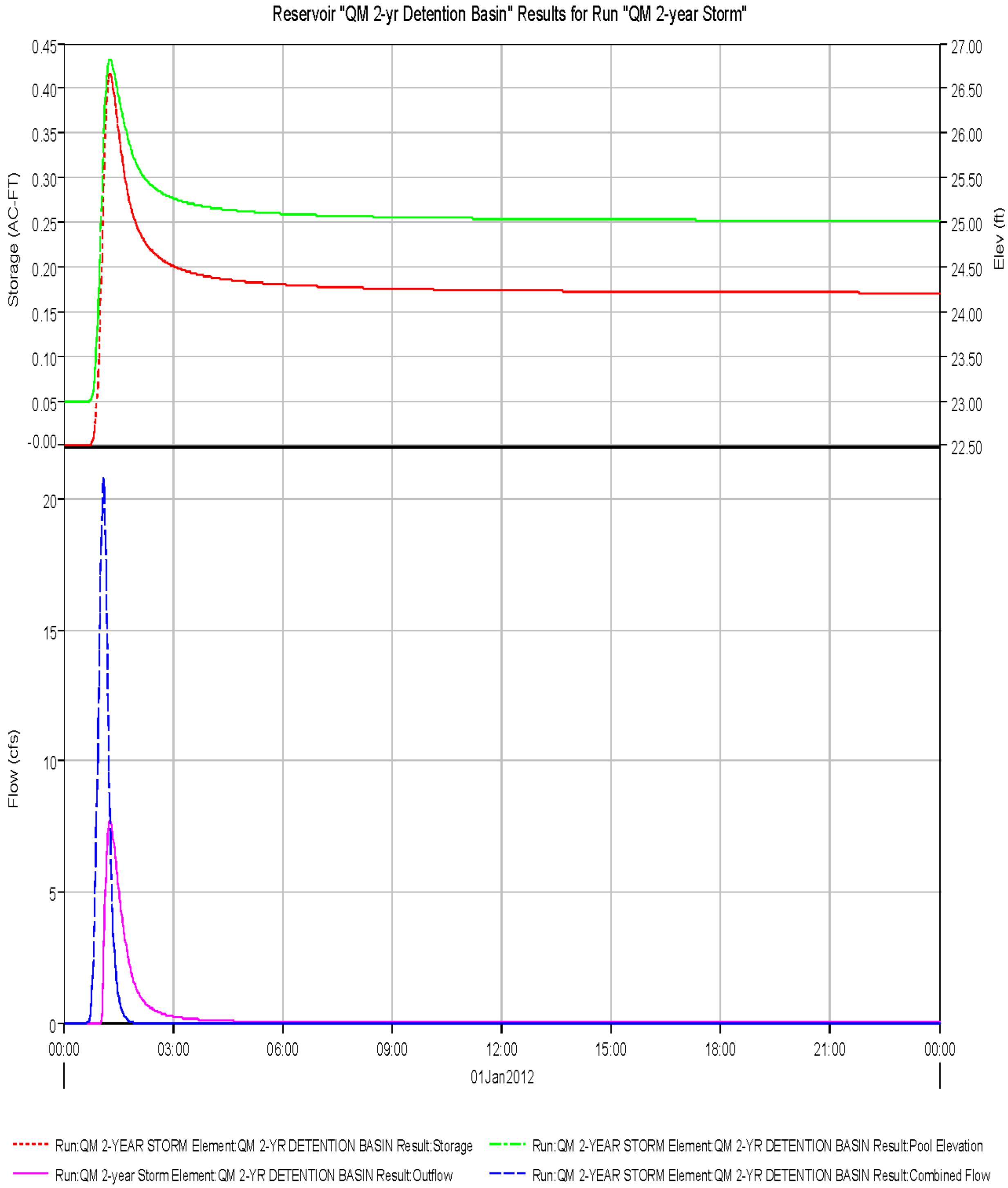
| | |
|---|---|
| Pipe: | RCP culvert (end-section conforming to fill) |
| Diameter: | 18 in |
| Length: | 100 ft |
| Inlet Elevation: | 25.00 ft |
| Outlet Elevation: | 24.00 ft |
| Entrance Coefficient: | 0.500 |
| Slope: | 0.010 |
| Outlet Coefficient: | 0.900 |
| Mannings n: | 0.013 |

## B.3 HEC-HMS Simulation:

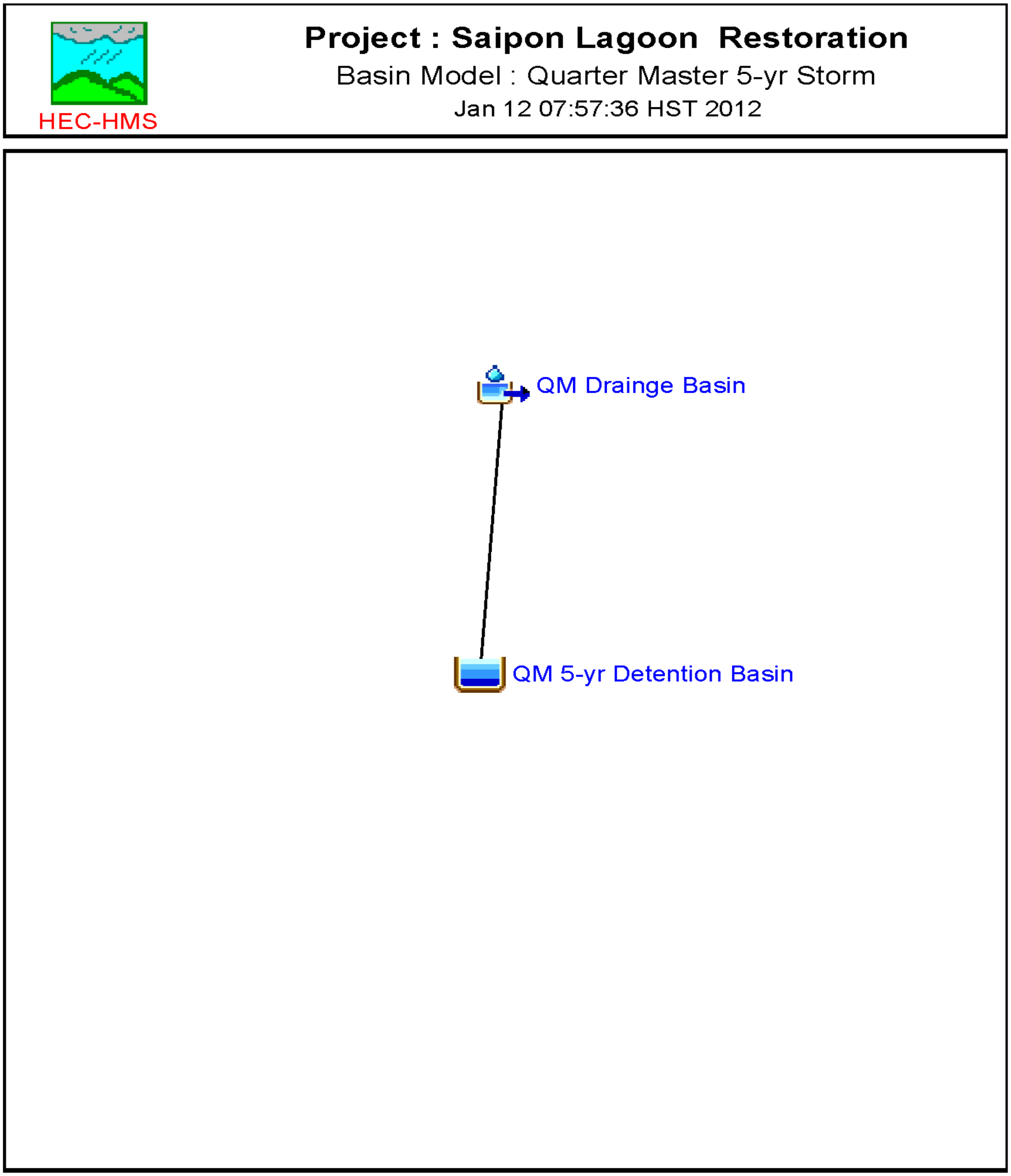
| | |
|---|---|
| Simulation Run: | QM 2-year Storm |
| Subbasin: | QM Drainage Basin |
| Meteorologic Model: | 2-year / 1 hour Storm |
| Control Specification: | Control -24-hour |

| Computed Results | | | |
|---|---|---|---|
| **Peak Inflow:** | **20.8 (cfs)** | **Time of Peak Inflow:** | **01:06** |
| **Peak Outflow:** | **7.7 (cfs)** | **Time of Peak Outflow:** | **01:16** |
| **Total Inflow:** | **0.6 (ac-ft)** | **Peak Storage:** | **0.4 (ac-ft)** |
| **Total Outflow:** | **0.4 (ac-ft)** | **Peak Elevation:** | **26.8 (ft)** |

## B.4 Hydrograph



# *2. Quartermaster Site: 5-Year Storm Event*



HEC-HMS

**Project : Saipon Lagoon Restoration**

Basin Model : Quarter Master 5-yr Storm

Jan 12 07:57:36 HST 2012

# C.Quartermaster Drainage Basin:

## A.1 Basin Model:

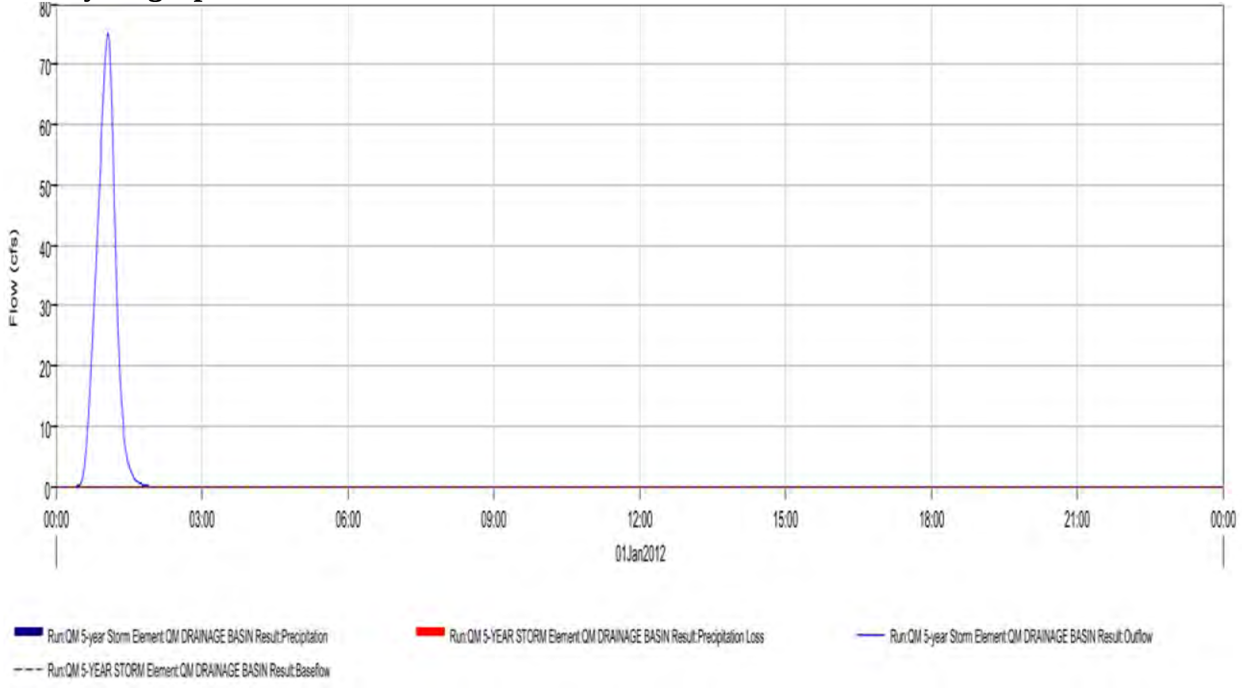
| | |
|---|---|
| Area: | 109 ac (0.1703 mi$^2$) |
| CN: | 65 |
| Tc: | 10.7 min |
| Rainfall 5-year/1 hour: | 2.61 in |
| Loss Method: | SCS Curve Number |
| Transform Method: | SCS Unit Hydrograph |

## A.2 HEC-HMS Simulation Results:

| | |
|---|---|
| Simulation Run: | QM 5-year Storm |
| Subbasin: | QM Drainage Basin |
| Meteorologic Model: | 5-year / 1 hour Storm |
| Control Specification: | Control -24-hour |

| Computed Results | | | |
|---|---|---|---|
| **Peak Discharge:** | **75.0 (cfs)** | **Time of Peak Discharge:** | **01:04** |
| **Total Precipitation:** | **22.7 (ac-ft)** | **Total Direct Runoff:** | **2.7 (ac-ft)** |
| **Total Loss:** | **20.0 (ac-ft)** | **Total Baseflow:** | **0.0 (ac-ft)** |
| **Total Excess:** | **2.7 (ac-ft)** | **Discharge:** | **2.7 (ac-ft)** |

## A3. Hydrograph



# D.Quartermaster 5-Year Detention Basin:

### B.1 Detention Basin Design:

| Elevation (ft) | Surf. Area (ac) | Increment Storage (ac-ft) | Cumulative Storage (ac-ft) |
|---|---|---|---|
| 23.00 | 0.180 | 0.000 | 0.000 |
| 24.00 | 0.460 | 0.320 | 0.320 |
| 25.00 | 0.480 | 0.470 | 0.790 |
| 26.00 | 0.510 | 0.495 | 1.285 |
| 28.00 | 0.570 | 1.080 | 2.365 |
| 30.00 | 0.630 | 1.200 | 3.565 |
| 32.00 | 0.690 | 1.320 | 4.885 |

### B.2 Outlet Design:

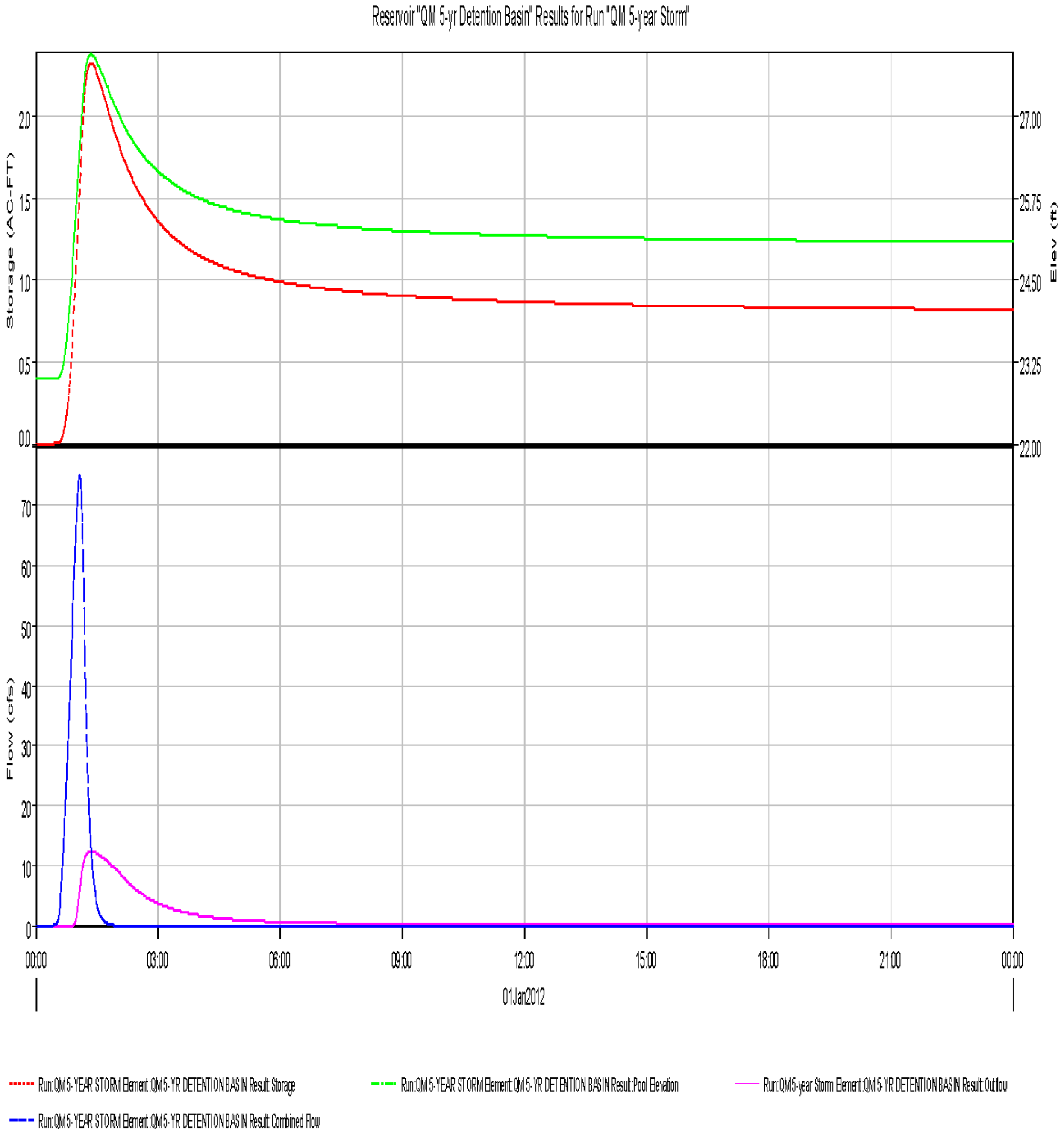
| | |
|---|---|
| Pipe: | RCP culvert (end-section conforming to fill) |
| Diameter: | 18 in |
| Length: | 100 ft |
| Inlet  Elevation: | 25.00 ft |
| Outlet Elevation: | 24.00 ft |
| Entrance Coefficient: | 0.500 |
| Slope: | 0.010 |
| Outlet Coefficient: | 0.900 |
| Mannings n: | 0.013 |

### B.3 HEC-HMS Simulation:

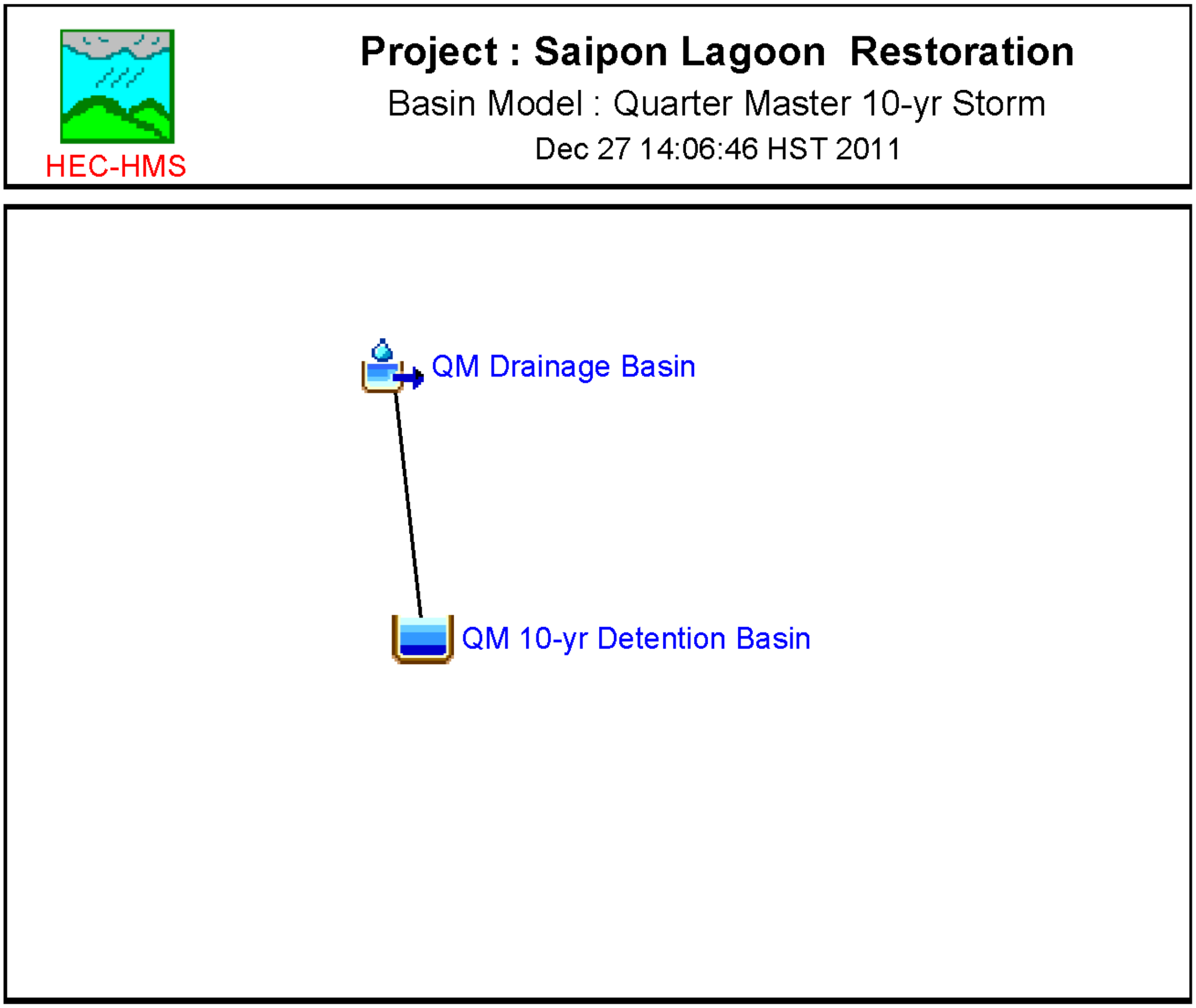
| | |
|---|---|
| Simulation Run: | QM 5-year Storm |
| Subbasin: | QM Drainage Basin |
| Meteorologic Model: | 5-year / 1 hour Storm |
| Control Specification: | Control -24-hour |

| Computed Results | | | |
|---|---|---|---|
| **Peak Inflow:** | **75.0 (cfs)** | **Time of Peak Inflow:** | **01:04** |
| **Peak Outflow:** | **12.4 (cfs)** | **Time of Peak Outflow:** | **01:21** |
| **Total Inflow:** | **2.7 (ac-ft)** | **Peak Storage:** | **2.3 (ac-ft)** |
| **Total Outflow:** | **1.9 (ac-ft)** | **Peak Elevation:** | **27.9 (ft)** |

## B.4 Hydrograph



# 3. Quartermaster Site: 10-Year Storm Event



HEC-HMS

**Project : Saipon Lagoon Restoration**

Basin Model : Quarter Master 10-yr Storm

Dec 27 14:06:46 HST 2011

# A.Quartermaster Drainage Basin:

## A.1 Basin Model:

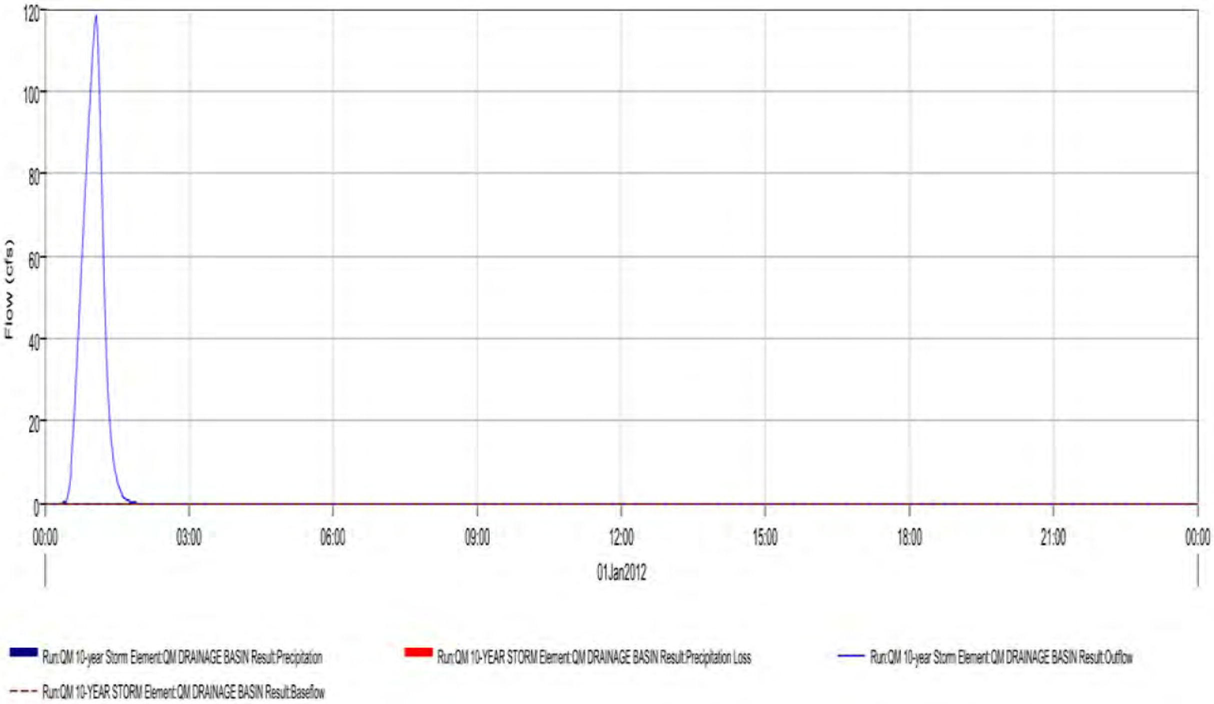
| | |
|---|---|
| Area: | 109 ac (0.1703 mi$^2$) |
| CN: | 65 |
| Tc: | 10.7 min |
| Rainfall 10-year/1 hour: | 3.06 in |
| Loss Method: | SCS Curve Number |
| Transform Method: | SCS Unit Hydrograph |

## A.2 HEC-HMS Simulation Results:

| | |
|---|---|
| Simulation Run: | QM 10-year Storm |
| Subbasin: | QM Drainage Basin |
| Meteorologic Model: | 10-year / 1 hour Storm |
| Control Specification: | Control -24-hour |

| Computed Results | | | |
|---|---|---|---|
| **Peak Discharge:** | **118.5 (cfs)** | **Time of Peak Discharge:** | **01:04** |
| **Total Precipitation:** | **27.5 (ac-ft)** | **Total Direct Runoff:** | **4.7 (ac-ft)** |
| **Total Loss:** | **22.8 (ac-ft)** | **Total Baseflow:** | **0.0 (ac-ft)** |
| **Total Excess:** | **4.7 (ac-ft)** | **Discharge:** | **4.7 (ac-ft)** |

## A3. Hydrograph



# B. Quartermaster 10-YearDetention Basin:

## B.1 Detention Basin Design:

| Elevation (ft) | Surf. Area (ac) | Increment Storage (ac-ft) | Cumulative Storage (ac-ft) |
|---|---|---|---|
| 23.00 | 0.180 | 0.000 | 0.000 |
| 24.00 | 0.680 | 0.430 | 0.430 |
| 25.00 | 0.710 | 0.695 | 1.125 |
| 26.00 | 0.740 | 0.725 | 1.850 |
| 28.00 | 0.810 | 1.550 | 3.400 |
| 30.00 | 0.880 | 1.690 | 5.090 |
| 32.00 | 0.950 | 1.830 | 6.920 |

## B.2 Outlet Design:

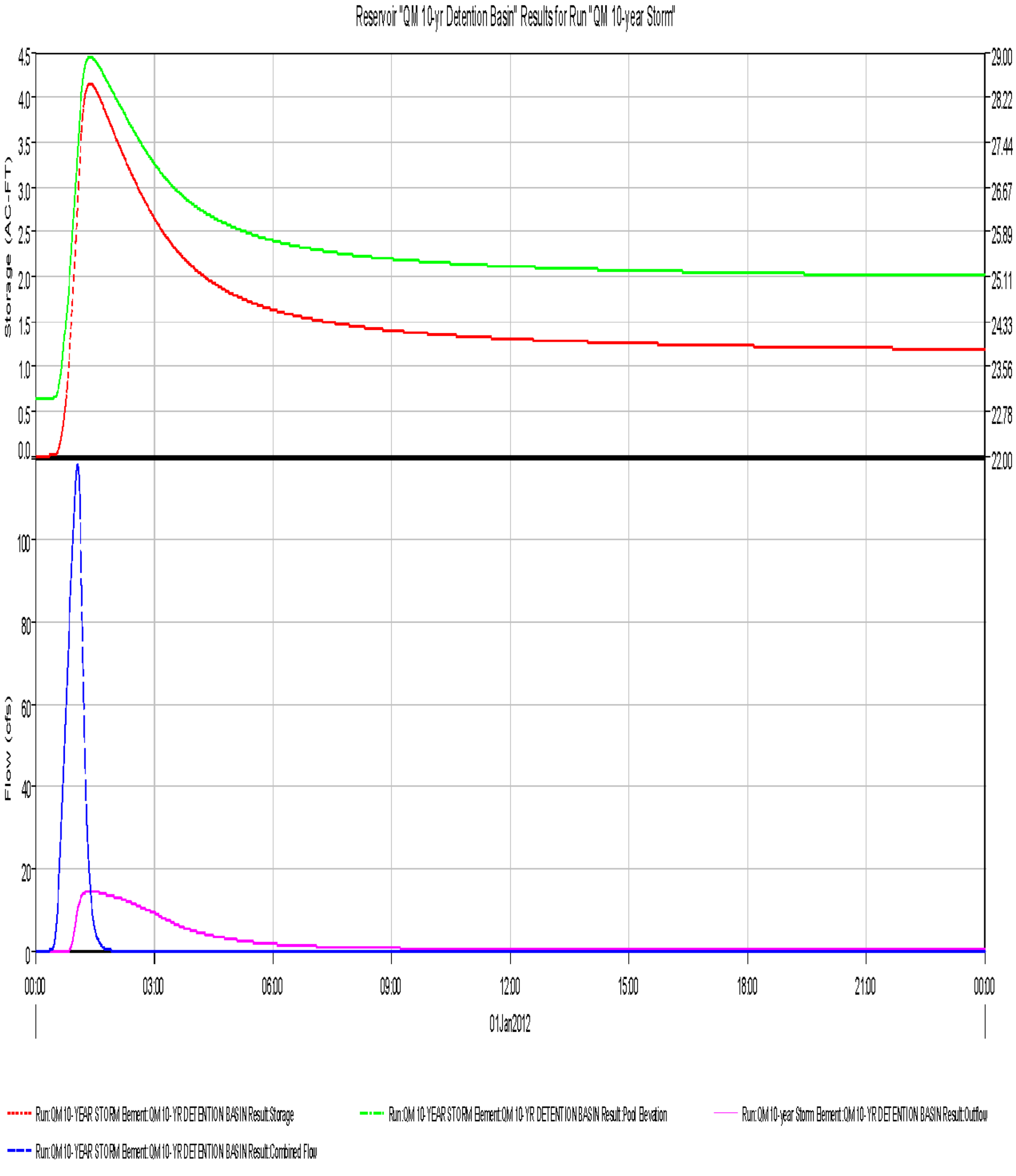
| | |
|---|---|
| Pipe: | RCP culvert (end-section conforming to fill) |
| Diameter: | 18 in |
| Length: | 100 ft |
| Inlet Elevation: | 25.00 ft |
| Outlet Elevation: | 24.00 ft |
| Entrance Coefficient: | 0.500 |
| Slope: | 0.010 |
| Outlet Coefficient: | 0.900 |
| Mannings n: | 0.013 |

## B.3 HEC-HMS Simulation:

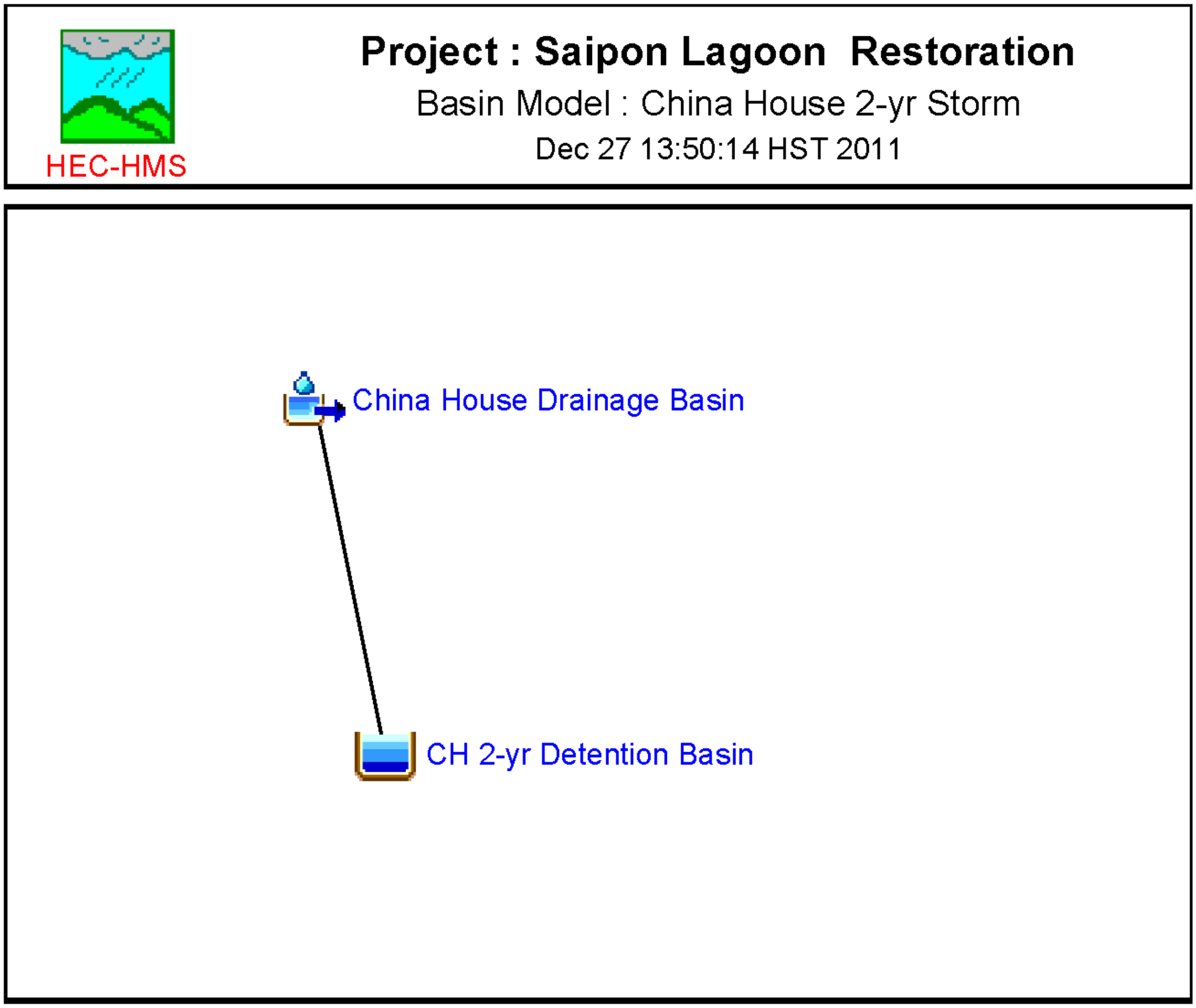
| | |
|---|---|
| Simulation Run: | QM 10-year Storm |
| Subbasin: | QM Drainage Basin |
| Meteorologic Model: | 10-year / 1 hour Storm |
| Control Specification: | Control -24-hour |

| Computed Results | | | |
|---|---|---|---|
| **Peak Inflow:** | **118.5 (cfs)** | **Time of Peak Inflow:** | **01:04** |
| **Peak Outflow:** | **14.5 (cfs)** | **Time of Peak Outflow:** | **01:23** |
| **Total Inflow:** | **4.7 (ac-ft)** | **Peak Storage:** | **4.2 (ac-ft)** |
| **Total Outflow:** | **3.5 (ac-ft)** | **Peak Elevation:** | **28.9 (ft)** |

## B.4 Hydrograph



# 4. China House Site: 2-Year Storm Event



HEC-HMS

**Project : Saipon Lagoon  Restoration**

Basin Model : China House 2-yr Storm

Dec 27 13:50:14 HST 2011

# A.China House Drainage Basin:

## A.1 Basin Model:

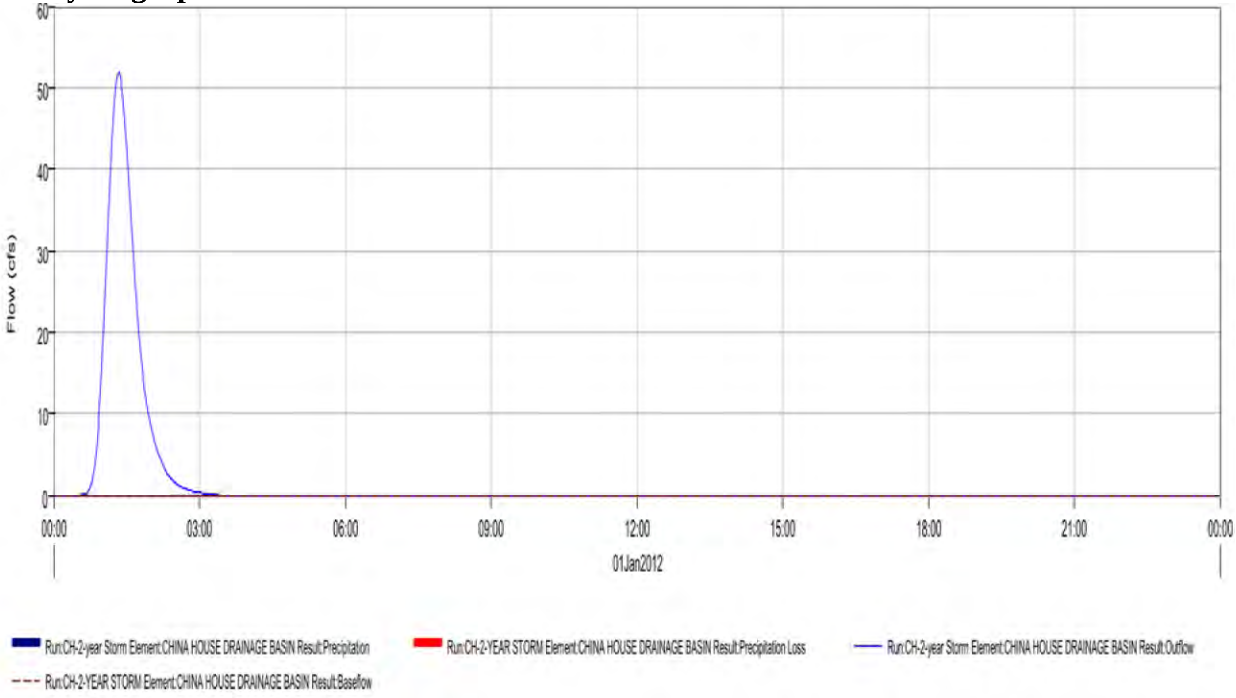
| | |
|---|---|
| Area: | 344 ac (0.5375 $mi^2$) |
| CN: | 68 |
| Tc: | 28.2 min |
| Rainfall 2-year/1 hour: | 1.93 in |
| Loss Method: | SCS Curve Number |
| Transform Method: | SCS Unit Hydrograph |

## A.2 HEC-HMS Simulation Results:

| | |
|---|---|
| Simulation Run: | CH 2-year Storm |
| Subbasin: | CH Drainage Basin |
| Meteorologic Model: | 2-year / 1 hour Storm |
| Control Specification: | Control -24-hour |

| Computed Results | | | |
|---|---|---|---|
| **Peak Discharge:** | **51.9 (cfs)** | **Time of Peak Discharge:** | **01:20** |
| **Total Precipitation:** | **48.6 (ac-ft)** | **Total Direct Runoff:** | **3.0 (ac-ft)** |
| **Total Loss:** | **45.6 (ac-ft)** | **Total Baseflow:** | **0.0 (ac-ft)** |
| **Total Excess:** | **3.0 (ac-ft)** | **Discharge:** | **3.0 (ac-ft)** |

## A3. Hydrograph



# B. China House 2-Year Detention Basin:

### B.1 Detention Basin Design:

| Elevation (ft) | Surf. Area (ac) | Increment Storage (ac-ft) | Cumulative Storage (ac-ft) |
|---|---|---|---|
| 20.00 | 0.190 | 0.000 | 0.000 |
| 21.00 | 0.450 | 0.320 | 0.320 |
| 22.00 | 0.470 | 0.460 | 0.780 |
| 24.00 | 0.530 | 1.000 | 1.780 |
| 26.00 | 0.580 | 1.110 | 2.890 |
| 28.00 | 0.640 | 1.220 | 4.110 |
| 29.00 | 0.670 | 0.655 | 4.765 |

### B.2 Outlet Design:

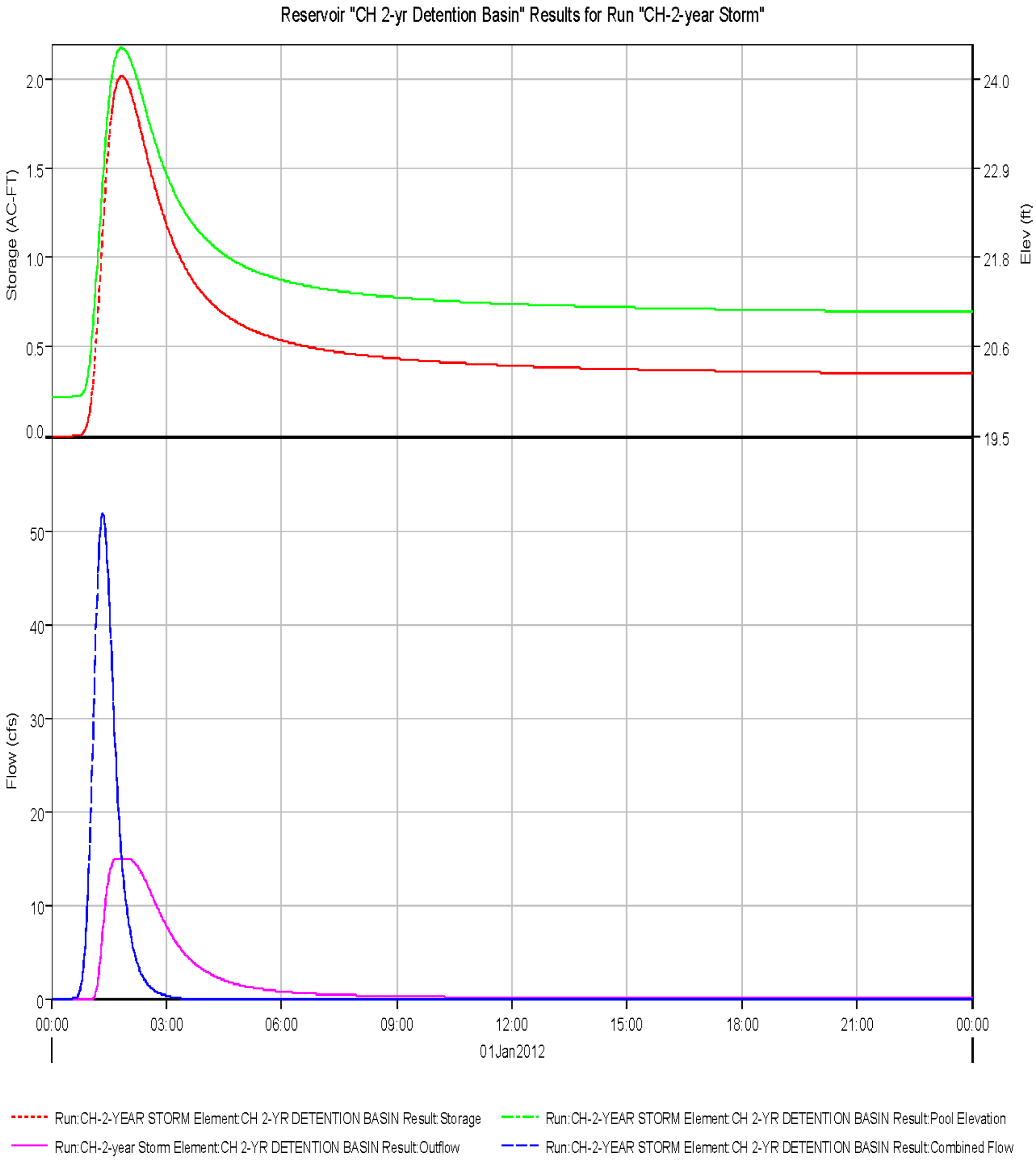
| | |
|---|---|
| Pipe: | RCP culvert (end-section conforming to fill) |
| Diameter: | 18 in |
| Length: | 750 ft |
| Inlet Elevation: | 21.00 ft |
| Outlet Elevation: | 7.00 ft |
| Entrance Coefficient: | 0.500 |
| Slope: | 0.0187 |
| Outlet Coefficient: | 0.900 |
| Mannings n: | 0.013 |

### B.3 HEC-HMS Simulation:

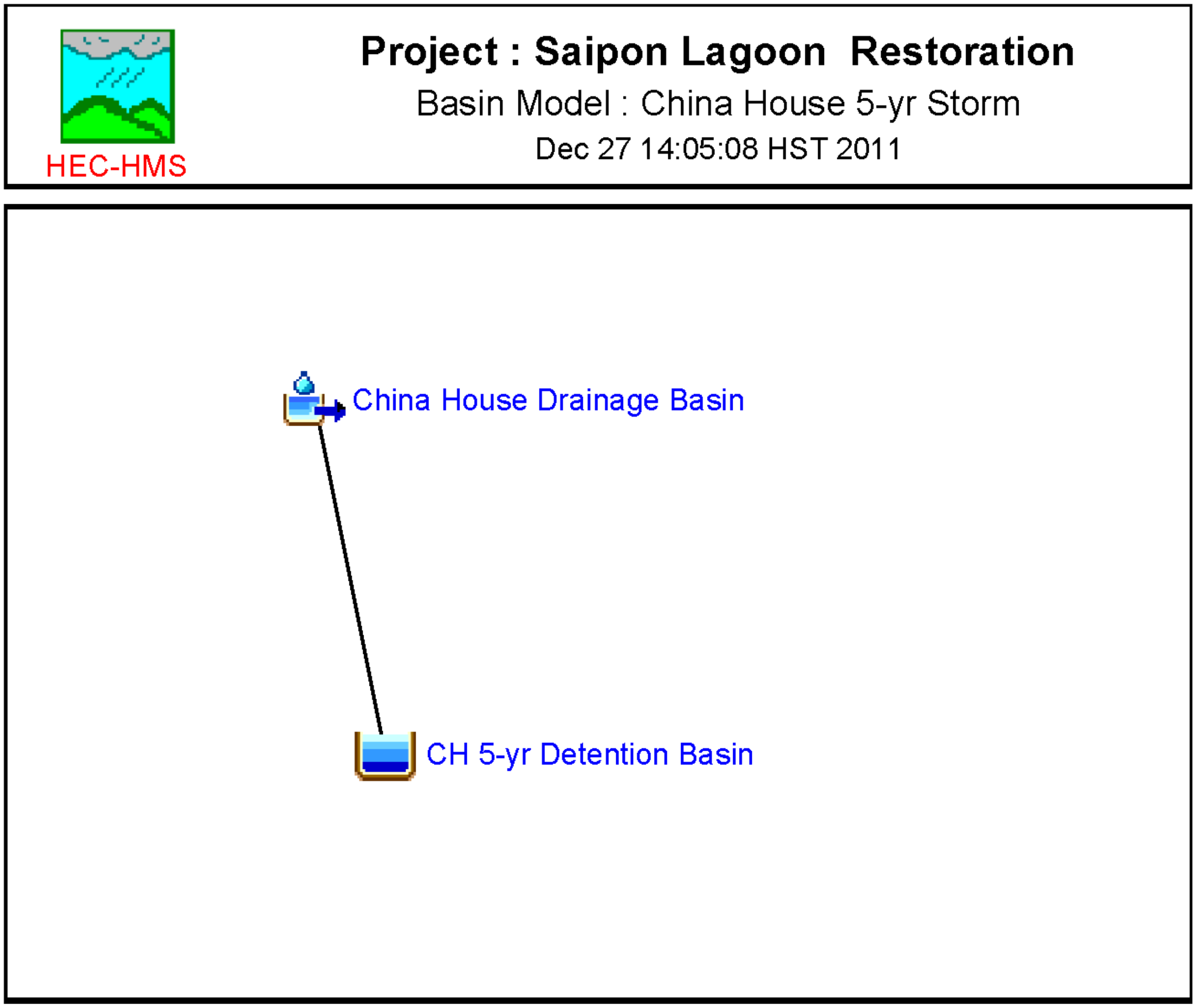
| | |
|---|---|
| Simulation Run: | CH 2-year Storm |
| Subbasin: | CH Drainage Basin |
| Meteorologic Model: | 2-year / 1 hour Storm |
| Control Specification: | Control -24-hour |

| Computed Results | | | |
|---|---|---|---|
| **Peak Inflow:** | **51.9 (cfs)** | **Time of Peak Inflow:** | **01:20** |
| **Peak Outflow:** | **15.0 (cfs)** | **Time of Peak Outflow:** | **02:01** |
| **Total Inflow:** | **3.0 (ac-ft)** | **Peak Storage:** | **2.0 (ac-ft)** |
| **Total Outflow:** | **2.6 (ac-ft)** | **Peak Elevation:** | **24.4 (ft)** |

## B.4 Hydrograph



# *5. China House Site: 5-Year Storm Event*



**Project : Saipon Lagoon Restoration**

Basin Model : China House 5-yr Storm

Dec 27 14:05:08 HST 2011

# A.China House Drainage Basin:

## A.1 Basin Model:

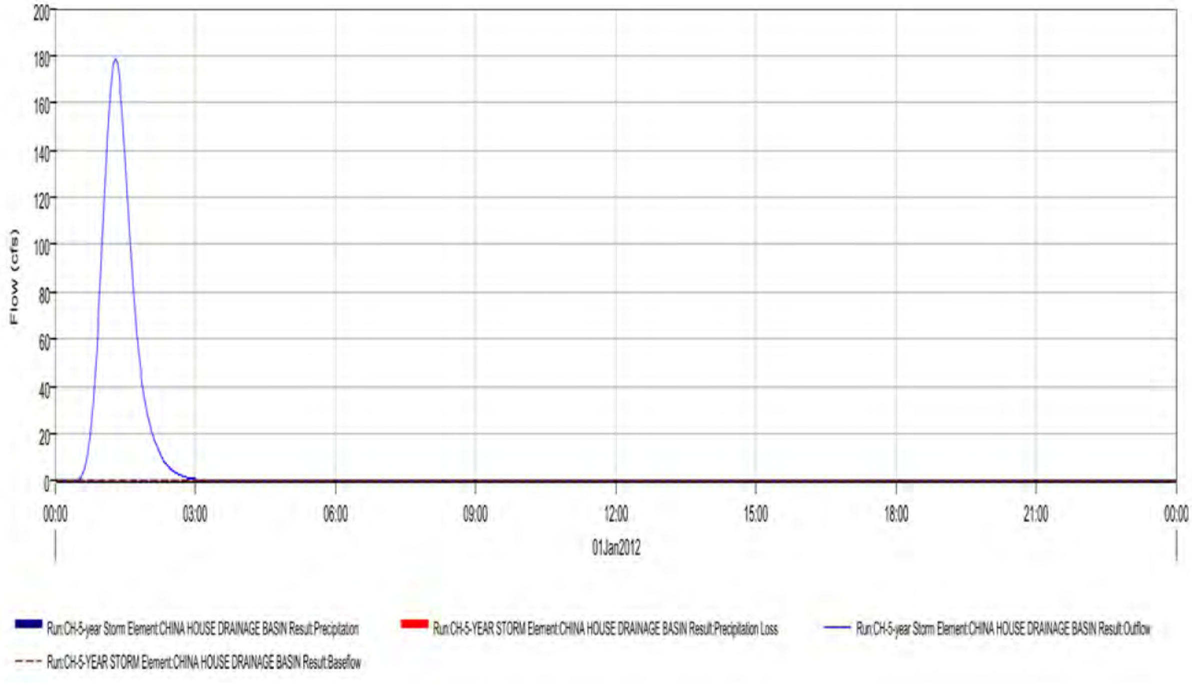
| | |
|---|---|
| Area: | 344 ac (0.5375 $mi^2$) |
| CN: | 68 |
| Tc: | 28.2 min |
| Rainfall 5-year/1 hour: | 2.61 in |
| Loss Method: | SCS Curve Number |
| Transform Method: | SCS Unit Hydrograph |

## A.2 HEC-HMS Simulation Results:

| | |
|---|---|
| Simulation Run: | CH 5-year Storm |
| Subbasin: | CH Drainage Basin |
| Meteorologic Model: | 5-year / 1 hour Storm |
| Control Specification: | Control -24-hour |

| Computed Results | | | |
|---|---|---|---|
| **Peak Discharge:** | **178.6 (cfs)** | **Time of Peak Discharge:** | **01:17** |
| **Total Precipitation:** | **71.6 (ac-ft)** | **Total Direct Runoff:** | **11.1 (ac-ft)** |
| **Total Loss:** | **60.5 (ac-ft)** | **Total Baseflow:** | **0.0 (ac-ft)** |
| **Total Excess:** | **11.1 (ac-ft)** | **Discharge:** | **11.1 (ac-ft)** |

## A3. Hydrograph



# B. China House 5-Year Detention Basin:

## B.1 Detention Basin Design:

| Elevation (ft) | Surf. Area (ac) | Increment Storage (ac-ft) | Cumulative Storage (ac-ft) |
|---|---|---|---|
| 19.00 | 0.190 | 0.000 | 0.000 |
| 20.00 | 0.740 | 0.465 | 0.465 |
| 21.00 | 1.310 | 1.025 | 1.490 |
| 22.00 | 1.360 | 1.335 | 2.825 |
| 24.00 | 1.450 | 2.810 | 5.635 |
| 26.00 | 1.550 | 3.000 | 8.635 |
| 28.00 | 1.650 | 3.200 | 11.835 |
| 29.00 | 1.760 | 1.705 | 13.540 |

## B.2 Outlet Design:

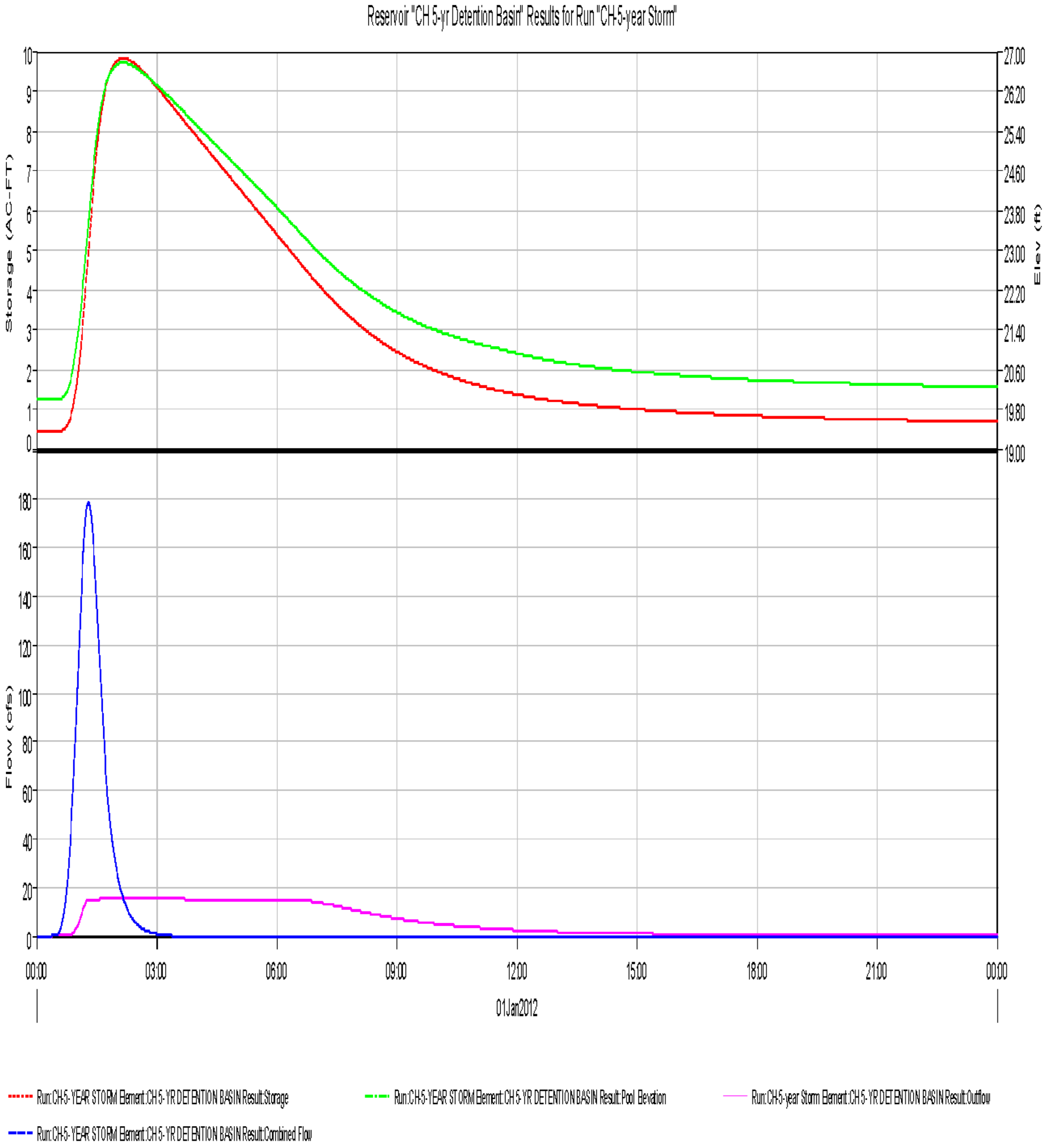
| | |
|---|---|
| Pipe: | RCP culvert (end-section conforming to fill) |
| Diameter: | 18 in |
| Length: | 750 ft |
| Inlet Elevation: | 20.00 ft |
| Outlet Elevation: | 7.00 ft |
| Entrance Coefficient: | 0.500 |
| Slope: | 0.0173 |
| Outlet Coefficient: | 0.900 |
| Mannings n: | 0.013 |

## B.3 HEC-HMS Simulation:

| | |
|---|---|
| Simulation Run: | CH 5-year Storm |
| Subbasin: | CH Drainage Basin |
| Meteorologic Model: | 5-year / 1 hour Storm |
| Control Specification: | Control -24-hour |

| Computed Results | | | |
|---|---|---|---|
| **Peak Inflow:** | **178.6 (cfs)** | **Time of Peak Inflow:** | **01:17** |
| **Peak Outflow:** | **15.6 (cfs)** | **Time of Peak Outflow:** | **02:09** |
| **Total Inflow:** | **11.1 (ac-ft)** | **Peak Storage:** | **9.8 (ac-ft)** |
| **Total Outflow:** | **10.9 (ac-ft)** | **Peak Elevation:** | **26.8 (ft)** |

## B.4 Hydrograph



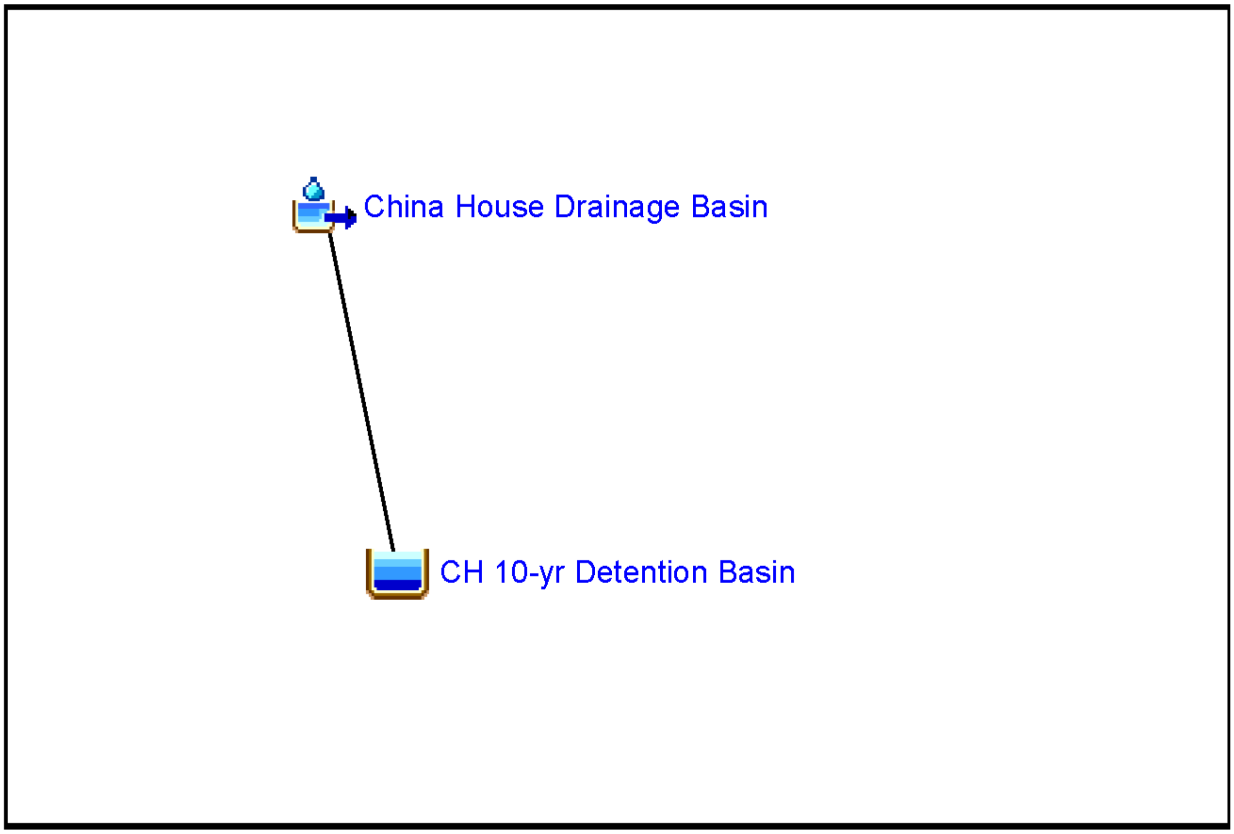
# 6. China House Site: 10-Year Storm Event

HEC-HMS

**Project : Saipon Lagoon Restoration**

Basin Model : China House 10-yr Storm

Dec 27 11:56:18 HST 2011



# A.China House Drainage Basin:

## A.1 Basin Model:

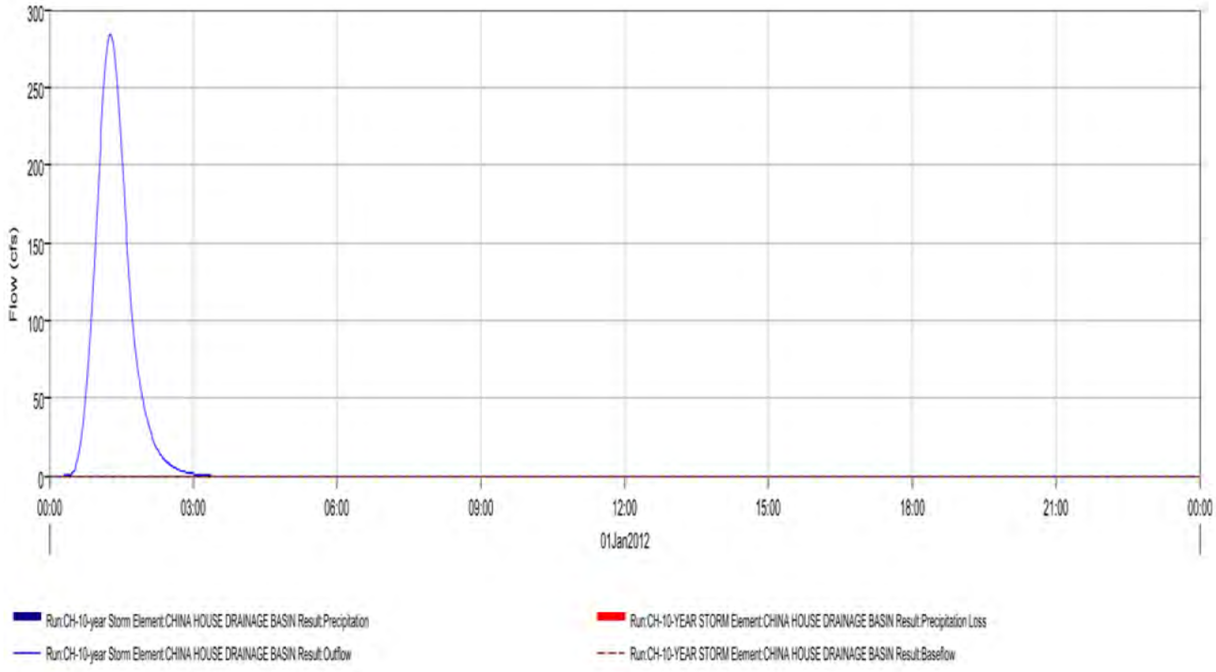
| | |
|---|---|
| Area: | 344 ac (0.5375 mi$^2$) |
| CN: | 68 |
| Tc: | 28.2 min |
| Rainfall 10-year/1 hour: | 3.06 in |
| Loss Method: | SCS Curve Number |
| Transform Method: | SCS Unit Hydrograph |

## A.2 HEC-HMS Simulation Results:

| | |
|---|---|
| Simulation Run: | CH 10-year Storm |
| Subbasin: | CH Drainage Basin |
| Meteorologic Model: | 10-year / 1 hour Storm |
| Control Specification: | Control -24-hour |

| Computed Results | | | |
|---|---|---|---|
| **Peak Discharge:** | **284.0 (cfs)** | **Time of Peak Discharge:** | **01:17** |
| **Total Precipitation:** | **86.6 (ac-ft)** | **Total Direct Runoff:** | **18.3 (ac-ft)** |
| **Total Loss:** | **68.3 (ac-ft)** | **Total Baseflow:** | **0.0 (ac-ft)** |
| **Total Excess:** | **18.3 (ac-ft)** | **Discharge:** | **18.3 (ac-ft)** |

## A3. Hydrograph



# B. China House 10-Year Detention Basin:

## B.1 Detention Basin Design:

| Elevation (ft) | Surf. Area (ac) | Increment Storage (ac-ft) | Cumulative Storage (ac-ft) |
|---|---|---|---|
| 18.00 | 0.001 | 0.000 | 0.000 |
| 19.00 | 0.191 | 0.096 | 0.096 |
| 20.00 | 0.743 | 0.467 | 0.563 |
| 21.00 | 1.312 | 1.028 | 1.590 |
| 22.00 | 1.412 | 1.362 | 2.953 |
| 24.00 | 1.509 | 2.921 | 5.873 |
| 26.00 | 1.609 | 3.118 | 8.992 |
| 28.00 | 1.711 | 3.320 | 12.312 |
| 29.00 | 1.764 | 1.737 | 14.049 |
| 30.00 | 1.817 | 1.790 | 15.839 |

## B.2 Outlet Design:

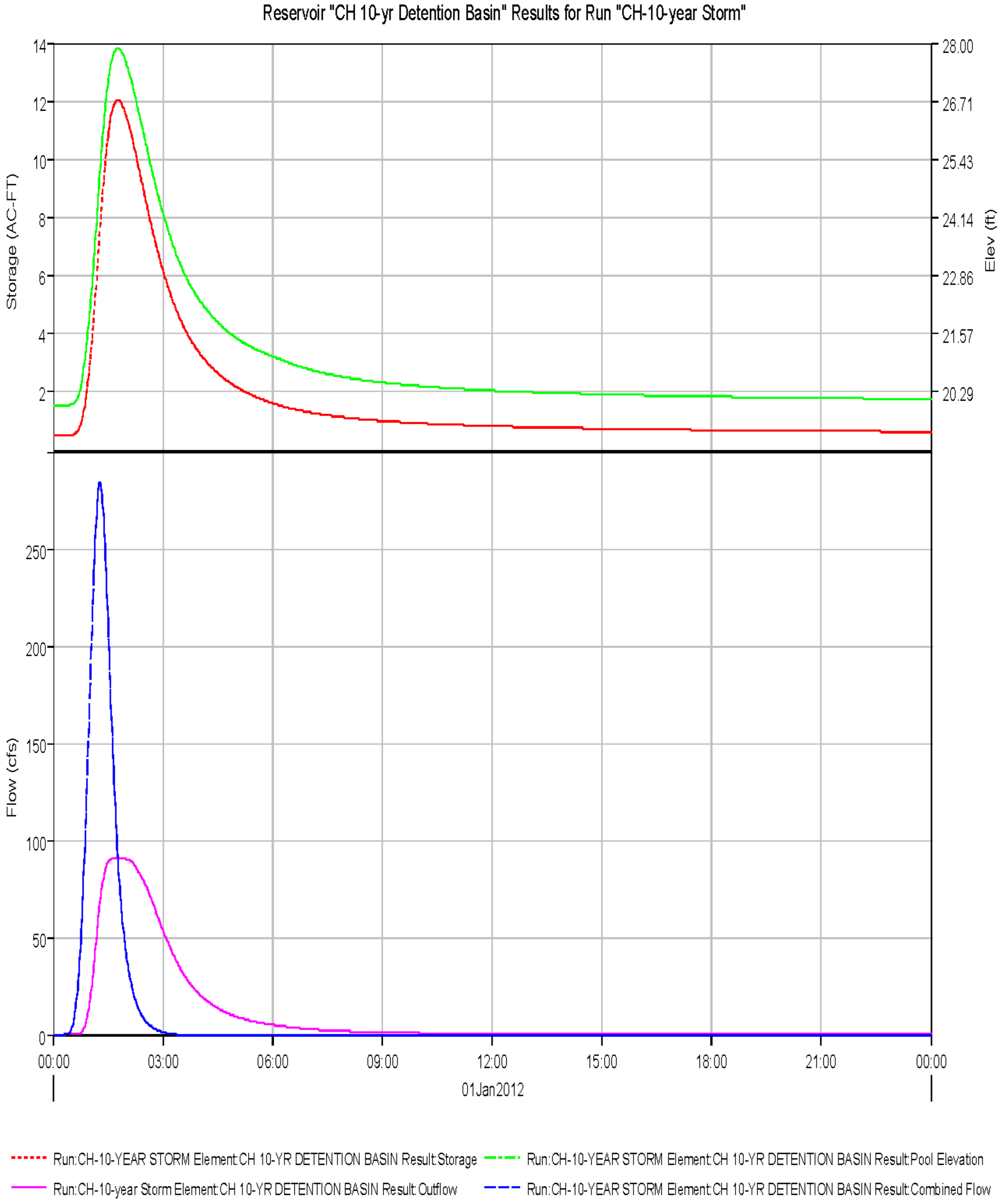
| | |
|---|---|
| Pipe: | RCP culvert (end-section conforming to fill) |
| Diameter: | 36 in |
| Length: | 750 ft |
| Inlet Elevation: | 20.00 ft |
| Outlet Elevation: | 7.00 ft |
| Entrance Coefficient: | 0.500 |
| Slope: | 0.0173 |
| Outlet Coefficient: | 0.900 |
| Mannings n: | 0.013 |

## B.3 HEC-HMS Simulation:

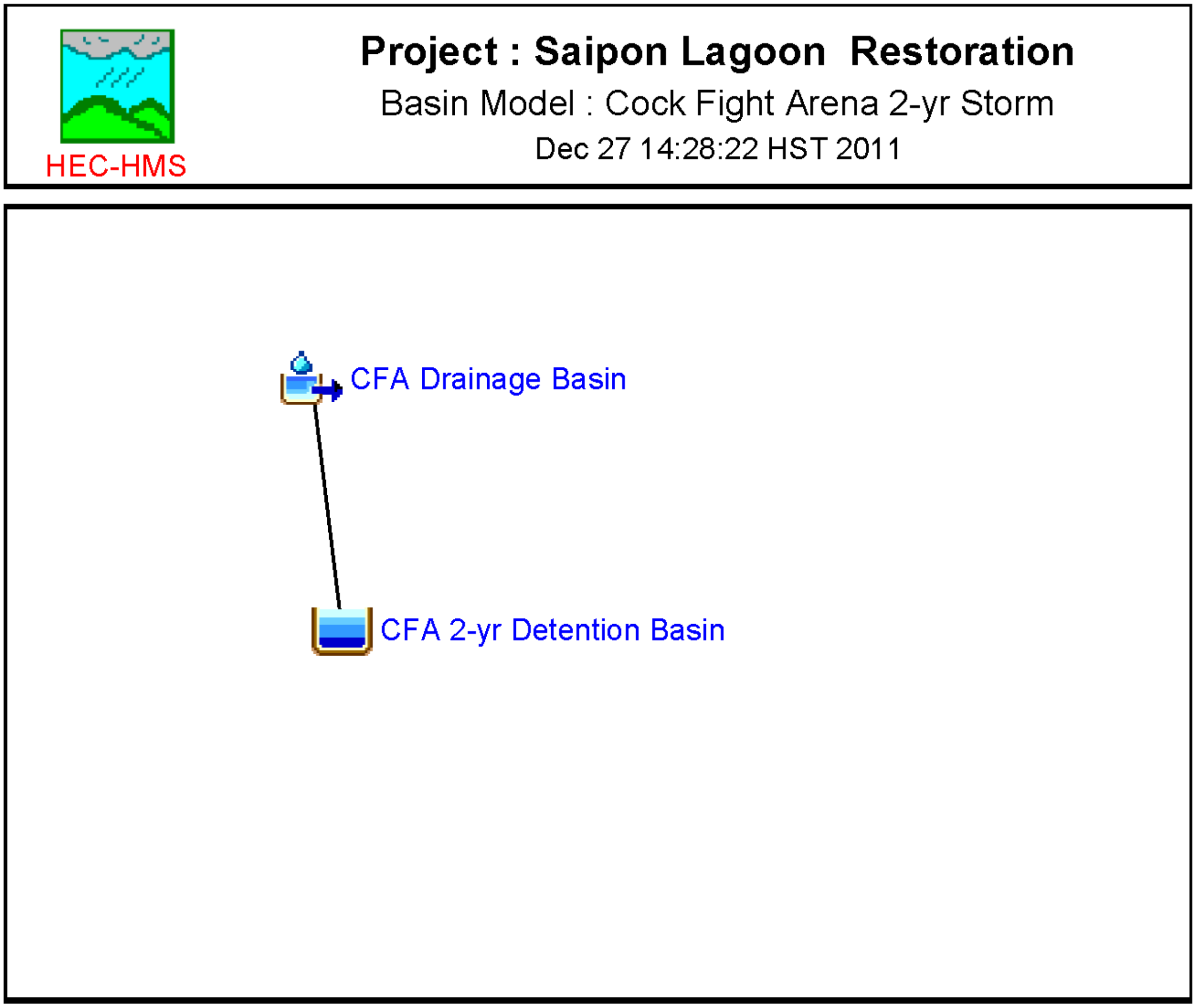
| | |
|---|---|
| Simulation Run: | CH 10-year Storm |
| Subbasin: | CH Drainage Basin |
| Meteorologic Model: | 10-year / 1 hour Storm |
| Control Specification: | Control -24-hour |

| Computed Results | | | |
|---|---|---|---|
| **Peak Inflow:** | **284.0 (cfs)** | **Time of Peak Inflow:** | **01:17** |
| **Peak Outflow:** | **91.1 (cfs)** | **Time of Peak Outflow:** | **01:46** |
| **Total Inflow:** | **18.3 (ac-ft)** | **Peak Storage:** | **12.0 (ac-ft)** |
| **Total Outflow:** | **18.1 (ac-ft)** | **Peak Elevation:** | **27.9 (ft)** |

## B.4 Hydrograph



# *7. Cock Fight Arena Site: 2-Year Storm Event*



HEC-HMS

**Project : Saipon Lagoon  Restoration**

Basin Model : Cock Fight Arena 2-yr Storm

Dec 27 14:28:22 HST 2011

# A.Cock Fight Arena Drainage Basin:

## A.1 Basin Model:

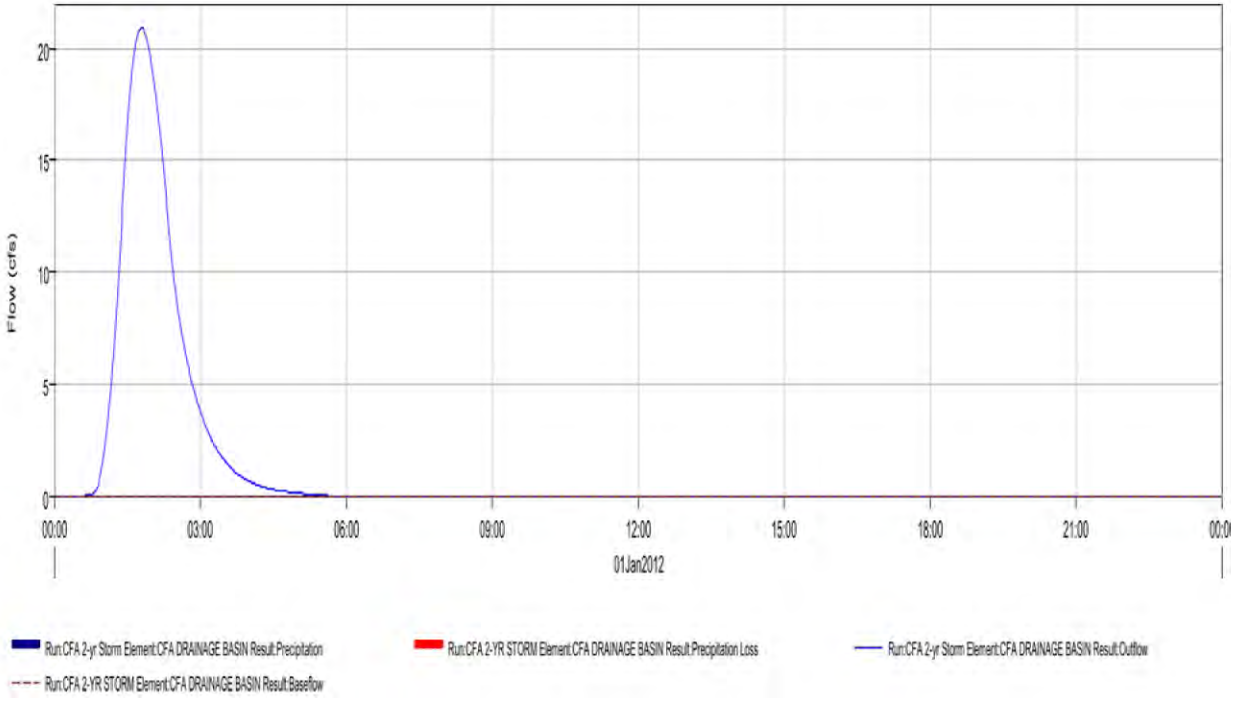
| | |
|---|---|
| Area: | 412.69 ac (0.6448 mi$^2$) |
| CN: | 65 |
| Tc: | 55.2 min |
| Rainfall 2-year/1 hour: | 1.93 in |
| Loss Method: | SCS Curve Number |
| Transform Method: | SCS Unit Hydrograph |

## A.2 HEC-HMS Simulation Results:

| | |
|---|---|
| Simulation Run: | CFA 2-year Storm |
| Subbasin: | CFA Drainage Basin |
| Meteorologic Model: | 2-year / 1 hour Storm |
| Control Specification: | Control -24-hour |

| Computed Results | | | |
|---|---|---|---|
| **Peak Discharge:** | **20.9 (cfs)** | **Time of Peak Discharge:** | **01:48** |
| **Total Precipitation:** | **58.2 (ac-ft)** | **Total Direct Runoff:** | **2.2 (ac-ft)** |
| **Total Loss:** | **56.0 (ac-ft)** | **Total Baseflow:** | **0.0 (ac-ft)** |
| **Total Excess:** | **2.2 (ac-ft)** | **Discharge:** | **2.2 (ac-ft)** |

## A3. Hydrograph



# B. Cock Fight Arena 2-Year Detention Basin:

## B.1 Detention Basin Design:

| Elevation (ft) | Surf. Area (ac) | Increment Storage (ac-ft) | Cumulative Storage (ac-ft) |
|---|---|---|---|
| 37.00 | 0.010 | 0.000 | 0.000 |
| 40.00 | 0.970 | 1.470 | 1.470 |
| 45.00 | 3.180 | 10.375 | 11.845 |

## B.2 Outlet Design:

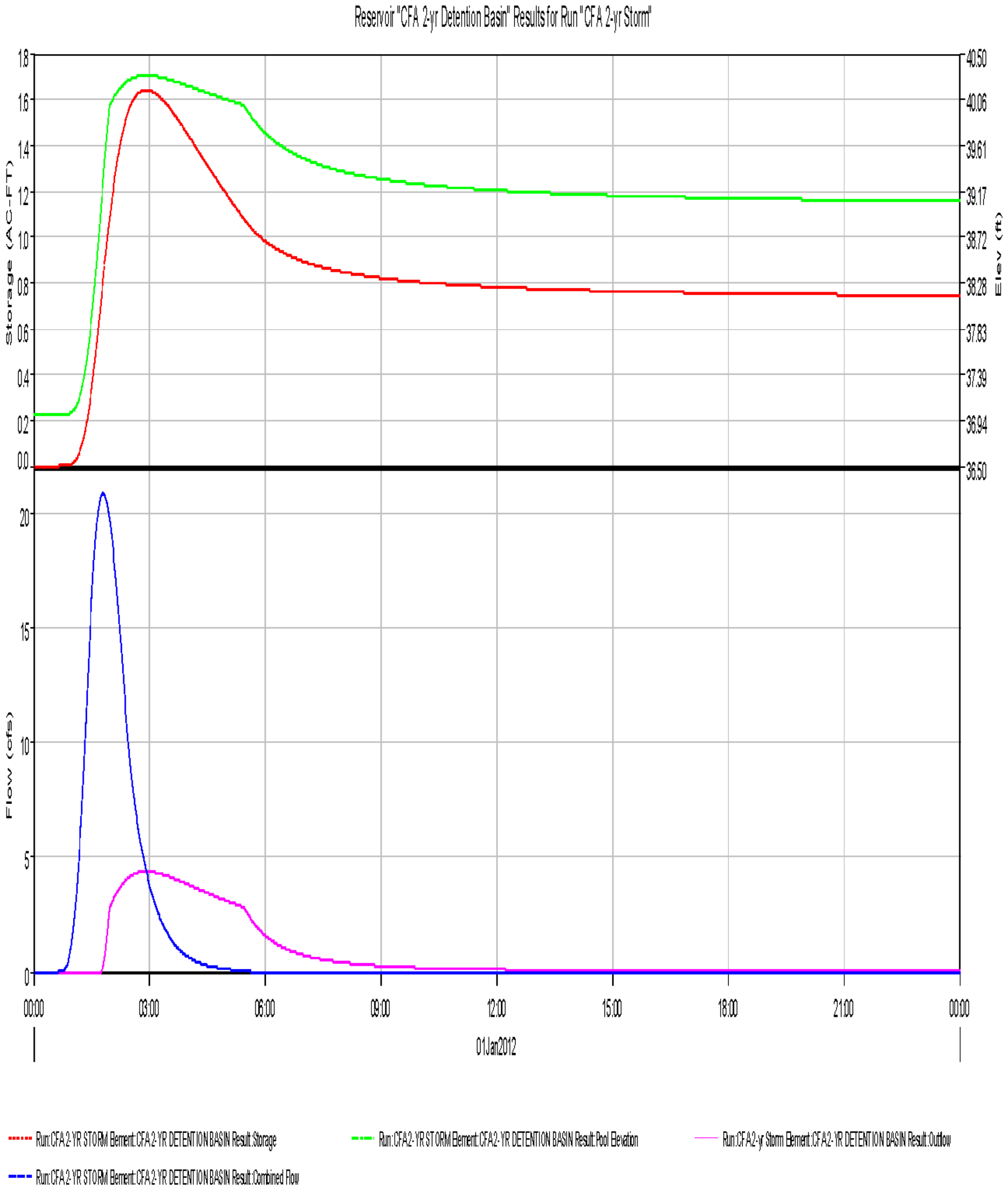
| | |
|---|---|
| Pipe: | RCP culvert (end-section conforming to fill) |
| Diameter: | 18 in |
| Length: | 2,200 ft |
| Inlet Elevation: | 39.00 ft |
| Outlet Elevation: | 7.00 ft |
| Entrance Coefficient: | 0.500 |
| Slope: | 0.0155 |
| Outlet Coefficient: | 0.900 |
| Mannings n: | 0.013 |

## B.3 HEC-HMS Simulation:

| | |
|---|---|
| Simulation Run: | CFA 2-year Storm |
| Subbasin: | CFA Drainage Basin |
| Meteorologic Model: | 2-year / 1 hour Storm |
| Control Specification: | Control -24-hour |

| Computed Results | | | |
|---|---|---|---|
| **Peak Inflow:** | **20.9 (cfs)** | **Time of Peak Inflow:** | **01:48** |
| **Peak Outflow:** | **4.4 (cfs)** | **Time of Peak Outflow:** | **02:55** |
| **Total Inflow:** | **2.2 (ac-ft)** | **Peak Storage:** | **1.6 (ac-ft)** |
| **Total Outflow:** | **1.4 (ac-ft)** | **Peak Elevation:** | **40.3 (ft)** |

## B.4 Hydrograph



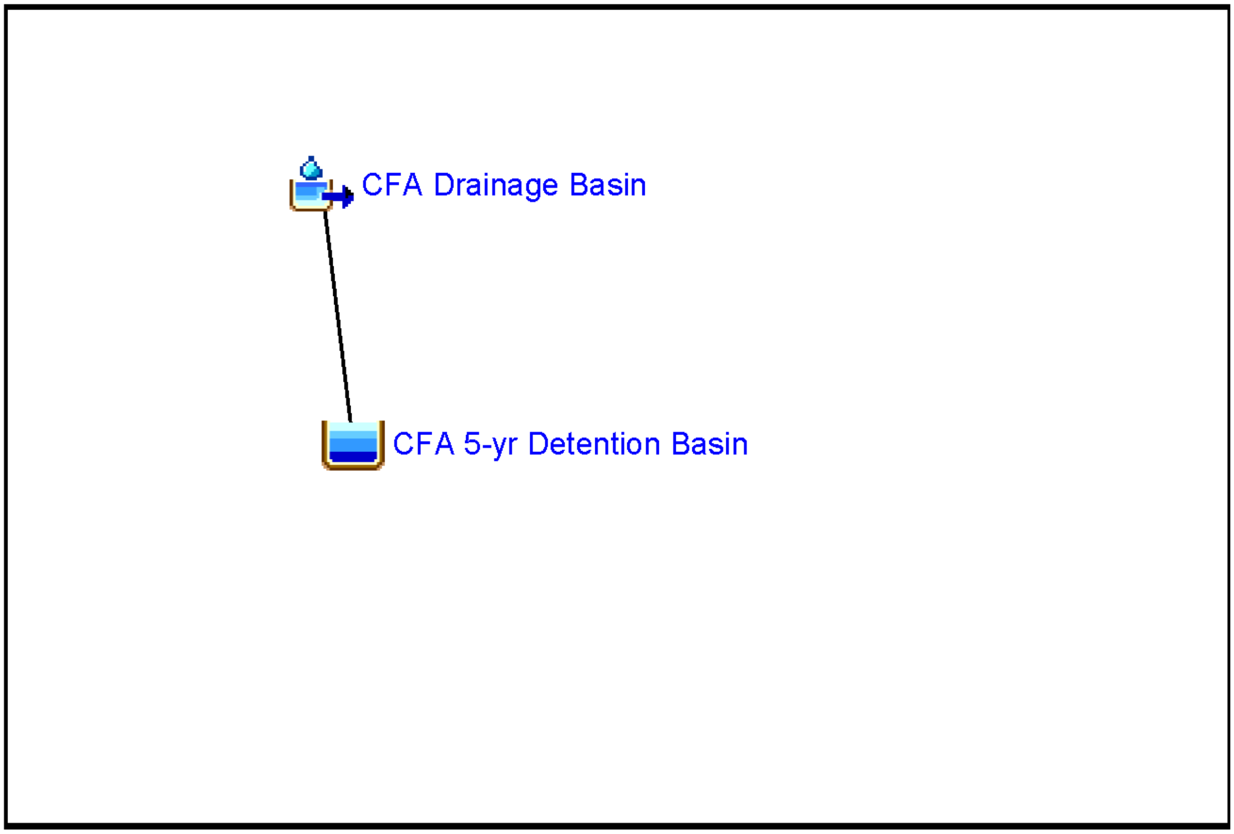
# *8. Cock Fight Arena Site: 5-Year Storm Event*

HEC-HMS

**Project : Saipon Lagoon Restoration**

Basin Model : Cock Fight Arena 5-yr Storm

Dec 27 13:39:27 HST 2011



# A. Cock Fight Arena Drainage Basin:

## A.1 Basin Model:

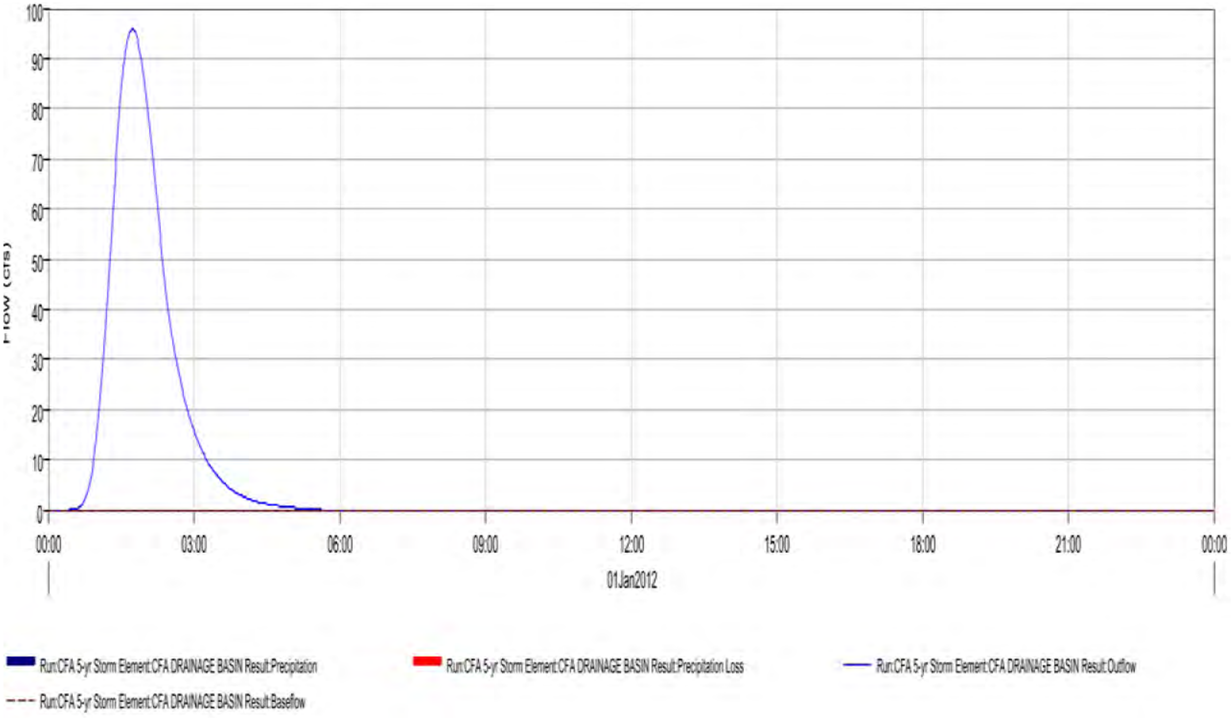
| | |
|---|---|
| Area: | 412.69 ac (0.6448 $mi^2$) |
| CN: | 65 |
| Tc: | 55.2 min |
| Rainfall 5-year/1 hour: | 2.61 in |
| Loss Method: | SCS Curve Number |
| Transform Method: | SCS Unit Hydrograph |

## A.2 HEC-HMS Simulation Results:

| | |
|---|---|
| Simulation Run: | CFA 5-year Storm |
| Subbasin: | CFA Drainage Basin |
| Meteorologic Model: | 5-year / 1 hour Storm |
| Control Specification: | Control -24-hour |

| Computed Results | | | |
|---|---|---|---|
| **Peak Discharge:** | **95.9 (cfs)** | **Time of Peak Discharge:** | **01:44** |
| **Total Precipitation:** | **85.9 (ac-ft)** | **Total Direct Runoff:** | **10.2 (ac-ft)** |
| **Total Loss:** | **75.7 (ac-ft)** | **Total Baseflow:** | **0.0 (ac-ft)** |
| **Total Excess:** | **10.2 (ac-ft)** | **Discharge:** | **10.2 (ac-ft)** |

## A3. Hydrograph


100
90
80
70
60
50
40
30
20
10
0
Flow (cfs)
00:00
03:00
06:00
09:00
12:00
15:00
18:00
21:00
00:00
01Jan2012
Run:CFA 5-yr Storm Element:CFA DRAINAGE BASIN Result:Precipitation
Run:CFA 5-yr Storm Element:CFA DRAINAGE BASIN Result:Precipitation Loss
Run:CFA 5-yr Storm Element:CFA DRAINAGE BASIN Result:Outflow
Run:CFA 5-yr Storm Element:CFA DRAINAGE BASIN Result:Baseflow

# B. Cock Fight Arena 5-Year Detention Basin:

### B.1 Detention Basin Design:

| Elevation (ft) | Surf. Area (ac) | Increment Storage (ac-ft) | Cumulative Storage (ac-ft) |
|---|---|---|---|
| 37.00 | 0.010 | 0.000 | 0.000 |
| 40.00 | 0.970 | 1.470 | 1.470 |
| 45.00 | 3.180 | 10.375 | 11.845 |

### B.2 Outlet Design:

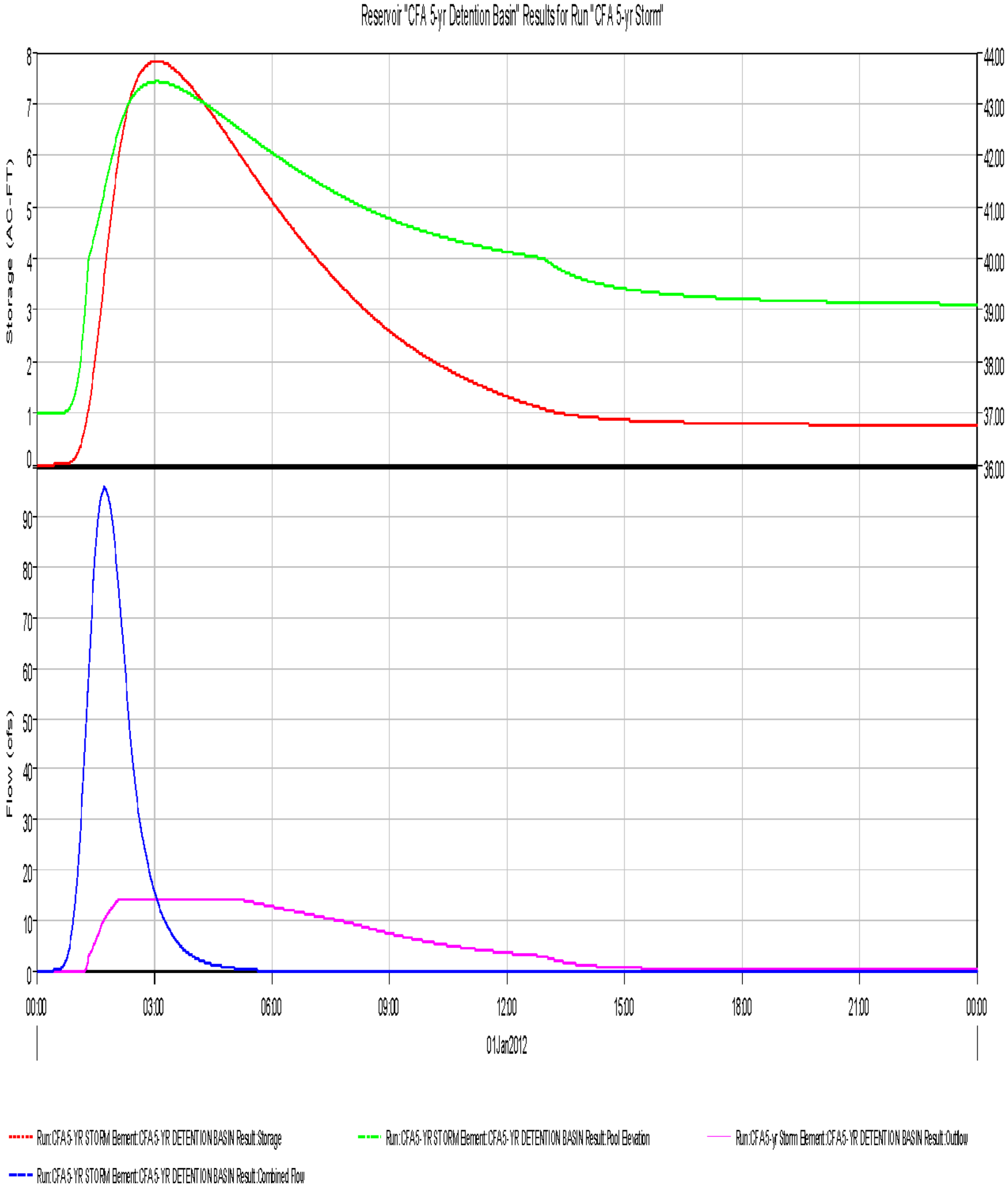
| | |
|---|---|
| Pipe: | RCP culvert (end-section conforming to fill) |
| Diameter: | 18 in |
| Length: | 2,200 ft |
| Inlet Elevation: | 39.00 ft |
| Outlet Elevation: | 7.00 ft |
| Entrance Coefficient: | 0.500 |
| Slope: | 0.0155 |
| Outlet Coefficient: | 0.900 |
| Mannings n: | 0.013 |

### B.3 HEC-HMS Simulation:

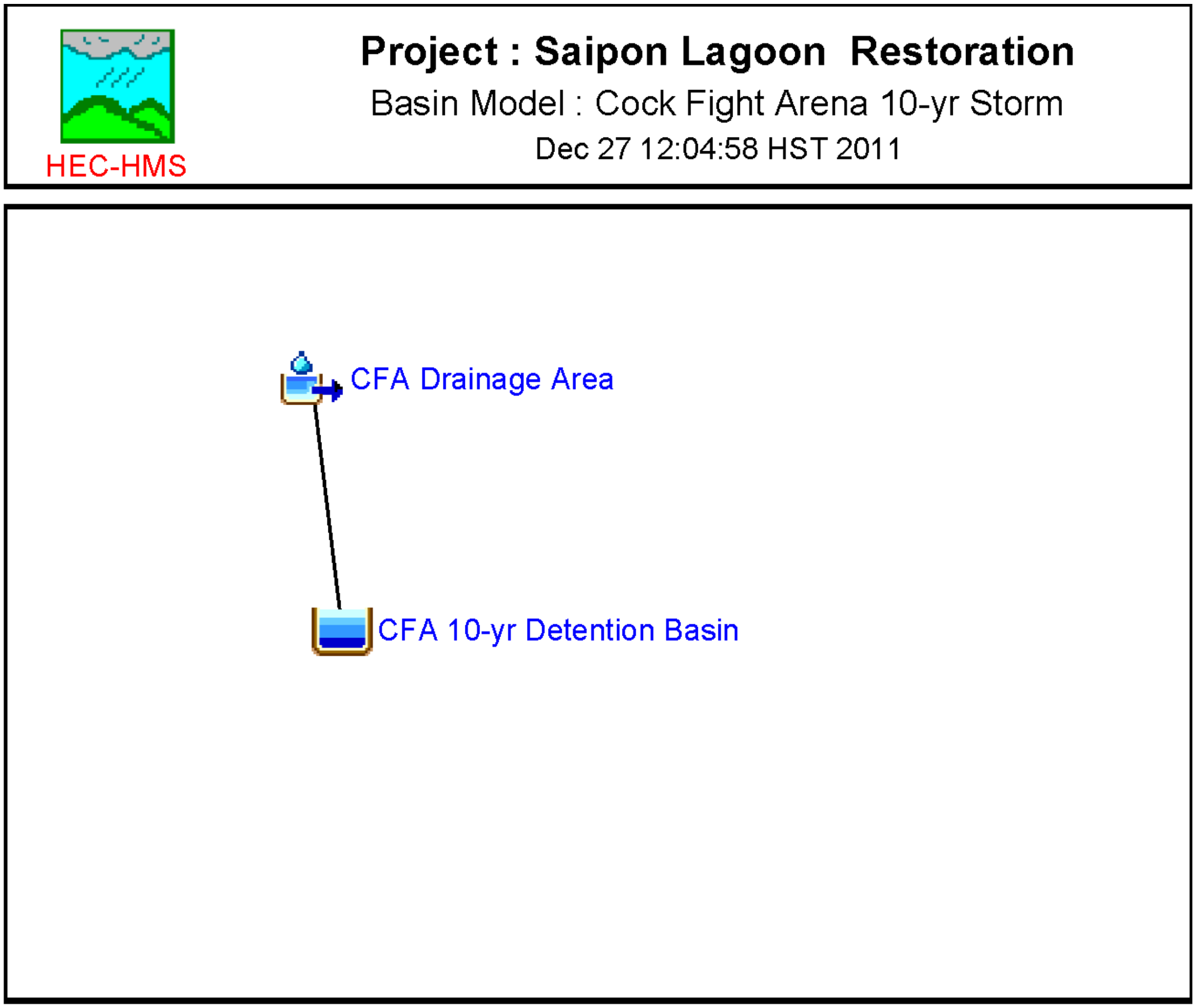
| | |
|---|---|
| Simulation Run: | CFA 5-year Storm |
| Subbasin: | CFA Drainage Basin |
| Meteorologic Model: | 5-year / 1 hour Storm |
| Control Specification: | Control -24-hour |

| Computed Results | | | |
|---|---|---|---|
| **Peak Inflow:** | **95.9 (cfs)** | **Time of Peak Inflow:** | **01:44** |
| **Peak Outflow:** | **14.0 (cfs)** | **Time of Peak Outflow:** | **05:01** |
| **Total Inflow:** | **10.2 (ac-ft)** | **Peak Storage:** | **7.8 (ac-ft)** |
| **Total Outflow:** | **9.4 (ac-ft)** | **Peak Elevation:** | **43.4 (ft)** |

## B.4 Hydrograph



# 9. Cock Fight Arena Site: 10-Year Storm Event



# A. Cock Fight Arena Drainage Basin:

## A.1 Basin Model:

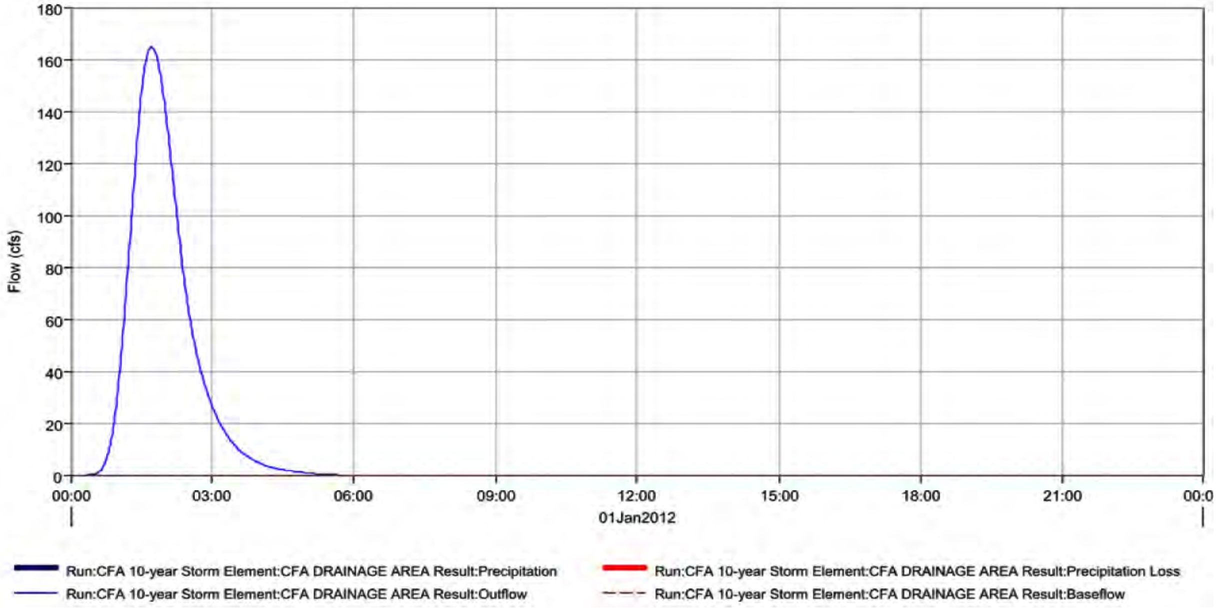
| | |
|---|---|
| Area: | 412.69 ac (0.6448 mi$^2$) |
| CN: | 65 |
| Tc: | 55.2 min |
| Rainfall 10-year/1 hour: | 3.06 in |
| Loss Method: | SCS Curve Number |
| Transform Method: | SCS Unit Hydrograph |

## A.2 HEC-HMS Simulation Results:

| | |
|---|---|
| Simulation Run: | CFA 10-year Storm |
| Subbasin: | CFA Drainage Basin |
| Meteorologic Model: | 10-year / 1 hour Storm |
| Control Specification: | Control -24-hour |

| Computed Results | | | |
|---|---|---|---|
| **Peak Discharge:** | **164.7 (cfs)** | **Time of Peak Discharge:** | **01:43** |
| **Total Precipitation:** | **103.8 (ac-ft)** | **Total Direct Runoff:** | **17.7 (ac-ft)** |
| **Total Loss:** | **86.1 (ac-ft)** | **Total Baseflow:** | **0.0 (ac-ft)** |
| **Total Excess:** | **17.7 (ac-ft)** | **Discharge:** | **17.7 (ac-ft)** |

## A3. Hydrograph



# A.Cock Fight Arena 10-Year Detention Basin:

### B.1 Detention Basin Design:

| Elevation (ft) | Surf. Area (ac) | Increment Storage (ac-ft) | Cumulative Storage (ac-ft) |
|---|---|---|---|
| 37.00 | 0.010 | 0.000 | 0.000 |
| 38.00 | 0.240 | 0.125 | 0.125 |
| 39.00 | 0.869 | 0.555 | 0.680 |
| 40.00 | 1.722 | 1.296 | 1.975 |
| 45.00 | 3.180 | 12.255 | 14.230 |

### B.2 Outlet Design:

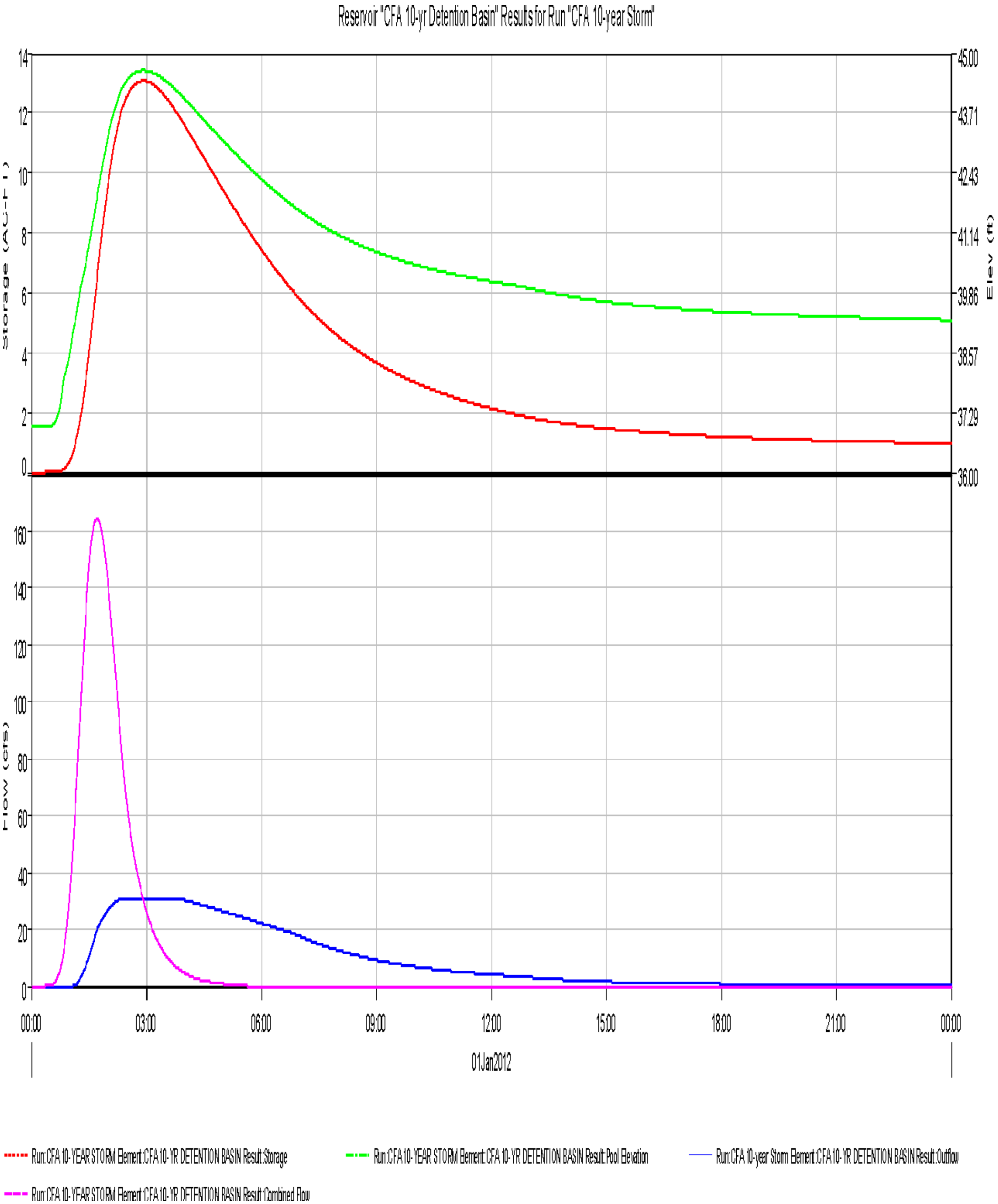
| | |
|---|---|
| Pipe: | RCP culvert (end-section conforming to fill) |
| Diameter: | 24 in |
| Length: | 2,200 ft |
| Inlet Elevation: | 39.00 ft |
| Outlet Elevation: | 7.00 ft |
| Entrance Coefficient: | 0.500 |
| Slope: | 0.0155 |
| Outlet Coefficient: | 0.900 |
| Mannings n: | 0.013 |

### B.3 HEC-HMS Simulation:

| | |
|---|---|
| Simulation Run: | CFA 10-year Storm |
| Subbasin: | CFA Drainage Basin |
| Meteorologic Model: | 10-year / 1 hour Storm |
| Control Specification: | Control -24-hour |

| Computed Results | | | |
|---|---|---|---|
| **Peak Inflow:** | **164.7 (cfs)** | **Time of Peak Inflow:** | **01:43** |
| **Peak Outflow:** | **30.3 (cfs)** | **Time of Peak Outflow:** | **03.55** |
| **Total Inflow:** | **17.7 (ac-ft)** | **Peak Storage:** | **13.1 (ac-ft)** |
| **Total Outflow:** | **16.7 (ac-ft)** | **Peak Elevation:** | **44.6 (ft)** |

## B.4 Hydrograph



# *Appendix B*
# *Traffic Data*

# MetroCount Traffic Executive
# Weekly Vehicle Counts

## WeeklyVehicle-13 -- English (ENU)

### Datasets:

**Site:** **[Site-6] Middle Rd.(30) South of Navy Rd. (37)**
**Direction:** 1 - North bound, A hit first., **Lane:** 0
**Survey Duration:** 12:06 Tuesday, July 17, 2007 => 15:09 Wednesday, July 25, 2007
**File:** C:\Program Files\MetroCount v316\User\Data\Site-625Jul2007.EC0 (Regular)
**Identifier:** U743JGM5 MC56-L5 [MC55] (c)Microcom 19Oct04
**Algorithm:** Factory default
**Data type:** Axle sensors - Paired (Class/Speed/Count)

### Profile:

**Filter time:** **12:06 Tuesday, July 17, 2007 => 15:09 Wednesday, July 25, 2007**
**Included classes:** 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
**Speed range:** 10 - 160 km/h.
**Direction:** North, East, South, West (bound)
**Separation:** All - (Headway)
**Name:** Factory default profile
**Scheme:** Vehicle classification (ARX)
**Units:** Metric (meter, kilometer, m/s, km/h, kg, tonne)
**In profile:** Vehicles = 49798 / 50013 (99.57%)

# Weekly Vehicle Counts

**WeeklyVehicle-13**
**Site:** Site-6.0N
**Description:** **Middle Rd.(30) South of Navy Rd. (37)**
**Filter time:** **12:06 Tuesday, July 17, 2007 => 15:09 Wednesday, July 25, 2007**
**Scheme:** Vehicle classification (ARX)
**Filter:** Cls(1 2 3 4 5 6 7 8 9 10 11 12 ) Dir(NESW) Sp(10,160) Headway(>0)

| | Mon<br>16 Jul | Tue<br>17 Jul | Wed<br>18 Jul | Thu<br>19 Jul | Fri<br>20 Jul | Sat<br>21 Jul | Sun<br>22 Jul | Averages<br>1 - 5 | <br>1 - 7 |
|---|---|---|---|---|---|---|---|---|---|
| Hour | | | | | | | | | |
| 0000-0100 | * | * | 0 | 90 | 96 | 126 | 107 | 62.0 | 83.8 |
| 0100-0200 | * | * | 0 | 44 | 56 | 91 | 50 | 33.3 | 48.2 |
| 0200-0300 | * | * | 0 | 34 | 37 | 98 | 59 | 23.7 | 45.6 |
| 0300-0400 | * | * | 0 | 25 | 28 | 56 | 60 | 17.7 | 33.8 |
| 0400-0500 | * | * | 0 | 27 | 36 | 44 | 45 | 21.0 | 30.4 |
| 0500-0600 | * | * | 0 | 59 | 64 | 83 | 77 | 41.0 | 56.6 |
| 0600-0700 | * | * | 0 | 188 | 195 | 169 | 128 | 127.7 | 136.0 |
| 0700-0800 | * | * | 0 | **632<** | **614<** | 397 | 268 | **415.3<** | **382.2<** |
| 0800-0900 | * | * | 0 | 559 | 554 | 385 | 283 | 371.0 | 356.2 |
| 0900-1000 | * | * | 0 | 501 | 520 | **430<** | 288 | 340.3 | 347.8 |
| 1000-1100 | * | * | 0 | 502 | 544 | 421 | 287 | 348.7 | 350.8 |
| 1100-1200 | * | * | **0<** | 478 | 563 | 429 | **288<** | 347.0 | 351.6 |
| 1200-1300 | * | 0 | 0 | 515 | 589 | 439 | 320 | 276.0 | 310.5 |
| 1300-1400 | * | 0 | 0 | 556 | **664<** | 432 | 357 | 305.0 | 334.8 |
| 1400-1500 | * | 0 | 219 | 537 | 603 | 394 | 318 | 339.8 | 345.2 |
| 1500-1600 | * | 0 | 497 | 519 | 587 | 401 | 300 | 400.8 | 384.0 |
| 1600-1700 | * | 0 | **556<** | **588<** | 611 | **468<** | 325 | **438.8<** | **424.7<** |
| 1700-1800 | * | 0 | 518 | 537 | 614 | 449 | **374<** | 417.3 | 415.3 |
| 1800-1900 | * | 0 | 389 | 429 | 431 | 334 | 296 | 312.3 | 313.2 |
| 1900-2000 | * | 0 | 350 | 355 | 373 | 322 | 284 | 269.5 | 280.7 |
| 2000-2100 | * | 0 | 298 | 273 | 312 | 254 | 296 | 220.8 | 238.8 |
| 2100-2200 | * | 0 | 231 | 249 | 289 | 256 | 216 | 192.3 | 206.8 |
| 2200-2300 | * | 0 | 191 | 198 | 230 | 223 | 159 | 154.8 | 166.8 |
| 2300-2400 | * | 0< | 127 | 129 | 197 | 179 | 126 | 113.3 | 126.3 |
| Totals | | | | | | | | | |
| 0700-1900 | * | * | 2179 | 6353 | 6894 | 4979 | 3704 | 4312.1 | 4316.3 |
| 0600-2200 | * | * | 3058 | 7418 | 8063 | 5980 | 4628 | 5122.3 | 5178.6 |
| 0600-0000 | * | * | 3376 | 7745 | 8490 | 6382 | 4913 | 5390.3 | 5471.8 |
| 0000-0000 | * | * | 3376 | 8024 | 8807 | 6880 | 5311 | 5588.9 | 5770.2 |
| AM Peak | * | * | 1100 | 0700 | 0700 | 0900 | 1100 | | |
| | * | * | 0 | 632 | 614 | 430 | 288 | | |
| PM Peak | * | 2300 | 1600 | 1600 | 1300 | 1600 | 1700 | | |
| | * | 0 | 556 | 588 | 664 | 468 | 374 | | |

* - No data.

# Weekly Vehicle Counts

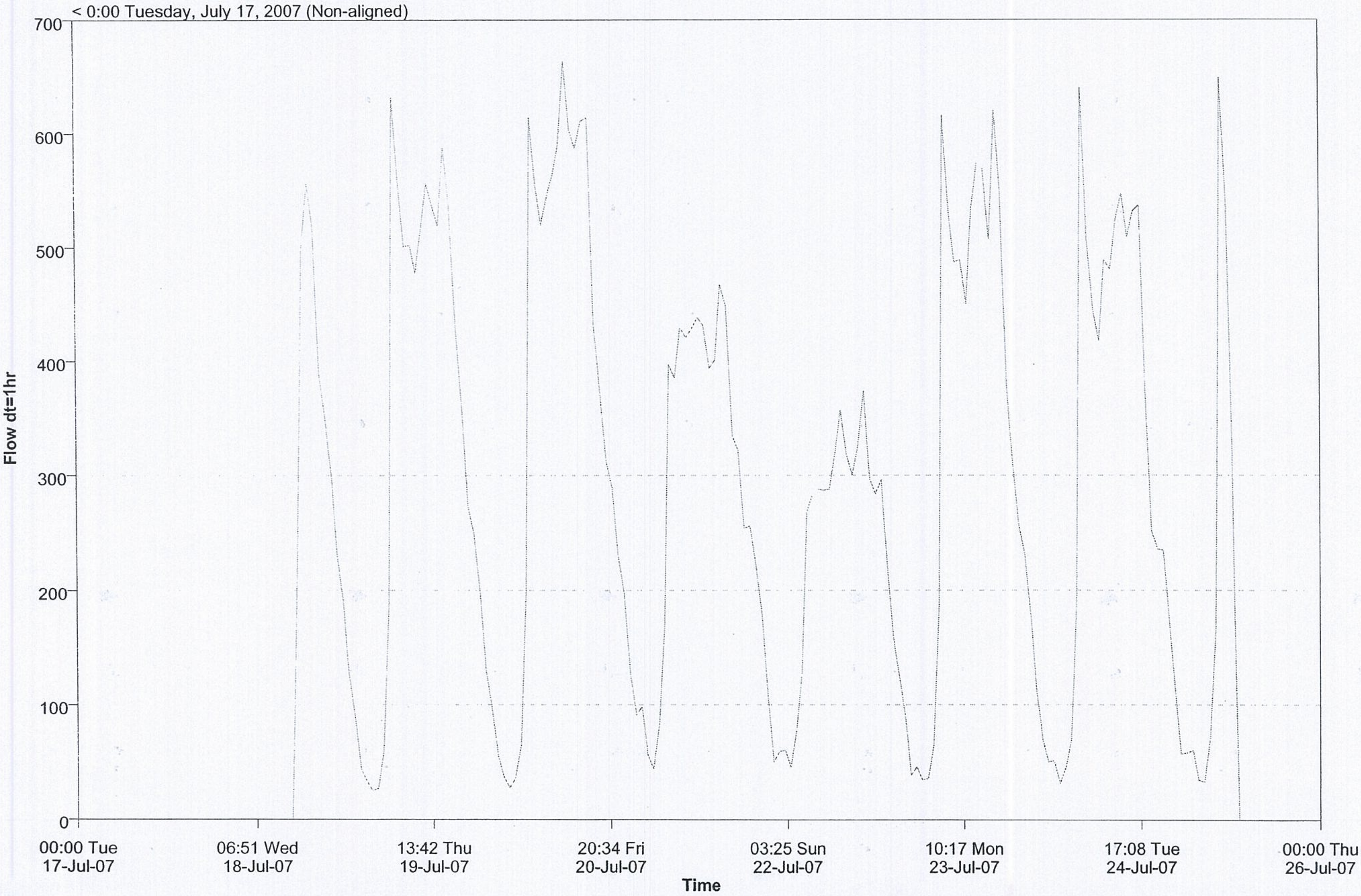
**WeeklyVehicle-13**
**Site:** Site-6.0N
**Description:** **Middle Rd.(30) South of Navy Rd. (37)**
**Filter time:** **12:06 Tuesday, July 17, 2007 => 15:09 Wednesday, July 25, 2007**
**Scheme:** Vehicle classification (ARX)
**Filter:** Cls(1 2 3 4 5 6 7 8 9 10 11 12 ) Dir(NESW) Sp(10,160) Headway(>0)

| | Mon | Tue | Wed | Thu | Fri | Sat | Sun | Averages | |
|---|---|---|---|---|---|---|---|---|---|
| Hour | 23 Jul | 24 Jul | 25 Jul | 26 Jul | 27 Jul | 28 Jul | 29 Jul | 1 - 5 | 1 - 7 |
| 0000-0100 | 91 | 69 | 57 | * | * | * | * | 72.3 | 72.3 |
| 0100-0200 | 39 | 50 | 58 | * | * | * | * | 49.0 | 49.0 |
| 0200-0300 | 46 | 51 | 60 | * | * | * | * | 52.3 | 52.3 |
| 0300-0400 | 35 | 32 | 35 | * | * | * | * | 34.0 | 34.0 |
| 0400-0500 | 36 | 46 | 33 | * | * | * | * | 38.3 | 38.3 |
| 0500-0600 | 64 | 69 | 71 | * | * | * | * | 68.0 | 68.0 |
| 0600-0700 | 185 | 194 | 167 | * | * | * | * | 182.0 | 182.0 |
| 0700-0800 | **616<** | **640<** | **649<** | * | * | * | * | **635.0<** | **635.0<** |
| 0800-0900 | 536 | 507 | 537 | * | * | * | * | 526.7 | 526.7 |
| 0900-1000 | 487 | 446 | 321 | * | * | * | * | 418.0 | 418.0 |
| 1000-1100 | 489 | 418 | 0 | * | * | * | * | 302.3 | 302.3 |
| 1100-1200 | 451 | 489 | 0 | * | * | * | * | 313.3 | 313.3 |
| 1200-1300 | 535 | 481 | 0 | * | * | * | * | 338.7 | 338.7 |
| 1300-1400 | 574 | 525 | 0 | * | * | * | * | 366.3 | 366.3 |
| 1400-1500 | 569 | **547<** | 0 | * | * | * | * | 372.0 | 372.0 |
| 1500-1600 | 507 | 509 | 0 | * | * | * | * | 338.7 | 338.7 |
| 1600-1700 | **621<** | 532 | * | * | * | * | * | **576.5<** | **576.5<** |
| 1700-1800 | 549 | 537 | * | * | * | * | * | 543.0 | 543.0 |
| 1800-1900 | 377 | 376 | * | * | * | * | * | 376.5 | 376.5 |
| 1900-2000 | 306 | 252 | * | * | * | * | * | 279.0 | 279.0 |
| 2000-2100 | 257 | 236 | * | * | * | * | * | 246.5 | 246.5 |
| 2100-2200 | 231 | 235 | * | * | * | * | * | 233.0 | 233.0 |
| 2200-2300 | 177 | 173 | * | * | * | * | * | 175.0 | 175.0 |
| 2300-2400 | 110 | 110 | * | * | * | * | * | 110.0 | 110.0 |
| Totals | | | | | | | | | |
| 0700-1900 | 6311 | 6007 | * | * | * | * | * | 5107.0 | 5107.0 |
| 0600-2200 | 7290 | 6924 | * | * | * | * | * | 6047.5 | 6047.5 |
| 0600-0000 | 7577 | 7207 | * | * | * | * | * | 6332.5 | 6332.5 |
| 0000-0000 | 7888 | 7524 | * | * | * | * | * | 6646.5 | 6646.5 |
| AM Peak | 0700 | 0700 | 0700 | * | * | * | * | | |
| | 616 | 640 | 649 | * | * | * | * | | |
| PM Peak | 1600 | 1400 | * | * | * | * | * | | |
| | 621 | 547 | * | * | * | * | * | | |

* - No data.

# Vehicle Flow

**VehicleFlow-14**(Metric) **Site:** Site-6.0N
**Description:**Middle Rd.(30) South of Navy Rd. (37)
**Filter time:**12:06 Tuesday, July 17, 2007 => 15:09 Wednesday, July 25, 2007
**Filter:** Cls(1 2 3 4 5 6 7 8 9 10 11 12 ) Dir(NESW) Sp(10,160) Headway(>0)
**Scheme:**Vehicle classification (ARX)



# MetroCount Traffic Executive
# Weekly Vehicle Counts

## WeeklyVehicle-11 -- English (ENU)

### Datasets:

| | |
|---|---|
| **Site:** | **[Site-5] Beach Rd (33) south of Micro Beach** |
| **Direction:** | 1 - North bound, A hit first., **Lane:** 0 |
| **Survey Duration:** | 12:03 Tuesday, July 17, 2007 => 14:57 Wednesday, July 25, 2007 |
| **File:** | C:\Program Files\MetroCount v316\User\Data\Site-525Jul2007.EC0 (Regular) |
| **Identifier:** | U747PY52 MC56-L5 [MC55] (c)Microcom 19Oct04 |
| **Algorithm:** | Factory default |
| **Data type:** | Axle sensors - Paired (Class/Speed/Count) |

### Profile:

| | |
|---|---|
| **Filter time:** | **12:03 Tuesday, July 17, 2007 => 14:57 Wednesday, July 25, 2007** |
| **Included classes:** | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 |
| **Speed range:** | 10 - 160 km/h. |
| **Direction:** | North, East, South, West (bound) |
| **Separation:** | All - (Headway) |
| **Name:** | Factory default profile |
| **Scheme:** | Vehicle classification (ARX) |
| **Units:** | Metric (meter, kilometer, m/s, km/h, kg, tonne) |
| **In profile:** | Vehicles = 29674 / 29692 (99.94%) |

# Weekly Vehicle Counts

**WeeklyVehicle-11**

| | |
|---|---|
| **Site:** | Site-5.0N |
| **Description:** | **Beach Rd (33) south of Micro Beach** |
| **Filter time:** | **12:03 Tuesday, July 17, 2007 => 14:57 Wednesday, July 25, 2007** |
| **Scheme:** | Vehicle classification (ARX) |
| **Filter:** | Cls(1 2 3 4 5 6 7 8 9 10 11 12 ) Dir(NESW) Sp(10,160) Headway(>0) |

| | Mon | Tue | Wed | Thu | Fri | Sat | Sun | Averages | |
|---|---|---|---|---|---|---|---|---|---|
| | 16 Jul | 17 Jul | 18 Jul | 19 Jul | 20 Jul | 21 Jul | 22 Jul | 1 - 5 | 1 - 7 |
| Hour | | | | | | | | | |
| 0000-0100 | * | * | 75 | 57 | 76 | 76 | 67 | 69.3 | 70.2 |
| 0100-0200 | * | * | 35 | 40 | 49 | 66 | 66 | 41.3 | 51.2 |
| 0200-0300 | * | * | 36 | 30 | 40 | 115 | 45 | 35.3 | 53.2 |
| 0300-0400 | * | * | 25 | 16 | 17 | 18 | 22 | 19.3 | 19.6 |
| 0400-0500 | * | * | 16 | 22 | 21 | 24 | 18 | 19.7 | 20.2 |
| 0500-0600 | * | * | 44 | 42 | 36 | 52 | 43 | 40.7 | 43.4 |
| 0600-0700 | * | * | 117 | 103 | 114 | 96 | 66 | 111.3 | 99.2 |
| 0700-0800 | * | * | 264 | **281<** | 260 | 170 | 128 | 268.3 | 220.6 |
| 0800-0900 | * | * | 265 | 260 | 265 | 197 | 175 | 263.3 | 232.4 |
| 0900-1000 | * | * | 228 | 235 | 257 | 205 | 174 | 240.0 | 219.8 |
| 1000-1100 | * | * | **269<** | 249 | 276 | 234 | **222<** | 264.7 | 250.0 |
| 1100-1200 | * | * | 243 | 259 | **344<** | **254<** | 192 | **282.0<** | **258.4<** |
| 1200-1300 | * | 0 | 282 | 281 | 327 | 242 | 268 | 222.5 | 233.3 |
| 1300-1400 | * | 0 | 314 | 328 | 299 | 228 | **269<** | 235.3 | 239.7 |
| 1400-1500 | * | 0 | 294 | 326 | 312 | 236 | 239 | 233.0 | 234.5 |
| 1500-1600 | * | 95 | 271 | 336 | 312 | 229 | 215 | 253.5 | 243.0 |
| 1600-1700 | * | 317 | 297 | 370 | **370<** | 268 | 253 | 338.5 | 312.5 |
| 1700-1800 | * | **360<** | **346<** | **400<** | 335 | **278<** | 258 | **360.3<** | **329.5<** |
| 1800-1900 | * | 261 | 272 | 361 | 304 | 272 | 262 | 299.5 | 288.7 |
| 1900-2000 | * | 237 | 262 | 349 | 265 | 207 | 221 | 278.3 | 256.8 |
| 2000-2100 | * | 206 | 191 | 273 | 222 | 182 | 162 | 223.0 | 206.0 |
| 2100-2200 | * | 170 | 180 | 209 | 201 | 198 | 137 | 190.0 | 182.5 |
| 2200-2300 | * | 118 | 136 | 191 | 192 | 175 | 126 | 159.3 | 156.3 |
| 2300-2400 | * | 87 | 104 | 84 | 128 | 109 | 68 | 100.8 | 96.7 |
| Totals | | | | | | | | | |
| 0700-1900 | * | * | 3345 | 3686 | 3661 | 2813 | 2655 | 3260.8 | 3062.4 |
| 0600-2200 | * | * | 4095 | 4620 | 4463 | 3496 | 3241 | 4063.4 | 3806.9 |
| 0600-0000 | * | * | 4335 | 4895 | 4783 | 3780 | 3435 | 4323.4 | 4059.9 |
| 0000-0000 | * | * | 4566 | 5102 | 5022 | 4131 | 3696 | 4549.1 | 4317.7 |
| AM Peak | * | * | 1000 | 0700 | 1100 | 1100 | 1000 | | |
| | * | * | 269 | 281 | 344 | 254 | 222 | | |
| PM Peak | * | 1700 | 1700 | 1700 | 1600 | 1700 | 1300 | | |
| | * | 360 | 346 | 400 | 370 | 278 | 269 | | |

* - No data.

# Weekly Vehicle Counts

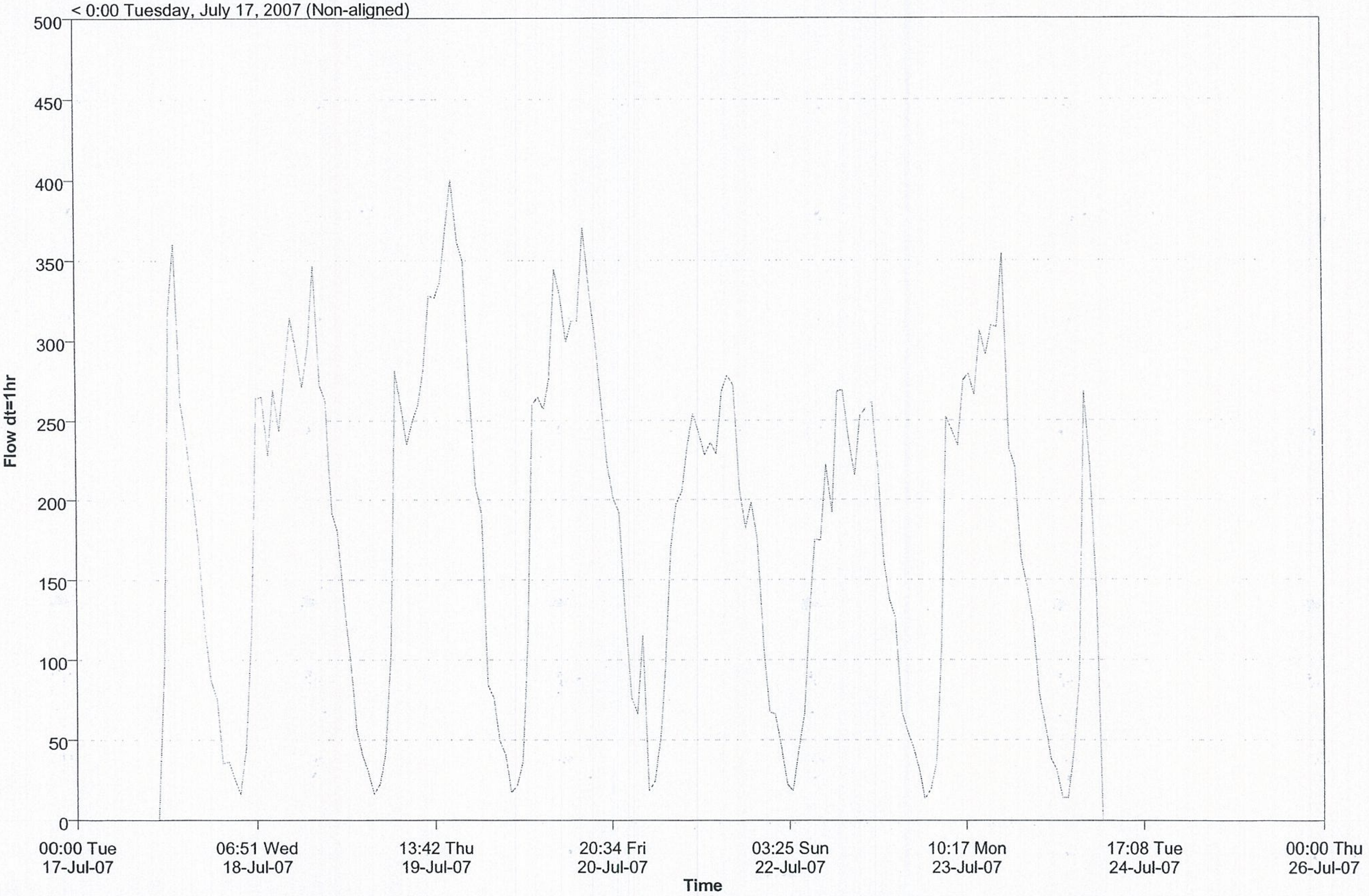
**WeeklyVehicle-11**
**Site:** Site-5.0N
**Description:** **Beach Rd (33) south of Micro Beach**
**Filter time:** **12:03 Tuesday, July 17, 2007 => 14:57 Wednesday, July 25, 2007**
**Scheme:** Vehicle classification (ARX)
**Filter:** Cls(1 2 3 4 5 6 7 8 9 10 11 12 ) Dir(NESW) Sp(10,160) Headway(>0)

| | Mon | Tue | Wed | Thu | Fri | Sat | Sun | Averages | |
|---|---|---|---|---|---|---|---|---|---|
| | 23 Jul | 24 Jul | 25 Jul | 26 Jul | 27 Jul | 28 Jul | 29 Jul | 1 - 5 | 1 - 7 |
| Hour | | | | | | | | | |
| 0000-0100 | 55 | 60 | 0 | * | * | * | * | 38.3 | 38.3 |
| 0100-0200 | 45 | 38 | 0 | * | * | * | * | 27.7 | 27.7 |
| 0200-0300 | 32 | 31 | 0 | * | * | * | * | 21.0 | 21.0 |
| 0300-0400 | 13 | 14 | 0 | * | * | * | * | 9.0 | 9.0 |
| 0400-0500 | 19 | 14 | 0 | * | * | * | * | 11.0 | 11.0 |
| 0500-0600 | 35 | 42 | 0 | * | * | * | * | 25.7 | 25.7 |
| 0600-0700 | 107 | 89 | 0 | * | * | * | * | 65.3 | 65.3 |
| 0700-0800 | 252 | **268<** | 0 | * | * | * | * | **173.3<** | **173.3<** |
| 0800-0900 | 244 | 220 | 0 | * | * | * | * | 154.7 | 154.7 |
| 0900-1000 | 234 | 143 | 0 | * | * | * | * | 125.7 | 125.7 |
| 1000-1100 | 275 | 0 | 0 | * | * | * | * | 91.7 | 91.7 |
| 1100-1200 | **279<** | 0 | **0<** | * | * | * | * | 93.0 | 93.0 |
| 1200-1300 | 266 | 0 | 0 | * | * | * | * | 88.7 | 88.7 |
| 1300-1400 | 306 | 0 | 0 | * | * | * | * | 102.0 | 102.0 |
| 1400-1500 | 291 | 0 | 0 | * | * | * | * | 97.0 | 97.0 |
| 1500-1600 | 309 | 0 | * | * | * | * | * | 154.5 | 154.5 |
| 1600-1700 | 308 | 0 | * | * | * | * | * | 154.0 | 154.0 |
| 1700-1800 | **354<** | 0 | * | * | * | * | * | **177.0<** | **177.0<** |
| 1800-1900 | 232 | 0 | * | * | * | * | * | 116.0 | 116.0 |
| 1900-2000 | 220 | 0 | * | * | * | * | * | 110.0 | 110.0 |
| 2000-2100 | 163 | 0 | * | * | * | * | * | 81.5 | 81.5 |
| 2100-2200 | 146 | 0 | * | * | * | * | * | 73.0 | 73.0 |
| 2200-2300 | 123 | 0 | * | * | * | * | * | 61.5 | 61.5 |
| 2300-2400 | 79 | **0<** | * | * | * | * | * | 39.5 | 39.5 |
| Totals | | | | | | | | | |
| 0700-1900 | 3350 | 631 | * | * | * | * | * | 1527.5 | 1527.5 |
| 0600-2200 | 3986 | 720 | * | * | * | * | * | 1857.3 | 1857.3 |
| 0600-0000 | 4188 | 720 | * | * | * | * | * | 1958.3 | 1958.3 |
| 0000-0000 | 4387 | 919 | * | * | * | * | * | 2091.0 | 2091.0 |
| AM Peak | 1100 | 0700 | 1100 | * | * | * | * | | |
| | 279 | 268 | 0 | * | * | * | * | | |
| PM Peak | 1700 | 2300 | * | * | * | * | * | | |
| | 354 | 0 | * | * | * | * | * | | |

* - No data.

# Vehicle Flow

**VehicleFlow-12**(Metric) **Site:** Site-5.0N
**Description:**Beach Rd (33) south of Micro Beach
**Filter time:**12:03 Tuesday, July 17, 2007 => 14:57 Wednesday, July 25, 2007
**Filter:** Cls(1 2 3 4 5 6 7 8 9 10 11 12 ) Dir(NESW) Sp(10,160) Headway(>0)
**Scheme:**Vehicle classification (ARX)



# MetroCount Traffic Executive
# Weekly Vehicle Counts

## WeeklyVehicle-9 -- English (ENU)

| | |
|---|---|
| **Datasets:** | |
| **Site:** | **[Site-4] Beach Rd. to Micro Beach West** |
| **Direction:** | 4 - West bound, A hit first., **Lane:** 0 |
| **Survey Duration:** | 12:01 Tuesday, July 17, 2007 => 13:10 Tuesday, July 24, 2007 |
| **File:** | C:\Program Files\MetroCount v316\User\Data\Site-425Jul2007.EC0 (Regular) |
| **Identifier:** | U811KBA4 MC56-L5 [MC55] (c)Microcom 19Oct04 |
| **Algorithm:** | Factory default |
| **Data type:** | Axle sensors - Paired (Class/Speed/Count) |

| | |
|---|---|
| **Profile:** | |
| **Filter time:** | **12:01 Tuesday, July 17, 2007 => 13:10 Tuesday, July 24, 2007** |
| **Included classes:** | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 |
| **Speed range:** | 10 - 160 km/h. |
| **Direction:** | North, East, South, West (bound) |
| **Separation:** | All - (Headway) |
| **Name:** | Factory default profile |
| **Scheme:** | Vehicle classification (ARX) |
| **Units:** | Metric (meter, kilometer, m/s, km/h, kg, tonne) |
| **In profile:** | Vehicles = 13661 / 13699 (99.72%) |

# Weekly Vehicle Counts

**WeeklyVehicle-9**
**Site:** Site-4.0W
**Description:** **Beach Rd. to Micro Beach West**
**Filter time:** **12:01 Tuesday, July 17, 2007 => 13:10 Tuesday, July 24, 2007**
**Scheme:** Vehicle classification (ARX)
**Filter:** Cls(1 2 3 4 5 6 7 8 9 10 11 12 ) Dir(NESW) Sp(10,160) Headway(>0)

| | **Mon** | **Tue** | **Wed** | **Thu** | **Fri** | **Sat** | **Sun** | **Averages** | |
|---|---|---|---|---|---|---|---|---|---|
| | 16 Jul | 17 Jul | 18 Jul | 19 Jul | 20 Jul | 21 Jul | 22 Jul | 1 - 5 | 1 - 7 |
| Hour | | | | | | | | | |
| 0000-0100 | * | * | 31 | 25 | 9 | 28 | 32 | 21.7 | 25.0 |
| 0100-0200 | * | * | 22 | 19 | 16 | 0 | 28 | 19.0 | 17.0 |
| 0200-0300 | * | * | 27 | 16 | 23 | 0 | 26 | 22.0 | 18.4 |
| 0300-0400 | * | * | 7 | 6 | 4 | 0 | 12 | 5.7 | 5.8 |
| 0400-0500 | * | * | 9 | 11 | 8 | 0 | 8 | 9.3 | 7.2 |
| 0500-0600 | * | * | 37 | 28 | 28 | 30 | 43 | 31.0 | 33.2 |
| 0600-0700 | * | * | 65 | 59 | 68 | 54 | 49 | 64.0 | 59.0 |
| 0700-0800 | * | * | 105 | 118 | 105 | 88 | 81 | 109.3 | 99.4 |
| 0800-0900 | * | * | **118<** | 135 | 123 | **108<** | 92 | 125.3 | 115.2 |
| 0900-1000 | * | * | 102 | 95 | 88 | 98 | 82 | 95.0 | 93.0 |
| 1000-1100 | * | * | 117 | 102 | 99 | 102 | 109 | 106.0 | 105.8 |
| 1100-1200 | * | * | 113 | **156<** | **151<** | 103 | **118<** | **140.0<** | **128.2<** |
| 1200-1300 | * | 0 | 140 | 126 | 78 | 99 | **188<** | 86.0 | 105.2 |
| 1300-1400 | * | 0 | 119 | 143 | 111 | 102 | 153 | 93.3 | 104.7 |
| 1400-1500 | * | 0 | 142 | 151 | 138 | 102 | 157 | 107.8 | 115.0 |
| 1500-1600 | * | 95 | 127 | 139 | 121 | 128 | 119 | 120.5 | 121.5 |
| 1600-1700 | * | 156 | 137 | 174 | 151 | 108 | 135 | 154.5 | 143.5 |
| 1700-1800 | * | **184<** | **211<** | **267<** | **184<** | **159<** | 182 | **211.5<** | **197.8<** |
| 1800-1900 | * | 116 | 131 | 212 | 142 | 138 | 129 | 150.3 | 144.7 |
| 1900-2000 | * | 96 | 83 | 215 | 117 | 90 | 83 | 127.8 | 114.0 |
| 2000-2100 | * | 136 | 82 | 119 | 86 | 74 | 73 | 105.8 | 95.0 |
| 2100-2200 | * | 126 | 84 | 59 | 90 | 77 | 54 | 89.8 | 81.7 |
| 2200-2300 | * | 85 | 40 | 0 | 78 | 63 | 47 | 50.8 | 52.2 |
| 2300-2400 | * | 64 | 39 | 0 | 50 | 37 | 32 | 38.3 | 37.0 |
| Totals | | | | | | | | | |
| 0700-1900 | * | * | 1562 | 1818 | 1491 | 1335 | 1545 | 1499.4 | 1473.9 |
| 0600-2200 | * | * | 1876 | 2270 | 1852 | 1630 | 1804 | 1886.7 | 1823.6 |
| 0600-0000 | * | * | 1955 | 2270 | 1980 | 1730 | 1883 | 1975.7 | 1912.8 |
| 0000-0000 | * | * | 2088 | 2375 | 2068 | 1788 | 2032 | 2084.3 | 2019.4 |
| AM Peak | * | * | 0800 | 1100 | 1100 | 0800 | 1100 | | |
| | * | * | 118 | 156 | 151 | 108 | 118 | | |
| PM Peak | * | 1700 | 1700 | 1700 | 1700 | 1700 | 1200 | | |
| | * | 184 | 211 | 267 | 184 | 159 | 188 | | |

* - No data.

# Weekly Vehicle Counts

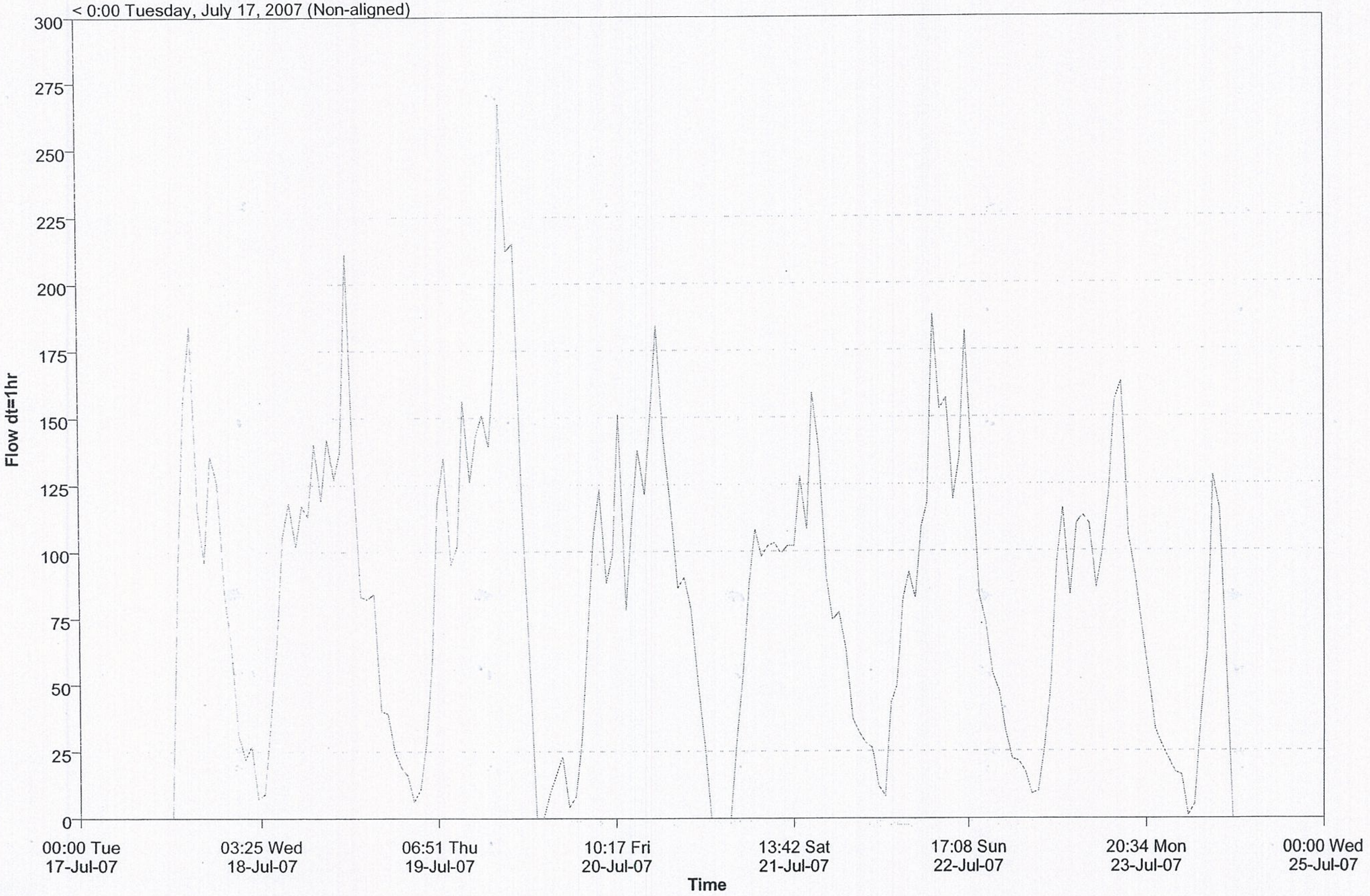
**WeeklyVehicle-9**
**Site:** Site-4.0W
**Description:** **Beach Rd. to Micro Beach West**
**Filter time:** **12:01 Tuesday, July 17, 2007 => 13:10 Tuesday, July 24, 2007**
**Scheme:** Vehicle classification (ARX)
**Filter:** Cls(1 2 3 4 5 6 7 8 9 10 11 12 ) Dir(NESW) Sp(10,160) Headway(>0)

| | Mon | Tue | Wed | Thu | Fri | Sat | Sun | Averages | |
|---|---|---|---|---|---|---|---|---|---|
| | 23 Jul | 24 Jul | 25 Jul | 26 Jul | 27 Jul | 28 Jul | 29 Jul | 1 - 5 | 1 - 7 |
| Hour | | | | | | | | | |
| 0000-0100 | 22 | 22 | * | * | * | * | * | 22.0 | 22.0 |
| 0100-0200 | 21 | 17 | * | * | * | * | * | 19.0 | 19.0 |
| 0200-0300 | 17 | 16 | * | * | * | * | * | 16.5 | 16.5 |
| 0300-0400 | 9 | 1 | * | * | * | * | * | 5.0 | 5.0 |
| 0400-0500 | 10 | 5 | * | * | * | * | * | 7.5 | 7.5 |
| 0500-0600 | 27 | 39 | * | * | * | * | * | 33.0 | 33.0 |
| 0600-0700 | 51 | 62 | * | * | * | * | * | 56.5 | 56.5 |
| 0700-0800 | 96 | **128<** | * | * | * | * | * | 112.0 | 112.0 |
| 0800-0900 | **116<** | 115 | * | * | * | * | * | **115.5<** | **115.5<** |
| 0900-1000 | 83 | 56 | * | * | * | * | * | 69.5 | 69.5 |
| 1000-1100 | 110 | 0 | * | * | * | * | * | 55.0 | 55.0 |
| 1100-1200 | 113 | 0 | * | * | * | * | * | 56.5 | 56.5 |
| 1200-1300 | 110 | 0 | * | * | * | * | * | 55.0 | 55.0 |
| 1300-1400 | 86 | 0 | * | * | * | * | * | 43.0 | 43.0 |
| 1400-1500 | 100 | * | * | * | * | * | * | 100.0 | 100.0 |
| 1500-1600 | 121 | * | * | * | * | * | * | 121.0 | 121.0 |
| 1600-1700 | 156 | * | * | * | * | * | * | 156.0 | 156.0 |
| 1700-1800 | **163<** | * | * | * | * | * | * | **163.0<** | **163.0<** |
| 1800-1900 | 106 | * | * | * | * | * | * | 106.0 | 106.0 |
| 1900-2000 | 91 | * | * | * | * | * | * | 91.0 | 91.0 |
| 2000-2100 | 71 | * | * | * | * | * | * | 71.0 | 71.0 |
| 2100-2200 | 52 | * | * | * | * | * | * | 52.0 | 52.0 |
| 2200-2300 | 33 | * | * | * | * | * | * | 33.0 | 33.0 |
| 2300-2400 | 27 | * | * | * | * | * | * | 27.0 | 27.0 |
| Totals | | | | | | | | | |
| 0700-1900 | 1360 | * | * | * | * | * | * | 1152.5 | 1152.5 |
| 0600-2200 | 1625 | * | * | * | * | * | * | 1423.0 | 1423.0 |
| 0600-0000 | 1685 | * | * | * | * | * | * | 1483.0 | 1483.0 |
| 0000-0000 | 1791 | * | * | * | * | * | * | 1586.0 | 1586.0 |
| AM Peak | 0800 | 0700 | * | * | * | * | * | | |
| | 116 | 128 | * | * | * | * | * | | |
| PM Peak | 1700 | * | * | * | * | * | * | | |
| | 163 | * | * | * | * | * | * | | |

* - No data.

# Vehicle Flow

**VehicleFlow-10**(Metric) **Site:** Site-4.0W
**Description:**Beach Rd. to Micro Beach West
**Filter time:**12:01 Tuesday, July 17, 2007 => 13:10 Tuesday, July 24, 2007
**Filter:** Cls(1 2 3 4 5 6 7 8 9 10 11 12 ) Dir(NESW) Sp(10,160) Headway(>0)
**Scheme:**Vehicle classification (ARX)



# MetroCount Traffic Executive
# Weekly Vehicle Counts

## WeeklyVehicle-7 -- English (ENU)

### Datasets:

| | |
|---|---|
| **Site:** | **[Site-3] MC5xxx Factory Setup** |
| **Direction:** | 2 - East bound, A hit first., **Lane:** 0 |
| **Survey Duration:** | 10:40 Tuesday, July 17, 2007 => 14:41 Wednesday, July 25, 2007 |
| **File:** | C:\Program Files\MetroCount v316\User\Data\Site-325Jul2007.EC0 (Regular) |
| **Identifier:** | U869NC7M MC56-L5 [MC55] (c)Microcom 19Oct04 |
| **Algorithm:** | Factory default |
| **Data type:** | Axle sensors - Paired (Class/Speed/Count) |

### Profile:

| | |
|---|---|
| **Filter time:** | **10:40 Tuesday, July 17, 2007 => 14:41 Wednesday, July 25, 2007** |
| **Included classes:** | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 |
| **Speed range:** | 10 - 160 km/h. |
| **Direction:** | North, East, South, West (bound) |
| **Separation:** | All - (Headway) |
| **Name:** | Factory default profile |
| **Scheme:** | Vehicle classification (ARX) |
| **Units:** | Metric (meter, kilometer, m/s, km/h, kg, tonne) |
| **In profile:** | Vehicles = 27754 / 27771 (99.94%) |

# Weekly Vehicle Counts

**WeeklyVehicle-7**

| | |
|---|---|
| **Site:** | Site-3.0E |
| **Description:** | **MC5xxx Factory Setup** |
| **Filter time:** | **10:40 Tuesday, July 17, 2007 => 14:41 Wednesday, July 25, 2007** |
| **Scheme:** | Vehicle classification (ARX) |
| **Filter:** | Cls(1 2 3 4 5 6 7 8 9 10 11 12 ) Dir(NESW) Sp(10,160) Headway(>0) |

| Hour | Mon 16 Jul | Tue 17 Jul | Wed 18 Jul | Thu 19 Jul | Fri 20 Jul | Sat 21 Jul | Sun 22 Jul | Averages 1 - 5 | Averages 1 - 7 |
|---|---|---|---|---|---|---|---|---|---|
| 0000-0100 | * | * | 64 | 63 | 74 | 82 | 59 | 67.0 | 68.4 |
| 0100-0200 | * | * | 45 | 54 | 44 | 63 | 68 | 47.7 | 54.8 |
| 0200-0300 | * | * | 35 | 38 | 47 | 98 | 49 | 40.0 | 53.4 |
| 0300-0400 | * | * | 26 | 23 | 18 | 27 | 30 | 22.3 | 24.8 |
| 0400-0500 | * | * | 12 | 17 | 17 | 30 | 19 | 15.3 | 19.0 |
| 0500-0600 | * | * | 29 | 35 | 30 | 40 | 29 | 31.3 | 32.6 |
| 0600-0700 | * | * | 105 | 90 | 94 | 85 | 55 | 96.3 | 85.8 |
| 0700-0800 | * | * | 252 | 248 | 246 | 155 | 109 | 248.7 | 202.0 |
| 0800-0900 | * | * | **262<** | 245 | 265 | 187 | 162 | 257.3 | 224.2 |
| 0900-1000 | * | * | 258 | **280<** | **296<** | 214 | 184 | **278.0<** | **246.4<** |
| 1000-1100 | * | 0 | 256 | 237 | 263 | 211 | **195<** | 189.0 | 193.7 |
| 1100-1200 | * | 0 | 239 | 211 | 285 | **224<** | 157 | 183.8 | 186.0 |
| 1200-1300 | * | 0 | 272 | 265 | **341<** | 210 | 206 | 219.5 | 215.7 |
| 1300-1400 | * | 0 | 319 | 312 | 323 | 239 | **253<** | 238.5 | 241.0 |
| 1400-1500 | * | 49 | 312 | 294 | 304 | 217 | 211 | 239.8 | 231.2 |
| 1500-1600 | * | 282 | 261 | 286 | 287 | 210 | 195 | 279.0 | 253.5 |
| 1600-1700 | * | 305 | **321<** | **334<** | 318 | 245 | 241 | **319.5<** | **294.0<** |
| 1700-1800 | * | **320<** | 299 | 288 | 322 | **263<** | 223 | 307.3 | 285.8 |
| 1800-1900 | * | 238 | 214 | 269 | 237 | 227 | 237 | 239.5 | 237.0 |
| 1900-2000 | * | 181 | 222 | 258 | 227 | 195 | 191 | 222.0 | 212.3 |
| 2000-2100 | * | 203 | 173 | 198 | 188 | 151 | 153 | 190.5 | 177.7 |
| 2100-2200 | * | 145 | 145 | 194 | 183 | 161 | 117 | 166.8 | 157.5 |
| 2200-2300 | * | 133 | 138 | 164 | 178 | 170 | 132 | 153.3 | 152.5 |
| 2300-2400 | * | 100 | 112 | 87 | 119 | 86 | 71 | 104.5 | 95.8 |
| Totals | | | | | | | | | |
| 0700-1900 | * | * | 3265 | 3269 | 3487 | 2602 | 2373 | 2999.8 | 2810.4 |
| 0600-2200 | * | * | 3910 | 4009 | 4179 | 3194 | 2889 | 3675.3 | 3443.7 |
| 0600-0000 | * | * | 4160 | 4260 | 4476 | 3450 | 3092 | 3933.1 | 3692.1 |
| 0000-0000 | * | * | 4371 | 4490 | 4706 | 3790 | 3346 | 4156.8 | 3945.1 |
| AM Peak | * | * | 0800 | 0900 | 0900 | 1100 | 1000 | | |
| | * | * | 262 | 280 | 296 | 224 | 195 | | |
| PM Peak | * | 1700 | 1600 | 1600 | 1200 | 1700 | 1300 | | |
| | * | 320 | 321 | 334 | 341 | 263 | 253 | | |

* - No data.

# Weekly Vehicle Counts

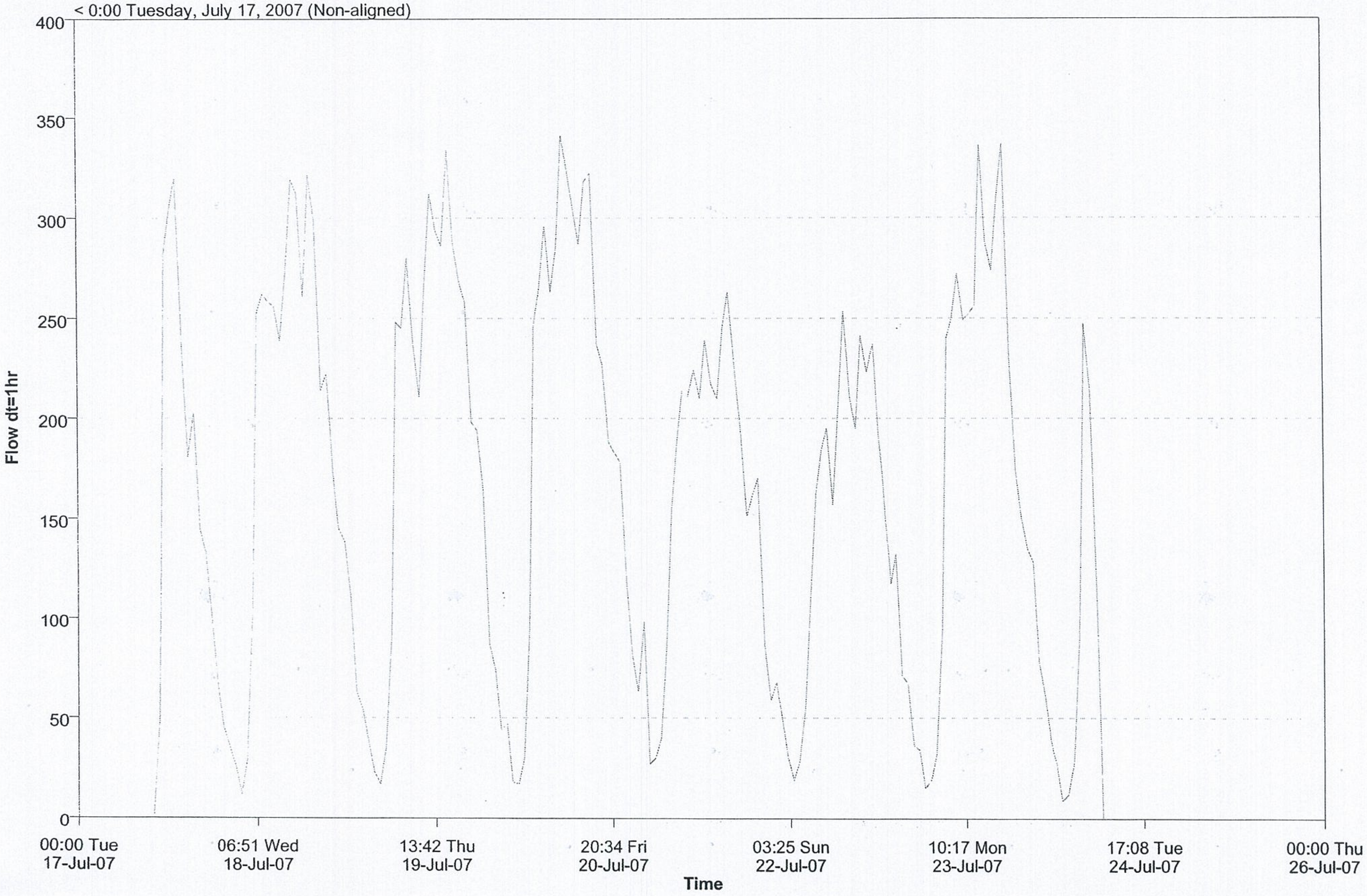
**WeeklyVehicle-7**
**Site:** Site-3.0E
**Description:** **MC5xxx Factory Setup**
**Filter time:** **10:40 Tuesday, July 17, 2007 => 14:41 Wednesday, July 25, 2007**
**Scheme:** Vehicle classification (ARX)
**Filter:** Cls(1 2 3 4 5 6 7 8 9 10 11 12 ) Dir(NESW) Sp(10,160) Headway(>0)

|  | Mon<br>23 Jul | Tue<br>24 Jul | Wed<br>25 Jul | Thu<br>26 Jul | Fri<br>27 Jul | Sat<br>28 Jul | Sun<br>29 Jul | Averages<br>1 - 5 | <br>1 - 7 |
|---|---|---|---|---|---|---|---|---|---|
| Hour |  |  |  |  |  |  |  |  |  |
| 0000-0100 | 67 | 61 | 0 | * | * | * | * | 42.7 | 42.7 |
| 0100-0200 | 36 | 38 | 0 | * | * | * | * | 24.7 | 24.7 |
| 0200-0300 | 34 | 27 | 0 | * | * | * | * | 20.3 | 20.3 |
| 0300-0400 | 15 | 9 | 0 | * | * | * | * | 8.0 | 8.0 |
| 0400-0500 | 19 | 12 | 0 | * | * | * | * | 10.3 | 10.3 |
| 0500-0600 | 32 | 28 | 0 | * | * | * | * | 20.0 | 20.0 |
| 0600-0700 | 94 | 89 | 0 | * | * | * | * | 61.0 | 61.0 |
| 0700-0800 | 240 | **247<** | 0 | * | * | * | * | **162.3<** | **162.3<** |
| 0800-0900 | 250 | 214 | 0 | * | * | * | * | 154.7 | 154.7 |
| 0900-1000 | **272<** | 113 | 0 | * | * | * | * | 128.3 | 128.3 |
| 1000-1100 | 249 | 0 | 0 | * | * | * | * | 83.0 | 83.0 |
| 1100-1200 | 252 | 0 | **0<** | * | * | * | * | 84.0 | 84.0 |
| 1200-1300 | 256 | 0 | 0 | * | * | * | * | 85.3 | 85.3 |
| 1300-1400 | 336 | 0 | 0 | * | * | * | * | 112.0 | 112.0 |
| 1400-1500 | 288 | 0 | 0 | * | * | * | * | 96.0 | 96.0 |
| 1500-1600 | 274 | 0 | * | * | * | * | * | 137.0 | 137.0 |
| 1600-1700 | 311 | 0 | * | * | * | * | * | 155.5 | 155.5 |
| 1700-1800 | **337<** | 0 | * | * | * | * | * | **168.5<** | **168.5<** |
| 1800-1900 | 230 | 0 | * | * | * | * | * | 115.0 | 115.0 |
| 1900-2000 | 174 | 0 | * | * | * | * | * | 87.0 | 87.0 |
| 2000-2100 | 150 | 0 | * | * | * | * | * | 75.0 | 75.0 |
| 2100-2200 | 135 | 0 | * | * | * | * | * | 67.5 | 67.5 |
| 2200-2300 | 128 | 0 | * | * | * | * | * | 64.0 | 64.0 |
| 2300-2400 | 78 | 0< | * | * | * | * | * | 39.0 | 39.0 |
| Totals |  |  |  |  |  |  |  |  |  |
| 0700-1900 | 3295 | 574 | * | * | * | * | * | 1481.7 | 1481.7 |
| 0600-2200 | 3848 | 663 | * | * | * | * | * | 1772.2 | 1772.2 |
| 0600-0000 | 4054 | 663 | * | * | * | * | * | 1875.2 | 1875.2 |
| 0000-0000 | 4257 | 838 | * | * | * | * | * | 2001.2 | 2001.2 |
| AM Peak | 0900 | 0700 | 1100 | * | * | * | * |  |  |
|  | 272 | 247 | 0 | * | * | * | * |  |  |
| PM Peak | 1700 | 2300 | * | * | * | * | * |  |  |
|  | 337 | 0 | * | * | * | * | * |  |  |

* - No data.

# Vehicle Flow

**VehicleFlow-8**(Metric) **Site:** Site-3.0E
**Description:**MC5xxx Factory Setup
**Filter time:**10:40 Tuesday, July 17, 2007 => 14:41 Wednesday, July 25, 2007
**Filter:** Cls(1 2 3 4 5 6 7 8 9 10 11 12 ) Dir(NESW) Sp(10,160) Headway(>0)
**Scheme:**Vehicle classification (ARX)



# MetroCount Traffic Executive
# Weekly Vehicle Counts

## WeeklyVehicle-6 -- English (ENU)

| | |
|---|---|
| **Datasets:** | |
| **Site:** | **[Site-2] MCSetup factory setup** (NAVY HILL Rd (37) east of middle Rd (30) |
| **Direction:** | 4 - West bound, A hit first., **Lane:** 0 |
| **Survey Duration:** | 10:35 Tuesday, July 17, 2007 => 14:32 Wednesday, July 25, 2007 |
| **File:** | C:\Program Files\MetroCount v316\User\Data\Site-225Jul2007.EC0 (Regular) |
| **Identifier:** | U7883DG0 MC56-L5 [MC55] (c)Microcom 19Oct04 |
| **Algorithm:** | Factory default |
| **Data type:** | Axle sensors - Paired (Class/Speed/Count) |

| | |
|---|---|
| **Profile:** | |
| **Filter time:** | **10:35 Tuesday, July 17, 2007 => 14:32 Wednesday, July 25, 2007** |
| **Included classes:** | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 |
| **Speed range:** | 10 - 160 km/h. |
| **Direction:** | North, East, South, West (bound) |
| **Separation:** | All - (Headway) |
| **Name:** | Factory default profile |
| **Scheme:** | Vehicle classification (ARX) |
| **Units:** | Metric (meter, kilometer, m/s, km/h, kg, tonne) |
| **In profile:** | Vehicles = 2194 / 6229 (35.22%) |

# Weekly Vehicle Counts

**WeeklyVehicle-6**
**Site:** Site-2.0W
**Description:** **MCSetup factory setup** Navy Hill Rd (37) east of Middle Rd (30)
**Filter time:** **10:35 Tuesday, July 17, 2007 => 14:32 Wednesday, July 25, 2007**
**Scheme:** Vehicle classification (ARX)
**Filter:** Cls(1 2 3 4 5 6 7 8 9 10 11 12 ) Dir(NESW) Sp(10,160) Headway(>0)

| Hour | Mon 16 Jul | Tue 17 Jul | Wed 18 Jul | Thu 19 Jul | Fri 20 Jul | Sat 21 Jul | Sun 22 Jul | Averages 1 - 5 | Averages 1 - 7 |
|---|---|---|---|---|---|---|---|---|---|
| 0000-0100 | * | * | 0 | 6 | 2 | 13 | 13 | 2.7 | 6.8 |
| 0100-0200 | * | * | 0 | 4 | 4 | 5 | 4 | 2.7 | 3.4 |
| 0200-0300 | * | * | 0 | 4 | 2 | 1 | 2 | 2.0 | 1.8 |
| 0300-0400 | * | * | 0 | 0 | 0 | 0 | 0 | 0.0 | 0.0 |
| 0400-0500 | * | * | 0 | 5 | 1 | 0 | 1 | 2.0 | 1.4 |
| 0500-0600 | * | * | 0 | 5 | 1 | 4 | 5 | 2.0 | 3.0 |
| 0600-0700 | * | * | 0 | 6 | 11 | 8 | 2 | 5.7 | 5.4 |
| 0700-0800 | * | * | 0 | **34<** | **28<** | 11 | 13 | **20.7<** | **17.2<** |
| 0800-0900 | * | * | 0 | 23 | 14 | 15 | 17 | 12.3 | 13.8 |
| 0900-1000 | * | * | 0 | 11 | 12 | **30<** | 20 | 7.7 | 14.6 |
| 1000-1100 | * | 0 | 0 | 13 | 14 | 17 | **21<** | 6.8 | 10.8 |
| 1100-1200 | * | 0 | **0<** | 15 | 7 | 16 | 10 | 5.5 | 8.0 |
| 1200-1300 | * | 0 | 0 | 23 | 16 | 31 | 20 | 9.8 | 15.0 |
| 1300-1400 | * | 0 | 0 | 13 | 14 | 24 | 13 | 6.8 | 10.7 |
| 1400-1500 | * | 0 | 0 | 14 | 13 | 17 | 9 | 6.8 | 8.8 |
| 1500-1600 | * | 0 | 12 | 12 | 13 | 14 | 21 | 9.3 | 12.0 |
| 1600-1700 | * | 0 | 18 | 18 | 10 | **37<** | 22 | 11.5 | 17.5 |
| 1700-1800 | * | 0 | **38<** | 25 | 40 | 29 | **27<** | **25.8<** | **26.5<** |
| 1800-1900 | * | 0 | 27 | **33<** | 35 | 25 | 22 | 23.8 | 23.7 |
| 1900-2000 | * | 0 | 11 | 21 | **41<** | 26 | 16 | 18.3 | 19.2 |
| 2000-2100 | * | 0 | 20 | 9 | 7 | 17 | 12 | 9.0 | 10.8 |
| 2100-2200 | * | 0 | 5 | 13 | 30 | 25 | 14 | 12.0 | 14.5 |
| 2200-2300 | * | 0 | 13 | 7 | 14 | 21 | 5 | 8.5 | 10.0 |
| 2300-2400 | * | **0<** | 6 | 4 | 17 | 12 | 4 | 6.8 | 7.2 |
| Totals | | | | | | | | | |
| 0700-1900 | * | * | 95 | 234 | 216 | 266 | 215 | 146.4 | 178.6 |
| 0600-2200 | * | * | 131 | 283 | 305 | 342 | 259 | 191.3 | 228.5 |
| 0600-0000 | * | * | 150 | 294 | 336 | 375 | 268 | 206.6 | 245.7 |
| 0000-0000 | * | * | 150 | 318 | 346 | 398 | 293 | 217.9 | 262.1 |
| AM Peak | * | * | 1100 | 0700 | 0700 | 0900 | 1000 | | |
| | * | * | 0 | 34 | 28 | 30 | 21 | | |
| PM Peak | * | 2300 | 1700 | 1800 | 1900 | 1600 | 1700 | | |
| | * | 0 | 38 | 33 | 41 | 37 | 27 | | |

* - No data.

# Weekly Vehicle Counts

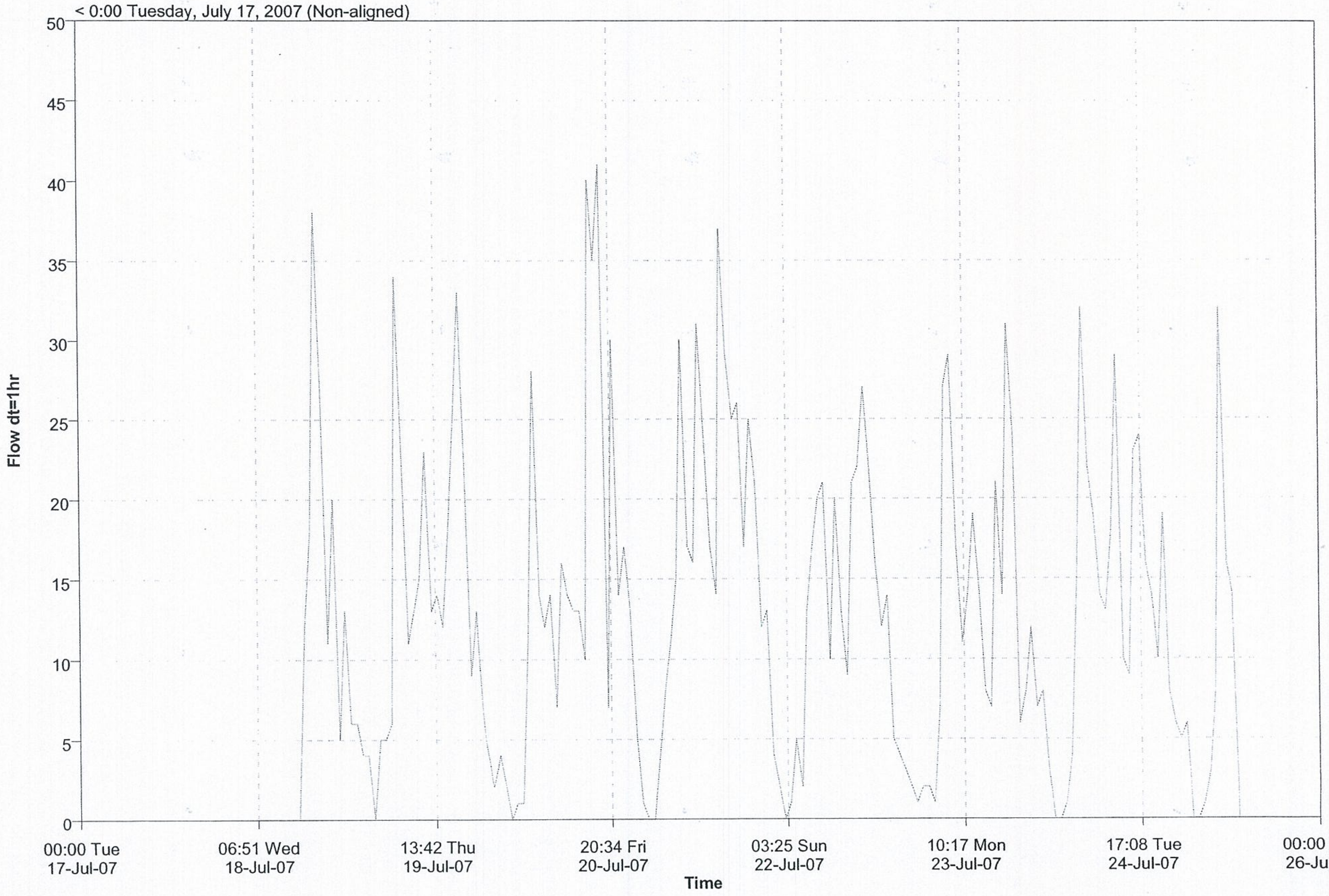
**WeeklyVehicle-6**
**Site:** Site-2.0W
**Description:** **MCSetup factory setup**
**Filter time:** **10:35 Tuesday, July 17, 2007 => 14:32 Wednesday, July 25, 2007**
**Scheme:** Vehicle classification (ARX)
**Filter:** Cls(1 2 3 4 5 6 7 8 9 10 11 12 ) Dir(NESW) Sp(10,160) Headway(>0)

| | Mon 23 Jul | Tue 24 Jul | Wed 25 Jul | Thu 26 Jul | Fri 27 Jul | Sat 28 Jul | Sun 29 Jul | Averages 1 - 5 | 1 - 7 |
|---|---|---|---|---|---|---|---|---|---|
| Hour | | | | | | | | | |
| 0000-0100 | 3 | 8 | 5 | * | * | * | * | 5.3 | 5.3 |
| 0100-0200 | 2 | 3 | 6 | * | * | * | * | 3.7 | 3.7 |
| 0200-0300 | 1 | 0 | 0 | * | * | * | * | 0.3 | 0.3 |
| 0300-0400 | 2 | 0 | 0 | * | * | * | * | 0.7 | 0.7 |
| 0400-0500 | 2 | 1 | 1 | * | * | * | * | 1.3 | 1.3 |
| 0500-0600 | 1 | 4 | 3 | * | * | * | * | 2.7 | 2.7 |
| 0600-0700 | 7 | 15 | 8 | * | * | * | * | 10.0 | 10.0 |
| 0700-0800 | 27 | **32<** | **32<** | * | * | * | * | **30.3<** | **30.3<** |
| 0800-0900 | **29<** | 22 | 16 | * | * | * | * | 22.3 | 22.3 |
| 0900-1000 | 17 | 19 | 14 | * | * | * | * | 16.7 | 16.7 |
| 1000-1100 | 11 | 14 | 0 | * | * | * | * | 8.3 | 8.3 |
| 1100-1200 | 14 | 13 | 0 | * | * | * | * | 9.0 | 9.0 |
| 1200-1300 | 19 | 18 | 0 | * | * | * | * | 12.3 | 12.3 |
| 1300-1400 | 14 | **29<** | 0 | * | * | * | * | 14.3 | 14.3 |
| 1400-1500 | 8 | 10 | 0 | * | * | * | * | 6.0 | 6.0 |
| 1500-1600 | 7 | 9 | * | * | * | * | * | 8.0 | 8.0 |
| 1600-1700 | 21 | 23 | * | * | * | * | * | 22.0 | 22.0 |
| 1700-1800 | 14 | 24 | * | * | * | * | * | 19.0 | 19.0 |
| 1800-1900 | **31<** | 16 | * | * | * | * | * | **23.5<** | **23.5<** |
| 1900-2000 | 24 | 14 | * | * | * | * | * | 19.0 | 19.0 |
| 2000-2100 | 6 | 10 | * | * | * | * | * | 8.0 | 8.0 |
| 2100-2200 | 8 | 19 | * | * | * | * | * | 13.5 | 13.5 |
| 2200-2300 | 12 | 8 | * | * | * | * | * | 10.0 | 10.0 |
| 2300-2400 | 7 | 6 | * | * | * | * | * | 6.5 | 6.5 |
| Totals | | | | | | | | | |
| 0700-1900 | 212 | 229 | * | * | * | * | * | 191.8 | 191.8 |
| 0600-2200 | 257 | 287 | * | * | * | * | * | 242.3 | 242.3 |
| 0600-0000 | 276 | 301 | * | * | * | * | * | 258.8 | 258.8 |
| 0000-0000 | 287 | 317 | * | * | * | * | * | 272.8 | 272.8 |
| AM Peak | 0800 | 0700 | 0700 | * | * | * | * | | |
| | 29 | 32 | 32 | * | * | * | * | | |
| PM Peak | 1800 | 1300 | * | * | * | * | * | | |
| | 31 | 29 | * | * | * | * | * | | |

* - No data.

# Vehicle Flow

**VehicleFlow-5**(Metric) **Site:** Site-2.0W
**Description:**MCSetup factory setup
**Filter time:**10:35 Tuesday, July 17, 2007 => 14:32 Wednesday, July 25, 2007
**Filter:** Cls(1 2 3 4 5 6 7 8 9 10 11 12 ) Dir(NESW) Sp(10,160) Headway(>0)
**Scheme:**Vehicle classification (ARX)



# MetroCount Traffic Executive
# Weekly Vehicle Counts

## WeeklyVehicle-2 -- English (ENU)

**Datasets:**

| | |
|---|---|
| **Site:** | **[Site-1] Middle Rd. (30) North of Navy Hill Rd.(37)** |
| **Direction:** | 3 - South bound, A hit first., **Lane:** 0 |
| **Survey Duration:** | 11:57 Tuesday, July 17, 2007 => 13:42 Wednesday, July 25, 2007 |
| **File:** | C:\Program Files\MetroCount v316\User\Data\Site-125Jul2007.EC0 (Regular) |
| **Identifier:** | U734RFPD MC56-L5 [MC55] (c)Microcom 19Oct04 |
| **Algorithm:** | Factory default |
| **Data type:** | Axle sensors - Paired (Class/Speed/Count) |

**Profile:**

| | |
|---|---|
| **Filter time:** | **11:57 Tuesday, July 17, 2007 => 13:42 Wednesday, July 25, 2007** |
| **Included classes:** | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 |
| **Speed range:** | 10 - 160 km/h. |
| **Direction:** | North, East, South, West (bound) |
| **Separation:** | All - (Headway) |
| **Name:** | Factory default profile |
| **Scheme:** | Vehicle classification (ARX) |
| **Units:** | Metric (meter, kilometer, m/s, km/h, kg, tonne) |
| **In profile:** | Vehicles = 63795 / 64120 (99.49%) |

# Weekly Vehicle Counts

**WeeklyVehicle-2**
**Site:** Site-1.0S
**Description:** **Middle Rd. (30) North of Navy Hill Rd.(37)**
**Filter time:** **11:57 Tuesday, July 17, 2007 => 13:42 Wednesday, July 25, 2007**
**Scheme:** Vehicle classification (ARX)
**Filter:** Cls(1 2 3 4 5 6 7 8 9 10 11 12 ) Dir(NESW) Sp(10,160) Headway(>0)

| | Mon | Tue | Wed | Thu | Fri | Sat | Sun | Averages | |
|---|---|---|---|---|---|---|---|---|---|
| Hour | 16 Jul | 17 Jul | 18 Jul | 19 Jul | 20 Jul | 21 Jul | 22 Jul | 1 - 5 | 1 - 7 |
| 0000-0100 | * | * | 117 | 107 | 109 | 152 | 123 | 111.0 | 121.6 |
| 0100-0200 | * | * | 35 | 42 | 53 | 78 | 63 | 43.3 | 54.2 |
| 0200-0300 | * | * | 33 | 36 | 47 | 75 | 42 | 38.7 | 46.6 |
| 0300-0400 | * | * | 25 | 22 | 29 | 42 | 38 | 25.3 | 31.2 |
| 0400-0500 | * | * | 22 | 29 | 28 | 31 | 34 | 26.3 | 28.8 |
| 0500-0600 | * | * | 94 | 96 | 90 | 94 | 91 | 93.3 | 93.0 |
| 0600-0700 | * | * | 202 | 180 | 187 | 196 | 129 | 189.7 | 178.8 |
| 0700-0800 | * | * | 673 | 716 | 698 | 380 | 248 | **695.7<** | 543.0 |
| 0800-0900 | * | * | 647 | 666 | 648 | 504 | 366 | 653.7 | 566.2 |
| 0900-1000 | * | * | 703 | 611 | 714 | 561 | 418 | 676.0 | **601.4<** |
| 1000-1100 | * | * | 604 | 632 | 736 | 547 | 338 | 657.3 | 571.4 |
| 1100-1200 | * | 0 | **704<** | **768<** | **891<** | **561<** | **434<** | 590.8 | 559.7 |
| 1200-1300 | * | 0 | 691 | 699 | 801 | 543 | 474 | 547.8 | 534.7 |
| 1300-1400 | * | 0 | 666 | 681 | 750 | 545 | 403 | 524.3 | 507.5 |
| 1400-1500 | * | 649 | 707 | 766 | 808 | 564 | 399 | 732.5 | 648.8 |
| 1500-1600 | * | 626 | 603 | 621 | 756 | 482 | 425 | 651.5 | 585.5 |
| 1600-1700 | * | **944<** | **952<** | **915<** | **964<** | 547 | **536<** | **943.8<** | **809.7<** |
| 1700-1800 | * | 859 | 837 | 808 | 929 | **640<** | 484 | 858.3 | 759.5 |
| 1800-1900 | * | 507 | 545 | 551 | 559 | 518 | 434 | 540.5 | 519.0 |
| 1900-2000 | * | 436 | 420 | 461 | 530 | 438 | 403 | 461.8 | 448.0 |
| 2000-2100 | * | 280 | 312 | 280 | 326 | 285 | 286 | 299.5 | 294.8 |
| 2100-2200 | * | 202 | 203 | 221 | 283 | 329 | 205 | 227.3 | 240.5 |
| 2200-2300 | * | 182 | 186 | 214 | 238 | 240 | 183 | 205.0 | 207.2 |
| 2300-2400 | * | 141 | 142 | 144 | 149 | 187 | 114 | 144.0 | 146.2 |
| Totals | | | | | | | | | |
| 0700-1900 | * | * | 8332 | 8434 | 9254 | 6392 | 4959 | 8071.9 | 7206.3 |
| 0600-2200 | * | * | 9469 | 9576 | 10580 | 7640 | 5982 | 9250.1 | 8368.5 |
| 0600-0000 | * | * | 9797 | 9934 | 10967 | 8067 | 6279 | 9599.1 | 8721.8 |
| 0000-0000 | * | * | 10123 | 10266 | 11323 | 8539 | 6670 | 9937.1 | 9097.2 |
| AM Peak | * | * | 1100 | 1100 | 1100 | 1100 | 1100 | | |
| | * | * | 704 | 768 | 891 | 561 | 434 | | |
| PM Peak | * | 1600 | 1600 | 1600 | 1600 | 1700 | 1600 | | |
| | * | 944 | 952 | 915 | 964 | 640 | 536 | | |

* - No data.

# Weekly Vehicle Counts

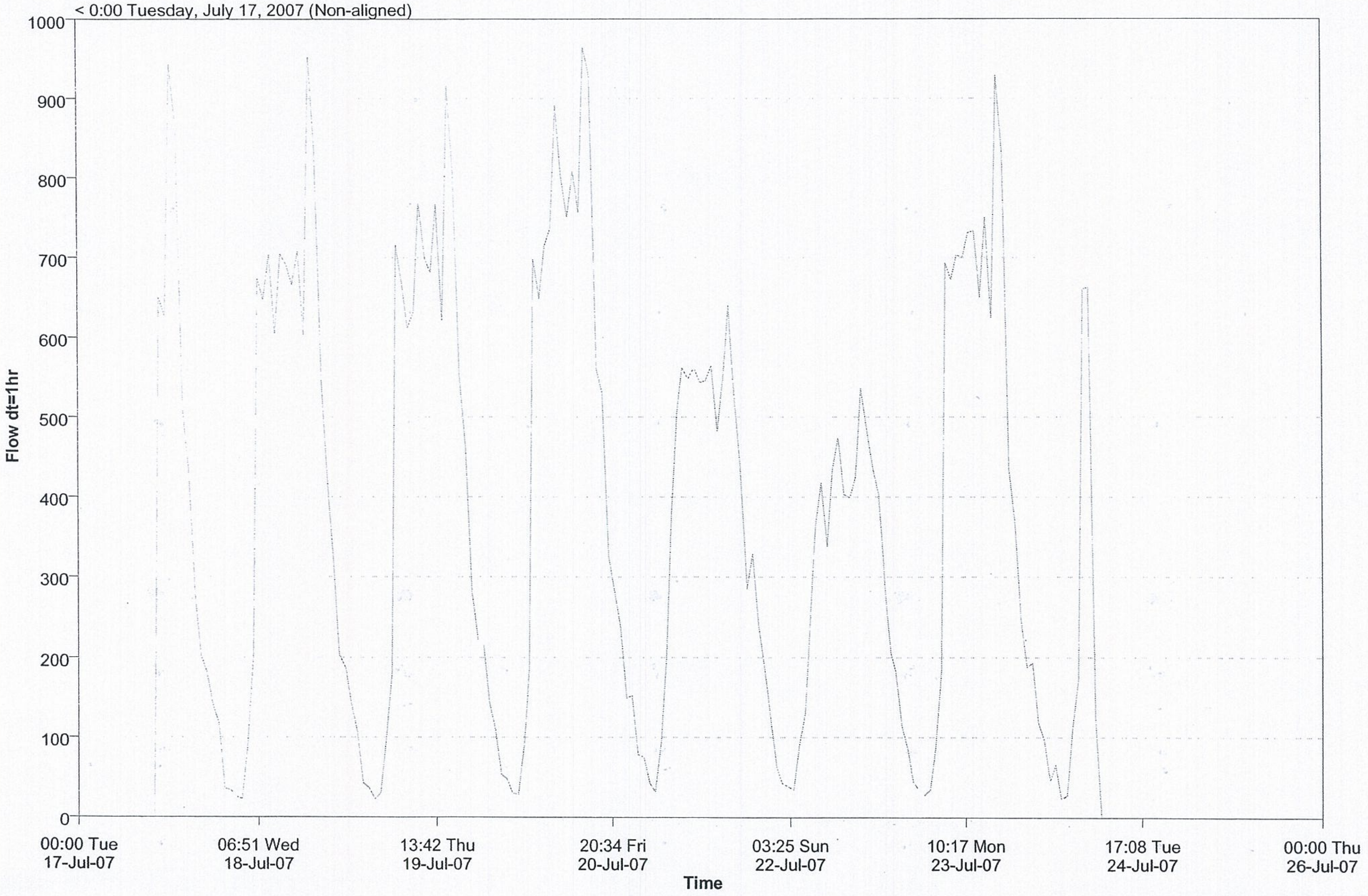
**WeeklyVehicle-2**
**Site:** Site-1.0S
**Description:** **Middle Rd. (30) North of Navy Hill Rd.(37)**
**Filter time:** **11:57 Tuesday, July 17, 2007 => 13:42 Wednesday, July 25, 2007**
**Scheme:** Vehicle classification (ARX)
**Filter:** Cls(1 2 3 4 5 6 7 8 9 10 11 12 ) Dir(NESW) Sp(10,160) Headway(>0)

| | Mon | Tue | Wed | Thu | Fri | Sat | Sun | Averages | |
|---|---|---|---|---|---|---|---|---|---|
| | 23 Jul | 24 Jul | 25 Jul | 26 Jul | 27 Jul | 28 Jul | 29 Jul | 1 - 5 | 1 - 7 |
| Hour | | | | | | | | | |
| 0000-0100 | 87 | 96 | 0 | * | * | * | * | 61.0 | 61.0 |
| 0100-0200 | 44 | 45 | 0 | * | * | * | * | 29.7 | 29.7 |
| 0200-0300 | 34 | 65 | 0 | * | * | * | * | 33.0 | 33.0 |
| 0300-0400 | 27 | 22 | 0 | * | * | * | * | 16.3 | 16.3 |
| 0400-0500 | 34 | 27 | 0 | * | * | * | * | 20.3 | 20.3 |
| 0500-0600 | 88 | 112 | 0 | * | * | * | * | 66.7 | 66.7 |
| 0600-0700 | 182 | 172 | 0 | * | * | * | * | 118.0 | 118.0 |
| 0700-0800 | 693 | 660 | 0 | * | * | * | * | **451.0<** | **451.0<** |
| 0800-0900 | 672 | **662<** | 0 | * | * | * | * | 444.7 | 444.7 |
| 0900-1000 | 703 | 123 | 0 | * | * | * | * | 275.3 | 275.3 |
| 1000-1100 | 699 | 0 | 0 | * | * | * | * | 233.0 | 233.0 |
| 1100-1200 | **731<** | 0 | **0<** | * | * | * | * | 243.7 | 243.7 |
| 1200-1300 | 733 | 0 | 0 | * | * | * | * | 244.3 | 244.3 |
| 1300-1400 | 649 | 0 | 0 | * | * | * | * | 216.3 | 216.3 |
| 1400-1500 | 750 | 0 | * | * | * | * | * | 375.0 | 375.0 |
| 1500-1600 | 624 | 0 | * | * | * | * | * | 312.0 | 312.0 |
| 1600-1700 | **929<** | 0 | * | * | * | * | * | **464.5<** | **464.5<** |
| 1700-1800 | 833 | 0 | * | * | * | * | * | 416.5 | 416.5 |
| 1800-1900 | 434 | 0 | * | * | * | * | * | 217.0 | 217.0 |
| 1900-2000 | 370 | 0 | * | * | * | * | * | 185.0 | 185.0 |
| 2000-2100 | 248 | 0 | * | * | * | * | * | 124.0 | 124.0 |
| 2100-2200 | 188 | 0 | * | * | * | * | * | 94.0 | 94.0 |
| 2200-2300 | 193 | 0 | * | * | * | * | * | 96.5 | 96.5 |
| 2300-2400 | 119 | **0<** | * | * | * | * | * | 59.5 | 59.5 |
| Totals | | | | | | | | | |
| 0700-1900 | 8450 | 1445 | * | * | * | * | * | 3893.3 | 3893.3 |
| 0600-2200 | 9438 | 1617 | * | * | * | * | * | 4414.3 | 4414.3 |
| 0600-0000 | 9750 | 1617 | * | * | * | * | * | 4570.3 | 4570.3 |
| 0000-0000 | 10064 | 1984 | * | * | * | * | * | 4797.3 | 4797.3 |
| AM Peak | 1100 | 0800 | 1100 | * | * | * | * | | |
| | 731 | 662 | 0 | * | * | * | * | | |
| PM Peak | 1600 | 2300 | * | * | * | * | * | | |
| | 929 | 0 | * | * | * | * | * | | |

* - No data.

# Vehicle Flow

**VehicleFlow-3**(Metric) **Site:** Site-1.0S
**Description:**Middle Rd. (30) North of Navy Hill Rd.(37)
**Filter time:**11:57 Tuesday, July 17, 2007 => 13:42 Wednesday, July 25, 2007
**Filter:** Cls(1 2 3 4 5 6 7 8 9 10 11 12 ) Dir(NESW) Sp(10,160) Headway(>0)
**Scheme:**Vehicle classification (ARX)



# MetroCount Traffic Executive
# Weekly Vehicle Counts

## WeeklyVehicle-25 -- English (ENU)

### Datasets:
**Site:** **[Site-12] QuarterMaster(35) Between Beach Rd.(33) and Middle Rd(30)**
**Direction:** 4 - West bound, A hit first., **Lane:** 0
**Survey Duration:** 11:37 Tuesday, July 17, 2007 => 16:10 Wednesday, July 25, 2007
**File:** C:\Program Files\MetroCount v316\User\Data\Site-1225Jul2007.EC0 (Regular)
**Identifier:** U7855HFX MC56-L5 [MC55] (c)Microcom 19Oct04
**Algorithm:** Factory default
**Data type:** Axle sensors - Paired (Class/Speed/Count)

### Profile:
**Filter time:** **11:37 Tuesday, July 17, 2007 => 16:10 Wednesday, July 25, 2007**
**Included classes:** 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
**Speed range:** 10 - 160 km/h.
**Direction:** North, East, South, West (bound)
**Separation:** All - (Headway)
**Name:** Factory default profile
**Scheme:** Vehicle classification (ARX)
**Units:** Metric (meter, kilometer, m/s, km/h, kg, tonne)
**In profile:** Vehicles = 7278 / 7328 (99.32%)

# Weekly Vehicle Counts

**WeeklyVehicle-25**

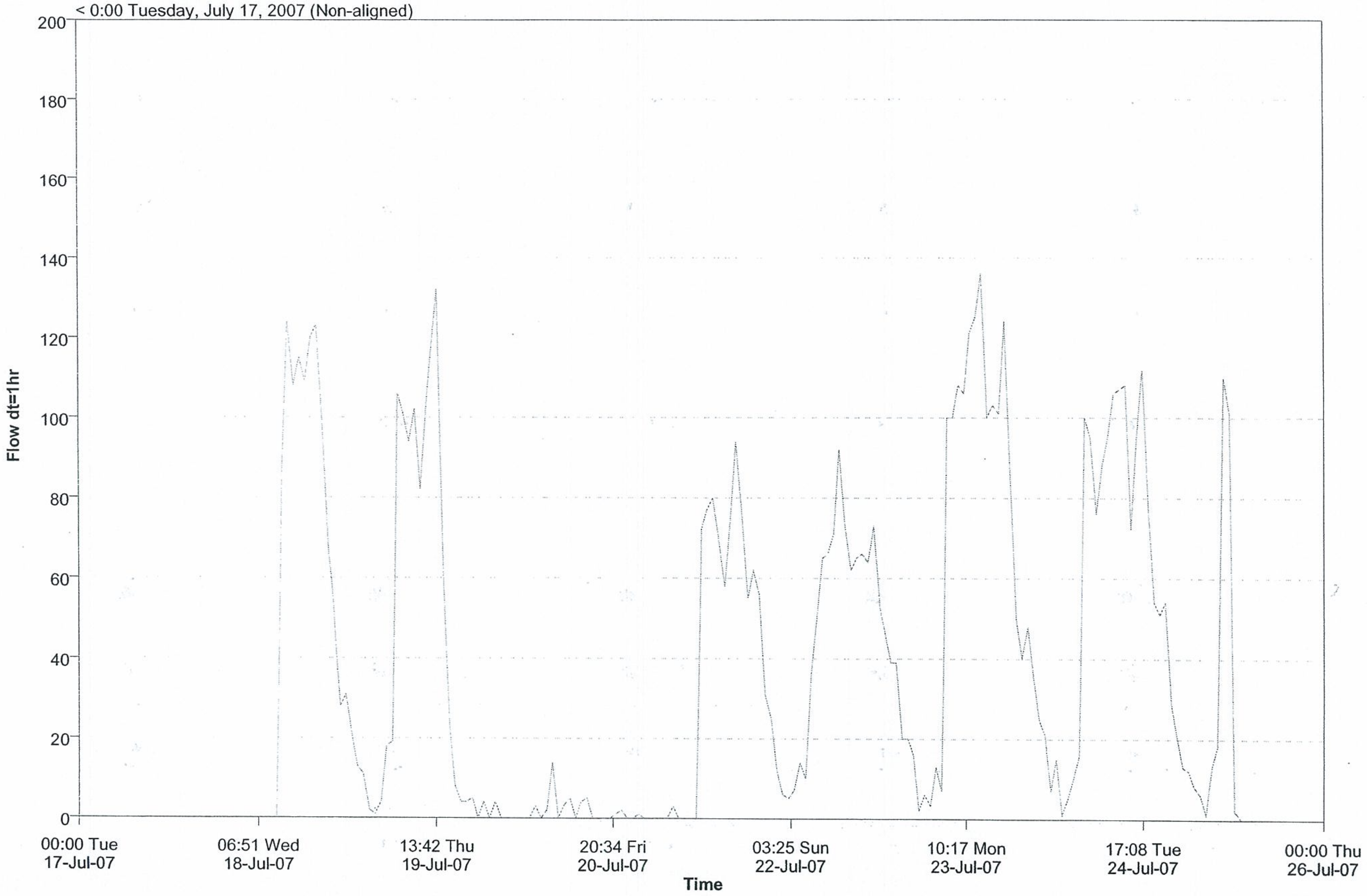
| | |
|---|---|
| **Site:** | Site-12.0W |
| **Description:** | **QuarterMaster(35) Between Beach Rd.(33) and Middle Rd(30)** |
| **Filter time:** | **11:37 Tuesday, July 17, 2007 => 16:10 Wednesday, July 25, 2007** |
| **Scheme:** | Vehicle classification (ARX) |
| **Filter:** | Cls(1 2 3 4 5 6 7 8 9 10 11 12 ) Dir(NESW) Sp(10,160) Headway(>0) |

| | Mon 16 Jul | Tue 17 Jul | Wed 18 Jul | Thu 19 Jul | Fri 20 Jul | Sat 21 Jul | Sun 22 Jul | Averages 1 - 5 | 1 - 7 |
|---|---|---|---|---|---|---|---|---|---|
| Hour | | | | | | | | | |
| 0000-0100 | * | * | 0 | 13 | 4 | 0 | 25 | 5.7 | 8.4 |
| 0100-0200 | * | * | 0 | 11 | 0 | 1 | 12 | 3.7 | 4.8 |
| 0200-0300 | * | * | 0 | 2 | 0 | 0 | 6 | 0.7 | 1.6 |
| 0300-0400 | * | * | 0 | 1 | 0 | 0 | 5 | 0.3 | 1.2 |
| 0400-0500 | * | * | 0 | 4 | 0 | 0 | 7 | 1.3 | 2.2 |
| 0500-0600 | * | * | 0 | 18 | 0 | 0 | 14 | 6.0 | 6.4 |
| 0600-0700 | * | * | 0 | 19 | 0 | 0 | 10 | 6.3 | 5.8 |
| 0700-0800 | * | * | 0 | **106<** | 3 | **3<** | 36 | 36.3 | 29.6 |
| 0800-0900 | * | * | 0 | 101 | 0 | 0 | 50 | 33.7 | 30.2 |
| 0900-1000 | * | * | 0 | 94 | 2 | 0 | 65 | 32.0 | 32.2 |
| 1000-1100 | * | * | 0 | 102 | **14<** | 0 | 66 | 38.7 | 36.4 |
| 1100-1200 | * | 0 | **86<** | 82 | 0 | 0 | **71<** | **42.0<** | **39.8<** |
| 1200-1300 | * | 0 | **124<** | 102 | 3 | 72 | **92<** | 57.3 | **65.5<** |
| 1300-1400 | * | 0 | 108 | 118 | 5 | 77 | 73 | 57.8 | 63.5 |
| 1400-1500 | * | 0 | 115 | **132<** | 0 | 80 | 62 | **61.8<** | 64.8 |
| 1500-1600 | * | 0 | 109 | 60 | 4 | 69 | 65 | 43.3 | 51.2 |
| 1600-1700 | * | 0 | 120 | 23 | **5<** | 58 | 66 | 37.0 | 45.3 |
| 1700-1800 | * | 0 | 123 | 8 | 0 | 74 | 64 | 32.8 | 44.8 |
| 1800-1900 | * | 0 | 98 | 4 | 0 | **94<** | 73 | 25.5 | 44.8 |
| 1900-2000 | * | 0 | 66 | 4 | 0 | 77 | 53 | 17.5 | 33.3 |
| 2000-2100 | * | 0 | 51 | 5 | 0 | 55 | 46 | 14.0 | 26.2 |
| 2100-2200 | * | 0 | 28 | 0 | 1 | 62 | 39 | 7.3 | 21.7 |
| 2200-2300 | * | 0 | 31 | 4 | 2 | 56 | 39 | 9.3 | 22.0 |
| 2300-2400 | * | 0< | 21 | 0 | 0 | 31 | 20 | 5.3 | 12.0 |
| Totals | | | | | | | | | |
| 0700-1900 | * | * | 883 | 932 | 36 | 527 | 783 | 497.9 | 548.2 |
| 0600-2200 | * | * | 1028 | 960 | 37 | 721 | 931 | 543.0 | 635.2 |
| 0600-0000 | * | * | 1080 | 964 | 39 | 808 | 990 | 557.5 | 669.2 |
| 0000-0000 | * | * | 1080 | 1013 | 43 | 809 | 1059 | 575.2 | 693.8 |
| AM Peak | * | * | 1100 | 0700 | 1000 | 0700 | 1100 | | |
| | * | * | 86 | 106 | 14 | 3 | 71 | | |
| PM Peak | * | 2300 | 1200 | 1400 | 1600 | 1800 | 1200 | | |
| | * | 0 | 124 | 132 | 5 | 94 | 92 | | |

* - No data.

# Vehicle Flow

**VehicleFlow-26**(Metric) **Site:** Site-12.0W
**Description:**QuarterMaster(35) Between Beach Rd.(33) and Middle Rd(30)
**Filter time:**11:37 Tuesday, July 17, 2007 => 16:10 Wednesday, July 25, 2007
**Filter:** Cls(1 2 3 4 5 6 7 8 9 10 11 12 ) Dir(NESW) Sp(10,160) Headway(>0)
**Scheme:**Vehicle classification (ARX)



# MetroCount Traffic Executive
# Weekly Vehicle Counts

## WeeklyVehicle-23 -- English (ENU)

### Datasets:

**Site:** **[Site-11] Beach Rd.(33) North of QuarterMaster Rd(35)**
**Direction:** 1 - North bound, A hit first., **Lane:** 0
**Survey Duration:** 11:32 Tuesday, July 17, 2007 => 15:58 Wednesday, July 25, 2007
**File:** C:\Program Files\MetroCount v316\User\Data\Site-1125Jul2007.EC0 (Regular)
**Identifier:** U832BH87 MC56-L5 [MC55] (c)Microcom 19Oct04
**Algorithm:** Factory default
**Data type:** Axle sensors - Paired (Class/Speed/Count)

### Profile:

**Filter time:** **11:32 Tuesday, July 17, 2007 => 15:58 Wednesday, July 25, 2007**
**Included classes:** 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
**Speed range:** 10 - 160 km/h.
**Direction:** North, East, South, West (bound)
**Separation:** All - (Headway)
**Name:** Factory default profile
**Scheme:** Vehicle classification (ARX)
**Units:** Metric (meter, kilometer, m/s, km/h, kg, tonne)
**In profile:** Vehicles = 54851 / 54855 (99.99%)

# Weekly Vehicle Counts

**WeeklyVehicle-23**

| | |
|---|---|
| **Site:** | Site-11.0N |
| **Description:** | **Beach Rd.(33) North of QuarterMaster Rd(35)** |
| **Filter time:** | **11:32 Tuesday, July 17, 2007 => 15:58 Wednesday, July 25, 2007** |
| **Scheme:** | Vehicle classification (ARX) |
| **Filter:** | Cls(1 2 3 4 5 6 7 8 9 10 11 12 ) Dir(NESW) Sp(10,160) Headway(>0) |

| | Mon | Tue | Wed | Thu | Fri | Sat | Sun | Averages | |
|---|---|---|---|---|---|---|---|---|---|
| | 16 Jul | 17 Jul | 18 Jul | 19 Jul | 20 Jul | 21 Jul | 22 Jul | 1 - 5 | 1 - 7 |
| Hour | | | | | | | | | |
| 0000-0100 | * | * | 0 | 131 | 143 | 204 | 198 | 91.3 | 135.2 |
| 0100-0200 | * | * | 0 | 97 | 91 | 133 | 93 | 62.7 | 82.8 |
| 0200-0300 | * | * | 0 | 78 | 81 | 159 | 102 | 53.0 | 84.0 |
| 0300-0400 | * | * | 0 | 32 | 44 | 65 | 57 | 25.3 | 39.6 |
| 0400-0500 | * | * | 0 | 32 | 29 | 43 | 26 | 20.3 | 26.0 |
| 0500-0600 | * | * | 0 | 73 | 49 | 76 | 58 | 40.7 | 51.2 |
| 0600-0700 | * | * | 0 | 116 | 121 | 151 | 109 | 79.0 | 99.4 |
| 0700-0800 | * | * | 0 | 385 | 375 | 293 | 156 | 253.3 | 241.8 |
| 0800-0900 | * | * | 0 | 398 | 403 | 334 | 254 | 267.0 | 277.8 |
| 0900-1000 | * | * | 0 | 379 | 418 | 378 | 280 | 265.7 | 291.0 |
| 1000-1100 | * | * | 309 | 448 | 489 | 412 | 318 | **415.3<** | **395.2<** |
| 1100-1200 | * | 0 | **491<** | **513<** | **548<** | **445<** | **326<** | 388.0 | 387.2 |
| 1200-1300 | * | 0 | 538 | 510 | 554 | 450 | 425 | 400.5 | 412.8 |
| 1300-1400 | * | 0 | 571 | 606 | 631 | 459 | 466 | 452.0 | 455.5 |
| 1400-1500 | * | 0 | 613 | 626 | 662 | **521<** | 433 | 475.3 | 475.8 |
| 1500-1600 | * | 0 | 549 | 509 | 595 | 405 | 390 | 413.3 | 408.0 |
| 1600-1700 | * | 0 | 612 | 629 | 650 | 411 | 397 | 472.8 | 449.8 |
| 1700-1800 | * | 0 | **697<** | **736<** | **784<** | 475 | **481<** | **554.3<** | **528.8<** |
| 1800-1900 | * | 0 | 482 | 486 | 543 | 466 | 406 | 377.8 | 397.2 |
| 1900-2000 | * | 0 | 481 | 488 | 428 | 398 | 347 | 349.3 | 357.0 |
| 2000-2100 | * | 0 | 425 | 390 | 368 | 353 | 312 | 295.8 | 308.0 |
| 2100-2200 | * | 0 | 350 | 384 | 375 | 358 | 309 | 277.3 | 296.0 |
| 2200-2300 | * | 0 | 274 | 252 | 318 | 259 | 242 | 211.0 | 224.2 |
| 2300-2400 | * | 0< | 213 | 170 | 222 | 232 | 159 | 151.3 | 166.0 |
| Totals | | | | | | | | | |
| 0700-1900 | * | * | 4862 | 6225 | 6652 | 5049 | 4332 | 4735.1 | 4721.0 |
| 0600-2200 | * | * | 6118 | 7603 | 7944 | 6309 | 5409 | 5736.3 | 5781.4 |
| 0600-0000 | * | * | 6605 | 8025 | 8484 | 6800 | 5810 | 6098.6 | 6171.5 |
| 0000-0000 | * | * | 6605 | 8468 | 8921 | 7480 | 6344 | 6391.9 | 6590.3 |
| AM Peak | * | * | 1100 | 1100 | 1100 | 1100 | 1100 | | |
| | * | * | 491 | 513 | 548 | 445 | 326 | | |
| PM Peak | * | 2300 | 1700 | 1700 | 1700 | 1400 | 1700 | | |
| | * | 0 | 697 | 736 | 784 | 521 | 481 | | |

* - No data.

# Weekly Vehicle Counts

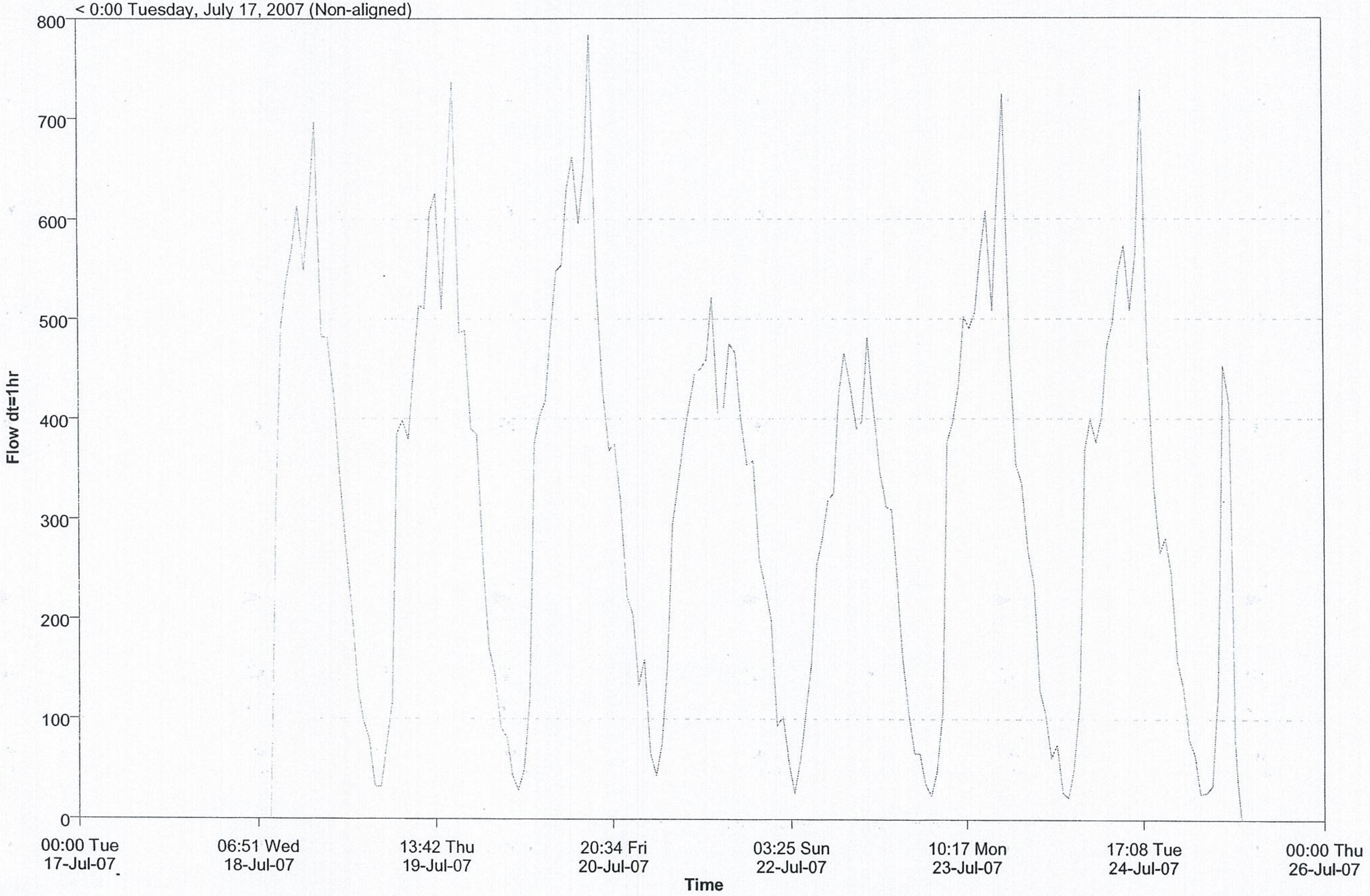
**WeeklyVehicle-23**
**Site:** Site-11.0N
**Description:** **Beach Rd.(33) North of QuarterMaster Rd(35)**
**Filter time:** **11:32 Tuesday, July 17, 2007 => 15:58 Wednesday, July 25, 2007**
**Scheme:** Vehicle classification (ARX)
**Filter:** Cls(1 2 3 4 5 6 7 8 9 10 11 12 ) Dir(NESW) Sp(10,160) Headway(>0)

| | Mon<br>23 Jul | Tue<br>24 Jul | Wed<br>25 Jul | Thu<br>26 Jul | Fri<br>27 Jul | Sat<br>28 Jul | Sun<br>29 Jul | Averages<br>1 - 5 | <br>1 - 7 |
|---|---|---|---|---|---|---|---|---|---|
| Hour | | | | | | | | | |
| 0000-0100 | 105 | 105 | 132 | * | * | * | * | 114.0 | 114.0 |
| 0100-0200 | 65 | 61 | 80 | * | * | * | * | 68.7 | 68.7 |
| 0200-0300 | 65 | 74 | 64 | * | * | * | * | 67.7 | 67.7 |
| 0300-0400 | 35 | 27 | 26 | * | * | * | * | 29.3 | 29.3 |
| 0400-0500 | 24 | 22 | 27 | * | * | * | * | 24.3 | 24.3 |
| 0500-0600 | 48 | 50 | 34 | * | * | * | * | 44.0 | 44.0 |
| 0600-0700 | 105 | 116 | 122 | * | * | * | * | 114.3 | 114.3 |
| 0700-0800 | 377 | 369 | **453<** | * | * | * | * | 399.7 | 399.7 |
| 0800-0900 | 396 | 400 | 416 | * | * | * | * | **404.0<** | **404.0<** |
| 0900-1000 | 433 | 376 | 78 | * | * | * | * | 295.7 | 295.7 |
| 1000-1100 | **502<** | 402 | 0 | * | * | * | * | 301.3 | 301.3 |
| 1100-1200 | 490 | **473<** | 0 | * | * | * | * | 321.0 | 321.0 |
| 1200-1300 | 506 | 497 | 0 | * | * | * | * | 334.3 | 334.3 |
| 1300-1400 | 564 | 547 | 0 | * | * | * | * | 370.3 | 370.3 |
| 1400-1500 | 607 | 573 | 0 | * | * | * | * | 393.3 | 393.3 |
| 1500-1600 | 508 | 508 | 0 | * | * | * | * | 338.7 | 338.7 |
| 1600-1700 | 626 | 566 | * | * | * | * | * | 596.0 | 596.0 |
| 1700-1800 | **724<** | **728<** | * | * | * | * | * | **726.0<** | **726.0<** |
| 1800-1900 | 463 | 466 | * | * | * | * | * | 464.5 | 464.5 |
| 1900-2000 | 354 | 331 | * | * | * | * | * | 342.5 | 342.5 |
| 2000-2100 | 335 | 266 | * | * | * | * | * | 300.5 | 300.5 |
| 2100-2200 | 267 | 281 | * | * | * | * | * | 274.0 | 274.0 |
| 2200-2300 | 234 | 244 | * | * | * | * | * | 239.0 | 239.0 |
| 2300-2400 | 128 | 158 | * | * | * | * | * | 143.0 | 143.0 |
| Totals | | | | | | | | | |
| 0700-1900 | 6196 | 5905 | * | * | * | * | * | 4944.8 | 4944.8 |
| 0600-2200 | 7257 | 6899 | * | * | * | * | * | 5976.2 | 5976.2 |
| 0600-0000 | 7619 | 7301 | * | * | * | * | * | 6358.2 | 6358.2 |
| 0000-0000 | 7961 | 7640 | * | * | * | * | * | 6706.2 | 6706.2 |
| AM Peak | 1000 | 1100 | 0700 | * | * | * | * | | |
| | 502 | 473 | 453 | * | * | * | * | | |
| PM Peak | 1700 | 1700 | * | * | * | * | * | | |
| | 724 | 728 | * | * | * | * | * | | |

* - No data.

# Vehicle Flow

**VehicleFlow-24**(Metric) **Site:** Site-11.0N
**Description:**Beach Rd.(33) North of QuarterMaster Rd(35)
**Filter time:**11:32 Tuesday, July 17, 2007 => 15:58 Wednesday, July 25, 2007
**Filter:** Cls(1 2 3 4 5 6 7 8 9 10 11 12 ) Dir(NESW) Sp(10,160) Headway(>0)
**Scheme:**Vehicle classification (ARX)



# MetroCount Traffic Executive
# Weekly Vehicle Counts

## WeeklyVehicle-21 -- English (ENU)

### Datasets:

| | |
|---|---|
| **Site:** | **[Site-10] Middle Rd.(30) North of QuarterMaster Rd(35)** |
| **Direction:** | 3 - South bound, A hit first., **Lane:** 0 |
| **Survey Duration:** | 11:28 Tuesday, July 17, 2007 => 15:50 Wednesday, July 25, 2007 |
| **File:** | C:\Program Files\MetroCount v316\User\Data\Site-1025Jul2007.EC0 (Regular) |
| **Identifier:** | U75173FE MC56-L5 [MC55] (c)Microcom 19Oct04 |
| **Algorithm:** | Factory default |
| **Data type:** | Axle sensors - Paired (Class/Speed/Count) |

### Profile:

| | |
|---|---|
| **Filter time:** | **11:28 Tuesday, July 17, 2007 => 15:50 Wednesday, July 25, 2007** |
| **Included classes:** | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 |
| **Speed range:** | 10 - 160 km/h. |
| **Direction:** | North, East, South, West (bound) |
| **Separation:** | All - (Headway) |
| **Name:** | Factory default profile |
| **Scheme:** | Vehicle classification (ARX) |
| **Units:** | Metric (meter, kilometer, m/s, km/h, kg, tonne) |
| **In profile:** | Vehicles = 71662 / 72134 (99.35%) |

# Weekly Vehicle Counts

**WeeklyVehicle-21**

| | |
|---|---|
| **Site:** | Site-10.0S |
| **Description:** | **Middle Rd.(30) North of QuarterMaster Rd(35)** |
| **Filter time:** | **11:28 Tuesday, July 17, 2007 => 15:50 Wednesday, July 25, 2007** |
| **Scheme:** | Vehicle classification (ARX) |
| **Filter:** | Cls(1 2 3 4 5 6 7 8 9 10 11 12 ) Dir(NESW) Sp(10,160) Headway(>0) |

| Hour | Mon<br>16 Jul | Tue<br>17 Jul | Wed<br>18 Jul | Thu<br>19 Jul | Fri<br>20 Jul | Sat<br>21 Jul | Sun<br>22 Jul | Averages<br>1 - 5 | <br>1 - 7 |
|---|---|---|---|---|---|---|---|---|---|
| 0000-0100 | * | * | 0 | 120 | 161 | 185 | 180 | 93.7 | 129.2 |
| 0100-0200 | * | * | 0 | 86 | 73 | 119 | 122 | 53.0 | 80.0 |
| 0200-0300 | * | * | 0 | 54 | 66 | 111 | 93 | 40.0 | 64.8 |
| 0300-0400 | * | * | 0 | 25 | 29 | 61 | 71 | 18.0 | 37.2 |
| 0400-0500 | * | * | 0 | 26 | 39 | 52 | 42 | 21.7 | 31.8 |
| 0500-0600 | * | * | 0 | 96 | 70 | 78 | 83 | 55.3 | 65.4 |
| 0600-0700 | * | * | 0 | 139 | 169 | 152 | 109 | 102.7 | 113.8 |
| 0700-0800 | * | * | 0 | 602 | 665 | 411 | 221 | 422.3 | 379.8 |
| 0800-0900 | * | * | 0 | 640 | 695 | 545 | 346 | 445.0 | 445.2 |
| 0900-1000 | * | * | 0 | 627 | 719 | 618 | 402 | 448.7 | 473.2 |
| 1000-1100 | * | * | 0 | 693 | 766 | 662 | 427 | **486.3<** | **509.6<** |
| 1100-1200 | * | 0 | **264<** | **705<** | **846<** | **668<** | **553<** | 453.8 | 506.0 |
| 1200-1300 | * | 0 | 632 | 698 | 878 | **701<** | 484 | 552.0 | 565.5 |
| 1300-1400 | * | 0 | 726 | 752 | 902 | 657 | 458 | 595.0 | 582.5 |
| 1400-1500 | * | 0 | 792 | 876 | **991<** | 627 | **494<** | 664.8 | 630.0 |
| 1500-1600 | * | 0 | 660 | 723 | 879 | 581 | 399 | 565.5 | 540.3 |
| 1600-1700 | * | 0 | 837 | **888<** | 953 | 573 | 477 | 669.5 | 621.3 |
| 1700-1800 | * | 0 | **893<** | 869 | 990 | 639 | 472 | **688.0<** | **643.8<** |
| 1800-1900 | * | 0 | 604 | 629 | 719 | 578 | 416 | 488.0 | 491.0 |
| 1900-2000 | * | 0 | 460 | 472 | 556 | 532 | 425 | 372.0 | 407.5 |
| 2000-2100 | * | 0 | 396 | 369 | 417 | 372 | 351 | 295.5 | 317.5 |
| 2100-2200 | * | 0 | 336 | 333 | 410 | 372 | 325 | 269.8 | 296.0 |
| 2200-2300 | * | 0 | 256 | 271 | 299 | 274 | 282 | 206.5 | 230.3 |
| 2300-2400 | * | 0< | 176 | 210 | 250 | 247 | 174 | 159.0 | 176.2 |
| Totals | | | | | | | | | |
| 0700-1900 | * | * | 5408 | 8702 | 10003 | 7260 | 5149 | 6478.8 | 6388.3 |
| 0600-2200 | * | * | 6600 | 10015 | 11555 | 8688 | 6359 | 7518.8 | 7523.1 |
| 0600-0000 | * | * | 7032 | 10496 | 12104 | 9209 | 6815 | 7884.3 | 7929.6 |
| 0000-0000 | * | * | 7032 | 10903 | 12542 | 9815 | 7406 | 8165.9 | 8338.0 |
| AM Peak | * | * | 1100 | 1100 | 1100 | 1100 | 1100 | | |
| | * | * | 264 | 705 | 846 | 668 | 553 | | |
| PM Peak | * | 2300 | 1700 | 1600 | 1400 | 1200 | 1400 | | |
| | * | 0 | 893 | 888 | 991 | 701 | 494 | | |

* - No data.

# Weekly Vehicle Counts

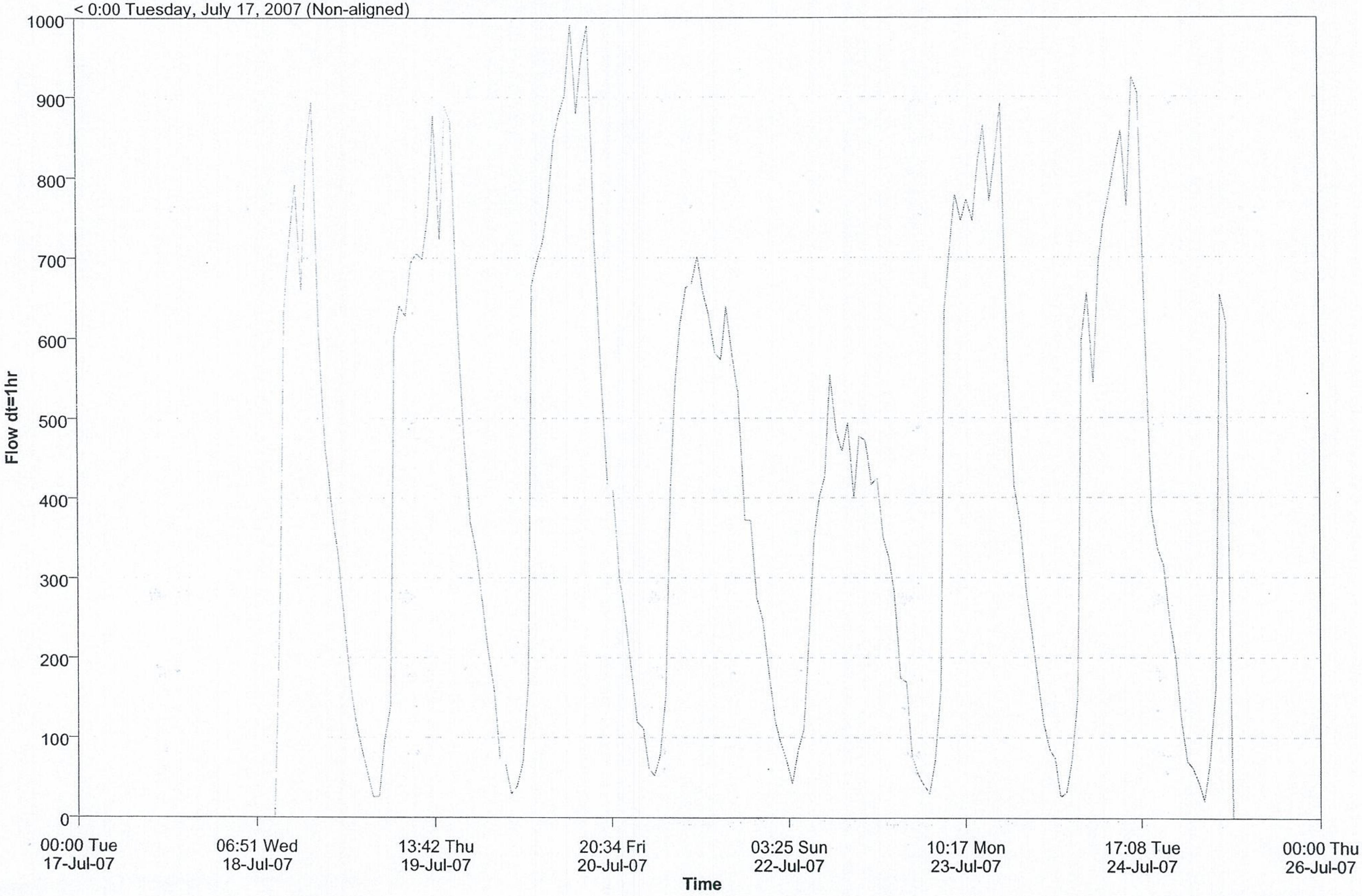
**WeeklyVehicle-21**
**Site:** Site-10.0S
**Description:** **Middle Rd.(30) North of QuarterMaster Rd(35)**
**Filter time:** **11:28 Tuesday, July 17, 2007 => 15:50 Wednesday, July 25, 2007**
**Scheme:** Vehicle classification (ARX)
**Filter:** Cls(1 2 3 4 5 6 7 8 9 10 11 12 ) Dir(NESW) Sp(10,160) Headway(>0)

| Hour | Mon<br>23 Jul | Tue<br>24 Jul | Wed<br>25 Jul | Thu<br>26 Jul | Fri<br>27 Jul | Sat<br>28 Jul | Sun<br>29 Jul | Averages<br>1 - 5 | <br>1 - 7 |
|---|---|---|---|---|---|---|---|---|---|
| 0000-0100 | 169 | 118 | 122 | * | * | * | * | 136.3 | 136.3 |
| 0100-0200 | 76 | 85 | 70 | * | * | * | * | 77.0 | 77.0 |
| 0200-0300 | 55 | 74 | 61 | * | * | * | * | 63.3 | 63.3 |
| 0300-0400 | 41 | 26 | 44 | * | * | * | * | 37.0 | 37.0 |
| 0400-0500 | 30 | 31 | 21 | * | * | * | * | 27.3 | 27.3 |
| 0500-0600 | 71 | 72 | 71 | * | * | * | * | 71.3 | 71.3 |
| 0600-0700 | 162 | 151 | 159 | * | * | * | * | 157.3 | 157.3 |
| 0700-0800 | 634 | 598 | **653<** | * | * | * | * | 628.3 | 628.3 |
| 0800-0900 | 707 | 655 | 618 | * | * | * | * | **660.0<** | **660.0<** |
| 0900-1000 | **778<** | 544 | 0 | * | * | * | * | 440.7 | 440.7 |
| 1000-1100 | 745 | 695 | 0 | * | * | * | * | 480.0 | 480.0 |
| 1100-1200 | 772 | **746<** | 0 | * | * | * | * | 506.0 | 506.0 |
| 1200-1300 | 745 | 781 | 0 | * | * | * | * | 508.7 | 508.7 |
| 1300-1400 | 819 | 821 | 0 | * | * | * | * | 546.7 | 546.7 |
| 1400-1500 | 864 | 858 | 0 | * | * | * | * | 574.0 | 574.0 |
| 1500-1600 | 769 | 764 | 0 | * | * | * | * | 511.0 | 511.0 |
| 1600-1700 | 828 | **925<** | * | * | * | * | * | 876.5 | 876.5 |
| 1700-1800 | **892<** | 904 | * | * | * | * | * | **898.0<** | **898.0<** |
| 1800-1900 | 570 | 624 | * | * | * | * | * | 597.0 | 597.0 |
| 1900-2000 | 414 | 382 | * | * | * | * | * | 398.0 | 398.0 |
| 2000-2100 | 369 | 335 | * | * | * | * | * | 352.0 | 352.0 |
| 2100-2200 | 283 | 316 | * | * | * | * | * | 299.5 | 299.5 |
| 2200-2300 | 228 | 247 | * | * | * | * | * | 237.5 | 237.5 |
| 2300-2400 | 173 | 199 | * | * | * | * | * | 186.0 | 186.0 |
| Totals | | | | | | | | | |
| 0700-1900 | 9123 | 8915 | * | * | * | * | * | 7226.8 | 7226.8 |
| 0600-2200 | 10351 | 10099 | * | * | * | * | * | 8433.7 | 8433.7 |
| 0600-0000 | 10752 | 10545 | * | * | * | * | * | 8857.2 | 8857.2 |
| 0000-0000 | 11194 | 10951 | * | * | * | * | * | 9269.5 | 9269.5 |
| AM Peak | 0900<br>778 | 1100<br>746 | 0700<br>653 | *<br>* | *<br>* | *<br>* | *<br>* | | |
| PM Peak | 1700<br>892 | 1600<br>925 | *<br>* | *<br>* | *<br>* | *<br>* | *<br>* | | |

* - No data.

# Vehicle Flow

**VehicleFlow-22**(Metric) **Site:** Site-10.0S
**Description:**Middle Rd.(30) North of QuarterMaster Rd(35)
**Filter time:**11:28 Tuesday, July 17, 2007 => 15:50 Wednesday, July 25, 2007
**Filter:** Cls(1 2 3 4 5 6 7 8 9 10 11 12 ) Dir(NESW) Sp(10,160) Headway(>0)
**Scheme:**Vehicle classification (ARX)



# MetroCount Traffic Executive
# Weekly Vehicle Counts

## WeeklyVehicle-15 -- English (ENU)

**Datasets:**

| | |
|---|---|
| **Site:** | **[Site-7] Middle Rd (30) South of Sugar King Rd (36)** |
| **Direction:** | 1 - North bound, A hit first., **Lane:** 0 |
| **Survey Duration:** | 12:09 Tuesday, July 17, 2007 => 15:19 Wednesday, July 25, 2007 |
| **File:** | C:\Program Files\MetroCount v316\User\Data\Site-725Jul2007.EC0 (Regular) |
| **Identifier:** | U8700MBT MC56-L5 [MC55] (c)Microcom 19Oct04 |
| **Algorithm:** | Factory default |
| **Data type:** | Axle sensors - Paired (Class/Speed/Count) |

**Profile:**

| | |
|---|---|
| **Filter time:** | **12:09 Tuesday, July 17, 2007 => 15:19 Wednesday, July 25, 2007** |
| **Included classes:** | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 |
| **Speed range:** | 10 - 160 km/h. |
| **Direction:** | North, East, South, West (bound) |
| **Separation:** | All - (Headway) |
| **Name:** | Factory default profile |
| **Scheme:** | Vehicle classification (ARX) |
| **Units:** | Metric (meter, kilometer, m/s, km/h, kg, tonne) |
| **In profile:** | Vehicles = 54089 / 54490 (99.26%) |

# Weekly Vehicle Counts

**WeeklyVehicle-15**
**Site:** Site-7.0N
**Description:** **Middle Rd (30) South of Sugar King Rd (36)**
**Filter time:** **12:09 Tuesday, July 17, 2007 => 15:19 Wednesday, July 25, 2007**
**Scheme:** Vehicle classification (ARX)
**Filter:** Cls(1 2 3 4 5 6 7 8 9 10 11 12 ) Dir(NESW) Sp(10,160) Headway(>0)

| Hour | Mon 16 Jul | Tue 17 Jul | Wed 18 Jul | Thu 19 Jul | Fri 20 Jul | Sat 21 Jul | Sun 22 Jul | Averages 1 - 5 | Averages 1 - 7 |
|---|---|---|---|---|---|---|---|---|---|
| 0000-0100 | * | * | 0 | 91 | 101 | 156 | 124 | 64.0 | 94.4 |
| 0100-0200 | * | * | 0 | 59 | 61 | 100 | 72 | 40.0 | 58.4 |
| 0200-0300 | * | * | 0 | 50 | 58 | 108 | 85 | 36.0 | 60.2 |
| 0300-0400 | * | * | 0 | 33 | 30 | 50 | 68 | 21.0 | 36.2 |
| 0400-0500 | * | * | 0 | 31 | 40 | 52 | 40 | 23.7 | 32.6 |
| 0500-0600 | * | * | 0 | 75 | 66 | 90 | 76 | 47.0 | 61.4 |
| 0600-0700 | * | * | 0 | 217 | 218 | 165 | 134 | 145.0 | 146.8 |
| 0700-0800 | * | * | 0 | 625 | 650 | 376 | 262 | **425.0<** | 382.6 |
| 0800-0900 | * | * | 0 | **634<** | 615 | 458 | 342 | 416.3 | 409.8 |
| 0900-1000 | * | * | 0 | 577 | 577 | 507 | **375<** | 384.7 | 407.2 |
| 1000-1100 | * | * | 0 | 550 | 629 | 517 | 360 | 393.0 | 411.2 |
| 1100-1200 | * | * | 0< | 559 | **655<** | **521<** | 331 | 404.7 | **413.2<** |
| 1200-1300 | * | 0 | 0 | 558 | 657 | 490 | 348 | 303.8 | 342.2 |
| 1300-1400 | * | 0 | 0 | 613 | 698 | 469 | 364 | 327.8 | 357.3 |
| 1400-1500 | * | 0 | 592 | **625<** | **716<** | 452 | 377 | **483.3<** | 460.3 |
| 1500-1600 | * | 0 | 572 | 560 | 667 | 461 | 337 | 449.8 | 432.8 |
| 1600-1700 | * | 0 | 585 | 618 | 669 | 473 | 325 | 468.0 | 445.0 |
| 1700-1800 | * | 0 | **599<** | 567 | 708 | **513<** | 401 | 468.5 | **464.7<** |
| 1800-1900 | * | 0 | 430 | 527 | 555 | 421 | 374 | 378.0 | 384.5 |
| 1900-2000 | * | 0 | 409 | 401 | 420 | 395 | **404<** | 307.5 | 338.2 |
| 2000-2100 | * | 0 | 304 | 318 | 367 | 298 | 337 | 247.3 | 270.7 |
| 2100-2200 | * | 0 | 257 | 252 | 322 | 260 | 270 | 207.8 | 226.8 |
| 2200-2300 | * | 0 | 209 | 202 | 238 | 235 | 194 | 162.3 | 179.7 |
| 2300-2400 | * | 0< | 138 | 131 | 205 | 184 | 148 | 118.5 | 134.3 |
| Totals | | | | | | | | | |
| 0700-1900 | * | * | 2778 | 7013 | 7796 | 5658 | 4196 | 4902.7 | 4910.8 |
| 0600-2200 | * | * | 3748 | 8201 | 9123 | 6776 | 5341 | 5810.2 | 5893.3 |
| 0600-0000 | * | * | 4095 | 8534 | 9566 | 7195 | 5683 | 6090.9 | 6207.3 |
| 0000-0000 | * | * | 4095 | 8873 | 9922 | 7751 | 6148 | 6322.6 | 6550.5 |
| AM Peak | * | * | 1100 | 0800 | 1100 | 1100 | 0900 | | |
| | * | * | 0 | 634 | 655 | 521 | 375 | | |
| PM Peak | * | 2300 | 1700 | 1400 | 1400 | 1700 | 1900 | | |
| | * | 0 | 599 | 625 | 716 | 513 | 404 | | |

* - No data.

# Weekly Vehicle Counts

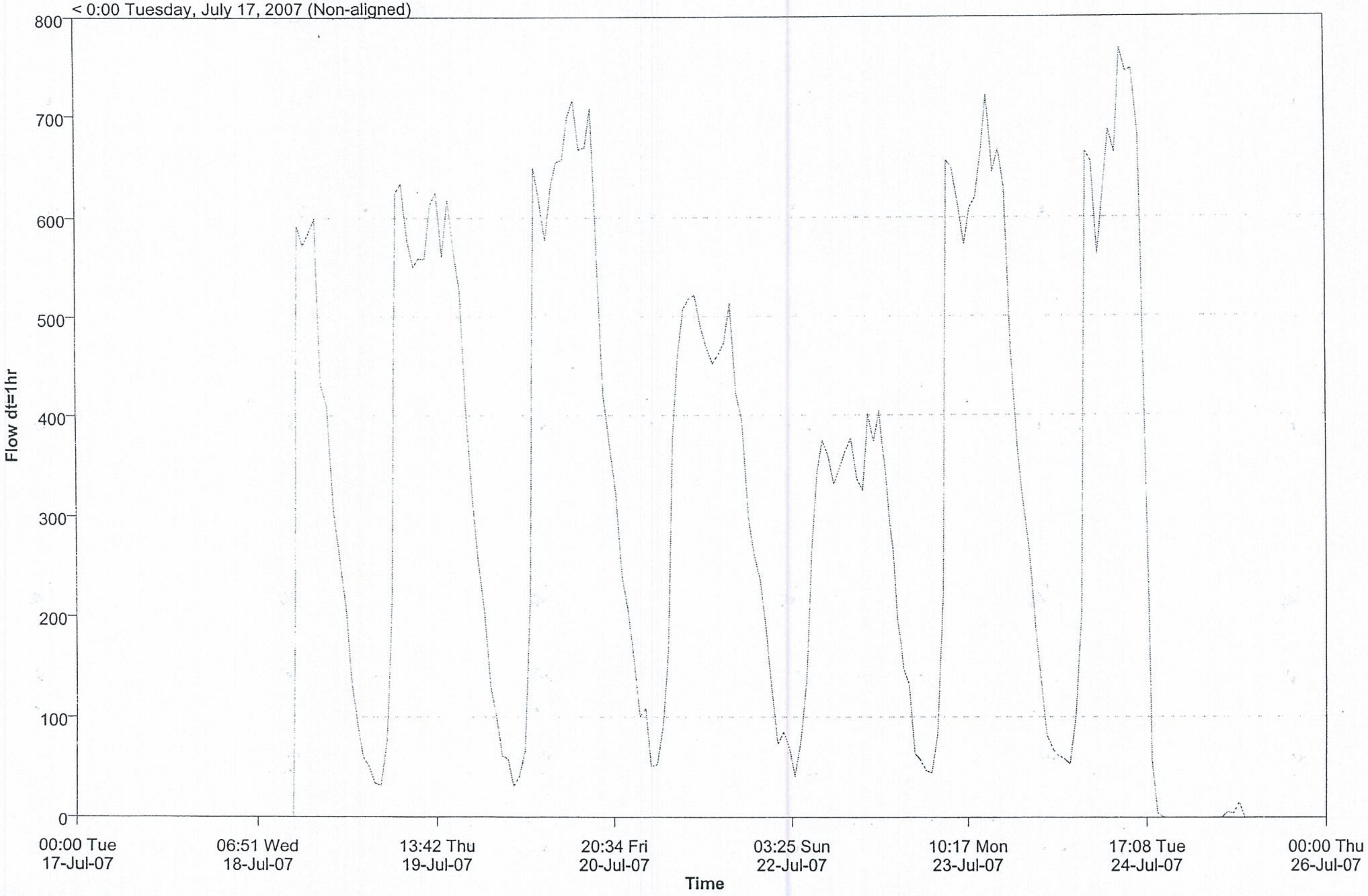
**WeeklyVehicle-15**
**Site:** Site-7.0N
**Description:** **Middle Rd (30) South of Sugar King Rd (36)**
**Filter time:** **12:09 Tuesday, July 17, 2007 => 15:19 Wednesday, July 25, 2007**
**Scheme:** Vehicle classification (ARX)
**Filter:** Cls(1 2 3 4 5 6 7 8 9 10 11 12 ) Dir(NESW) Sp(10,160) Headway(>0)

| | Mon<br>23 Jul | Tue<br>24 Jul | Wed<br>25 Jul | Thu<br>26 Jul | Fri<br>27 Jul | Sat<br>28 Jul | Sun<br>29 Jul | Averages<br>1 - 5 | <br>1 - 7 |
|---|---|---|---|---|---|---|---|---|---|
| Hour | | | | | | | | | |
| 0000-0100 | 132 | 82 | 0 | * | * | * | * | 71.3 | 71.3 |
| 0100-0200 | 63 | 68 | 0 | * | * | * | * | 43.7 | 43.7 |
| 0200-0300 | 57 | 61 | 0 | * | * | * | * | 39.3 | 39.3 |
| 0300-0400 | 46 | 58 | 0 | * | * | * | * | 34.7 | 34.7 |
| 0400-0500 | 44 | 53 | 0 | * | * | * | * | 32.3 | 32.3 |
| 0500-0600 | 82 | 100 | 0 | * | * | * | * | 60.7 | 60.7 |
| 0600-0700 | 222 | 200 | 0 | * | * | * | * | 140.7 | 140.7 |
| 0700-0800 | **656<** | 665 | 5 | * | * | * | * | **442.0<** | **442.0<** |
| 0800-0900 | 649 | 655 | 4 | * | * | * | * | 436.0 | 436.0 |
| 0900-1000 | 613 | 562 | **14<** | * | * | * | * | 396.3 | 396.3 |
| 1000-1100 | 573 | 625 | 0 | * | * | * | * | 399.3 | 399.3 |
| 1100-1200 | 608 | **686<** | 0 | * | * | * | * | 431.3 | 431.3 |
| 1200-1300 | 620 | 664 | 0 | * | * | * | * | 428.0 | 428.0 |
| 1300-1400 | 664 | **768<** | 0 | * | * | * | * | 477.3 | 477.3 |
| 1400-1500 | **721<** | 744 | 0 | * | * | * | * | 488.3 | 488.3 |
| 1500-1600 | 645 | 747 | 0 | * | * | * | * | 464.0 | 464.0 |
| 1600-1700 | 667 | 681 | * | * | * | * | * | **674.0<** | **674.0<** |
| 1700-1800 | 630 | 368 | * | * | * | * | * | 499.0 | 499.0 |
| 1800-1900 | 467 | 58 | * | * | * | * | * | 262.5 | 262.5 |
| 1900-2000 | 369 | 4 | * | * | * | * | * | 186.5 | 186.5 |
| 2000-2100 | 313 | 0 | * | * | * | * | * | 156.5 | 156.5 |
| 2100-2200 | 266 | 0 | * | * | * | * | * | 133.0 | 133.0 |
| 2200-2300 | 189 | 0 | * | * | * | * | * | 94.5 | 94.5 |
| 2300-2400 | 132 | 0 | * | * | * | * | * | 66.0 | 66.0 |
| Totals | | | | | | | | | |
| 0700-1900 | 7513 | 7223 | * | * | * | * | * | 5398.2 | 5398.2 |
| 0600-2200 | 8683 | 7427 | * | * | * | * | * | 6014.8 | 6014.8 |
| 0600-0000 | 9004 | 7427 | * | * | * | * | * | 6175.3 | 6175.3 |
| 0000-0000 | 9428 | 7849 | * | * | * | * | * | 6457.3 | 6457.3 |
| AM Peak | 0700 | 1100 | 0900 | * | * | * | * | | |
| | 656 | 686 | 14 | * | * | * | * | | |
| PM Peak | 1400 | 1300 | * | * | * | * | * | | |
| | 721 | 768 | * | * | * | * | * | | |

* - No data.

# Vehicle Flow

**VehicleFlow-16**(Metric) **Site:** Site-7.0N
**Description:**Middle Rd (30) South of Sugar King Rd (36)
**Filter time:**12:09 Tuesday, July 17, 2007 => 15:19 Wednesday, July 25, 2007
**Filter:** Cls(1 2 3 4 5 6 7 8 9 10 11 12 ) Dir(NESW) Sp(10,160) Headway(>0)
**Scheme:**Vehicle classification (ARX)



# MetroCount Traffic Executive
# Weekly Vehicle Counts

## WeeklyVehicle-17 -- English (ENU)

### Datasets:

**Site:** **[Site-8] Beach rd.(33) South of Sugar King Rd. (36)**
**Direction:** 1 - North bound, A hit first., **Lane:** 0
**Survey Duration:** 11:19 Tuesday, July 17, 2007 => 15:33 Wednesday, July 25, 2007
**File:** C:\Program Files\MetroCount v316\User\Data\Site-825Jul2007.EC0 (Regular)
**Identifier:** U74947WQ MC56-L5 [MC55] (c)Microcom 19Oct04
**Algorithm:** Factory default
**Data type:** Axle sensors - Paired (Class/Speed/Count)

### Profile:

**Filter time:** **11:19 Tuesday, July 17, 2007 => 15:33 Wednesday, July 25, 2007**
**Included classes:** 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
**Speed range:** 10 - 160 km/h.
**Direction:** North, East, South, West (bound)
**Separation:** All - (Headway)
**Name:** Factory default profile
**Scheme:** Vehicle classification (ARX)
**Units:** Metric (meter, kilometer, m/s, km/h, kg, tonne)
**In profile:** Vehicles = 59002 / 59169 (99.72%)

# Weekly Vehicle Counts

**WeeklyVehicle-17**
**Site:** Site-8.0N
**Description:** **Beach rd.(33) South of Sugar King Rd. (36)**
**Filter time:** **11:19 Tuesday, July 17, 2007 => 15:33 Wednesday, July 25, 2007**
**Scheme:** Vehicle classification (ARX)
**Filter:** Cls(1 2 3 4 5 6 7 8 9 10 11 12 ) Dir(NESW) Sp(10,160) Headway(>0)

| | **Mon** | **Tue** | **Wed** | **Thu** | **Fri** | **Sat** | **Sun** | **Averages** | |
|---|---|---|---|---|---|---|---|---|---|
| | **16 Jul** | **17 Jul** | **18 Jul** | **19 Jul** | **20 Jul** | **21 Jul** | **22 Jul** | **1 - 5** | **1 - 7** |
| **Hour** | | | | | | | | | |
| 0000-0100 | * | * | 0 | 108 | 110 | 160 | 120 | 72.7 | 99.6 |
| 0100-0200 | * | * | 0 | 75 | 85 | 124 | 108 | 53.3 | 78.4 |
| 0200-0300 | * | * | 0 | 67 | 75 | 151 | 111 | 47.3 | 80.8 |
| 0300-0400 | * | * | 0 | 24 | 38 | 46 | 37 | 20.7 | 29.0 |
| 0400-0500 | * | * | 0 | 37 | 42 | 55 | 40 | 26.3 | 34.8 |
| 0500-0600 | * | * | 0 | 57 | 71 | 75 | 60 | 42.7 | 52.6 |
| 0600-0700 | * | * | 0 | 172 | 216 | 173 | 121 | 129.3 | 136.4 |
| 0700-0800 | * | * | 0 | 510 | 495 | 328 | 262 | 335.0 | 319.0 |
| 0800-0900 | * | * | 0 | 521 | 522 | 423 | 379 | 347.7 | 369.0 |
| 0900-1000 | * | * | 403 | **528<** | 554 | 445 | 364 | 495.0 | 458.8 |
| 1000-1100 | * | * | **506<** | 505 | 579 | **476<** | **475<** | **530.0<** | **508.2<** |
| 1100-1200 | * | 0 | 474 | 527 | **712<** | 82 | 380 | 428.3 | 362.5 |
| 1200-1300 | * | 0 | 635 | 608 | 670 | **536<** | 490 | 478.3 | 489.8 |
| 1300-1400 | * | 0 | 638 | 571 | 153 | 496 | 486 | 340.5 | 390.7 |
| 1400-1500 | * | 0 | 609 | 624 | 616 | 515 | 485 | 462.3 | 474.8 |
| 1500-1600 | * | 0 | 243 | 690 | 576 | 501 | 439 | 377.3 | 408.2 |
| 1600-1700 | * | 0 | 180 | 673 | 717 | 513 | 416 | 392.5 | 416.5 |
| 1700-1800 | * | 0 | **645<** | **709<** | **746<** | 526 | **531<** | **525.0<** | **526.2<** |
| 1800-1900 | * | 0 | 538 | 590 | 602 | 521 | 431 | 432.5 | 447.0 |
| 1900-2000 | * | 0 | 625 | 594 | 527 | 446 | 15 | 436.5 | 367.8 |
| 2000-2100 | * | 0 | 491 | 416 | 453 | 365 | 373 | 340.0 | 349.7 |
| 2100-2200 | * | 0 | 396 | 315 | 423 | 464 | 273 | 283.5 | 311.8 |
| 2200-2300 | * | 0 | 249 | 266 | 352 | 300 | 212 | 216.8 | 229.8 |
| 2300-2400 | * | 0< | 189 | 164 | 259 | 234 | 153 | 153.0 | 166.5 |
| **Totals** | | | | | | | | | |
| 0700-1900 | * | * | 4871 | 7056 | 6942 | 5362 | 5138 | 5144.2 | 5170.7 |
| 0600-2200 | * | * | 6383 | 8553 | 8561 | 6810 | 5920 | 6333.5 | 6336.4 |
| 0600-0000 | * | * | 6821 | 8983 | 9172 | 7344 | 6285 | 6703.3 | 6732.7 |
| 0000-0000 | * | * | 6821 | 9351 | 9593 | 7955 | 6761 | 6966.3 | 7107.9 |
| **AM Peak** | * | * | 1000 | 0900 | 1100 | 1000 | 1000 | | |
| | * | * | 506 | 528 | 712 | 476 | 475 | | |
| **PM Peak** | * | 2300 | 1700 | 1700 | 1700 | 1200 | 1700 | | |
| | * | 0 | 645 | 709 | 746 | 536 | 531 | | |

* - No data.

# Weekly Vehicle Counts

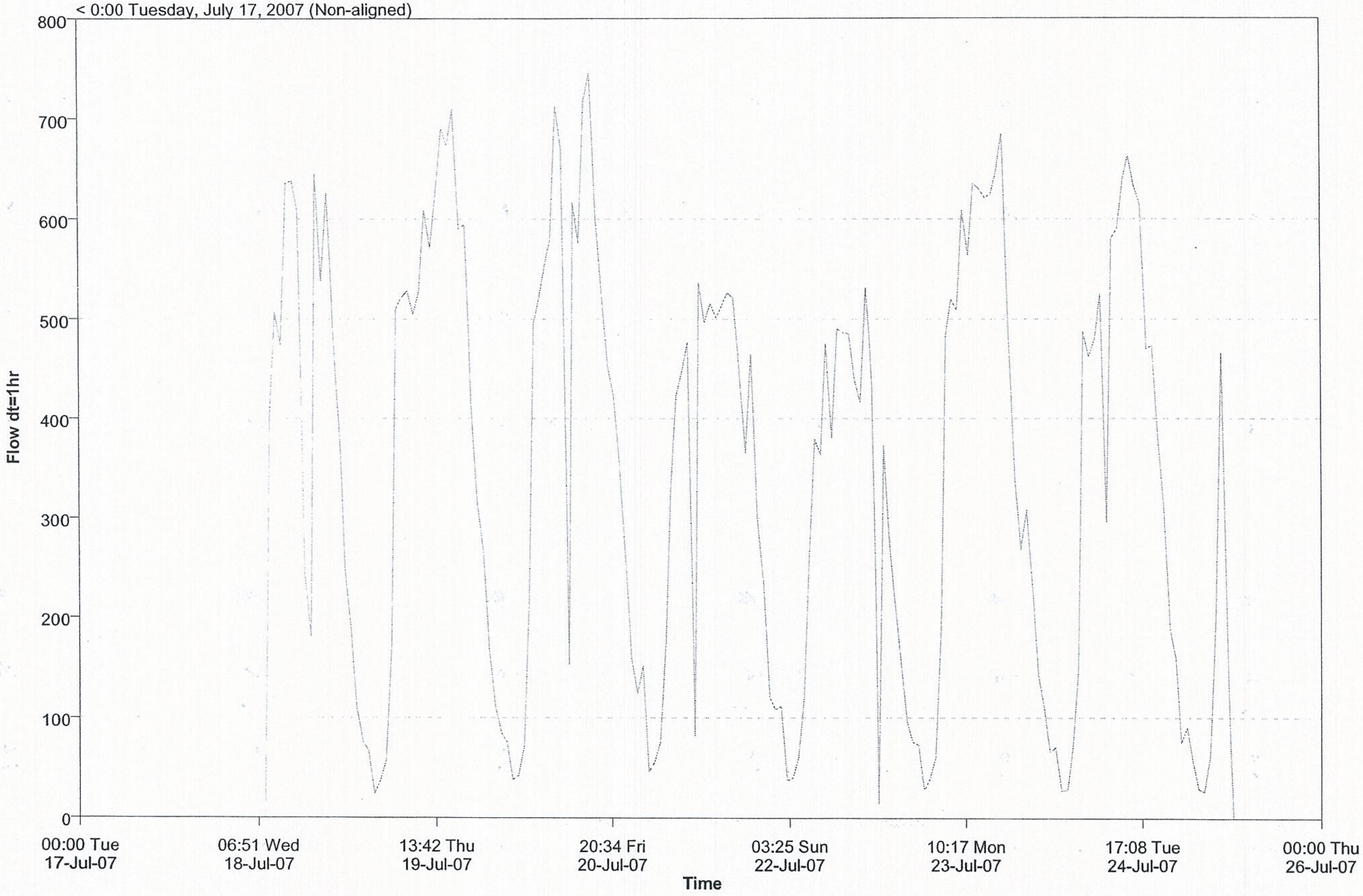
**WeeklyVehicle-17**
**Site:** Site-8.0N
**Description:** **Beach rd.(33) South of Sugar King Rd. (36)**
**Filter time:** **11:19 Tuesday, July 17, 2007 => 15:33 Wednesday, July 25, 2007**
**Scheme:** Vehicle classification (ARX)
**Filter:** Cls(1 2 3 4 5 6 7 8 9 10 11 12 ) Dir(NESW) Sp(10,160) Headway(>0)

| | Mon | Tue | Wed | Thu | Fri | Sat | Sun | Averages | |
|---|---|---|---|---|---|---|---|---|---|
| | 23 Jul | 24 Jul | 25 Jul | 26 Jul | 27 Jul | 28 Jul | 29 Jul | 1 - 5 | 1 - 7 |
| Hour | | | | | | | | | |
| 0000-0100 | 95 | 108 | 75 | * | * | * | * | 92.7 | 92.7 |
| 0100-0200 | 75 | 65 | 90 | * | * | * | * | 76.7 | 76.7 |
| 0200-0300 | 72 | 70 | 54 | * | * | * | * | 65.3 | 65.3 |
| 0300-0400 | 28 | 27 | 29 | * | * | * | * | 28.0 | 28.0 |
| 0400-0500 | 39 | 28 | 26 | * | * | * | * | 31.0 | 31.0 |
| 0500-0600 | 60 | 69 | 61 | * | * | * | * | 63.3 | 63.3 |
| 0600-0700 | 188 | 149 | 194 | * | * | * | * | 177.0 | 177.0 |
| 0700-0800 | 482 | 487 | **466<** | * | * | * | * | **478.3<** | **478.3<** |
| 0800-0900 | 519 | 462 | 209 | * | * | * | * | 396.7 | 396.7 |
| 0900-1000 | 509 | 480 | 0 | * | * | * | * | 329.7 | 329.7 |
| 1000-1100 | **608<** | **525<** | 0 | * | * | * | * | 377.7 | 377.7 |
| 1100-1200 | 564 | 296 | 0 | * | * | * | * | 286.7 | 286.7 |
| 1200-1300 | 635 | 580 | 0 | * | * | * | * | 405.0 | 405.0 |
| 1300-1400 | 630 | 590 | 0 | * | * | * | * | 406.7 | 406.7 |
| 1400-1500 | 621 | 639 | 0 | * | * | * | * | 420.0 | 420.0 |
| 1500-1600 | 624 | **663<** | 0 | * | * | * | * | 429.0 | 429.0 |
| 1600-1700 | 649 | 633 | * | * | * | * | * | 641.0 | 641.0 |
| 1700-1800 | **685<** | 614 | * | * | * | * | * | **649.5<** | **649.5<** |
| 1800-1900 | 485 | 470 | * | * | * | * | * | 477.5 | 477.5 |
| 1900-2000 | 336 | 473 | * | * | * | * | * | 404.5 | 404.5 |
| 2000-2100 | 268 | 379 | * | * | * | * | * | 323.5 | 323.5 |
| 2100-2200 | 308 | 309 | * | * | * | * | * | 308.5 | 308.5 |
| 2200-2300 | 230 | 189 | * | * | * | * | * | 209.5 | 209.5 |
| 2300-2400 | 142 | 160 | * | * | * | * | * | 151.0 | 151.0 |
| Totals | | | | | | | | | |
| 0700-1900 | 7011 | 6439 | * | * | * | * | * | 5297.7 | 5297.7 |
| 0600-2200 | 8111 | 7749 | * | * | * | * | * | 6511.2 | 6511.2 |
| 0600-0000 | 8483 | 8098 | * | * | * | * | * | 6871.7 | 6871.7 |
| 0000-0000 | 8852 | 8465 | * | * | * | * | * | 7228.7 | 7228.7 |
| AM Peak | 1000 | 1000 | 0700 | * | * | * | * | | |
| | 608 | 525 | 466 | * | * | * | * | | |
| PM Peak | 1700 | 1500 | * | * | * | * | * | | |
| | 685 | 663 | * | * | * | * | * | | |

* - No data.

# Vehicle Flow

**VehicleFlow-18**(Metric) **Site:** Site-8.0N
**Description:**Beach rd.(33) South of Sugar King Rd. (36)
**Filter time:**11:19 Tuesday, July 17, 2007 => 15:33 Wednesday, July 25, 2007
**Filter:** Cls(1 2 3 4 5 6 7 8 9 10 11 12 ) Dir(NESW) Sp(10,160) Headway(>0)
**Scheme:**Vehicle classification (ARX)



# MetroCount Traffic Executive
# Weekly Vehicle Counts

## WeeklyVehicle-19 -- English (ENU)

### Datasets:

| | |
|---|---|
| **Site:** | **[Site-9] Gualo Rai (311),between middle rd. to beach rd** |
| **Direction:** | 4 - West bound, A hit first., **Lane:** 0 |
| **Survey Duration:** | 11:24 Tuesday, July 17, 2007 => 15:45 Wednesday, July 25, 2007 |
| **File:** | C:\Program Files\MetroCount v316\User\Data\Site-925Jul2007.EC0 (Regular) |
| **Identifier:** | U838YAFH MC56-L5 [MC55] (c)Microcom 19Oct04 |
| **Algorithm:** | Factory default |
| **Data type:** | Axle sensors - Paired (Class/Speed/Count) |

### Profile:

| | |
|---|---|
| **Filter time:** | **11:24 Tuesday, July 17, 2007 => 15:45 Wednesday, July 25, 2007** |
| **Included classes:** | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 |
| **Speed range:** | 10 - 160 km/h. |
| **Direction:** | North, East, South, West (bound) |
| **Separation:** | All - (Headway) |
| **Name:** | Factory default profile |
| **Scheme:** | Vehicle classification (ARX) |
| **Units:** | Metric (meter, kilometer, m/s, km/h, kg, tonne) |
| **In profile:** | Vehicles = 2876 / 3033 (94.82%) |

# Weekly Vehicle Counts

**WeeklyVehicle-19**
**Site:** Site-9.0W
**Description:** **Gualo Rai (311),between middle rd. to beach rd**
**Filter time:** **11:24 Tuesday, July 17, 2007 => 15:45 Wednesday, July 25, 2007**
**Scheme:** Vehicle classification (ARX)
**Filter:** Cls(1 2 3 4 5 6 7 8 9 10 11 12 ) Dir(NESW) Sp(10,160) Headway(>0)

| | Mon | Tue | Wed | Thu | Fri | Sat | Sun | Averages | |
|---|---|---|---|---|---|---|---|---|---|
| | 16 Jul | 17 Jul | 18 Jul | 19 Jul | 20 Jul | 21 Jul | 22 Jul | 1 - 5 | 1 - 7 |
| Hour | | | | | | | | | |
| 0000-0100 | * | * | 0 | 10 | 6 | 5 | 3 | 5.3 | 4.8 |
| 0100-0200 | * | * | 0 | 5 | 4 | 5 | 6 | 3.0 | 4.0 |
| 0200-0300 | * | * | 0 | 0 | 0 | 6 | 4 | 0.0 | 2.0 |
| 0300-0400 | * | * | 0 | 3 | 0 | 2 | 0 | 1.0 | 1.0 |
| 0400-0500 | * | * | 0 | 1 | 2 | 0 | 2 | 1.0 | 1.0 |
| 0500-0600 | * | * | 0 | 1 | 4 | 3 | 2 | 1.7 | 2.0 |
| 0600-0700 | * | * | 0 | 4 | 3 | 5 | 5 | 2.3 | 3.4 |
| 0700-0800 | * | * | 0 | 16 | 23 | 14 | 6 | 13.0 | 11.8 |
| 0800-0900 | * | * | 0 | 22 | 20 | 27 | 13 | 14.0 | 16.4 |
| 0900-1000 | * | * | 13 | 36 | 23 | 21 | 14 | 24.0 | 21.4 |
| 1000-1100 | * | * | **28<** | 32 | **29<** | 24 | **17<** | **29.7<** | **26.0<** |
| 1100-1200 | * | 0 | 25 | **40<** | 27 | **30<** | 16 | 23.0 | 23.0 |
| 1200-1300 | * | 0 | 36 | 33 | 28 | 17 | 17 | 24.3 | 21.8 |
| 1300-1400 | * | 0 | 34 | **41<** | 31 | 14 | 17 | 26.5 | 22.8 |
| 1400-1500 | * | 0 | 34 | 31 | 46 | 22 | 20 | 27.8 | 25.5 |
| 1500-1600 | * | 0 | **47<** | 34 | 41 | 18 | 13 | 30.5 | 25.5 |
| 1600-1700 | * | 0 | 34 | 40 | 41 | 29 | 15 | 28.8 | 26.5 |
| 1700-1800 | * | 0 | 41 | 27 | **54<** | 21 | **24<** | **30.5<** | **27.8<** |
| 1800-1900 | * | 0 | 18 | 23 | 26 | 11 | 19 | 16.8 | 16.2 |
| 1900-2000 | * | 0 | 20 | 19 | 16 | 17 | 16 | 13.8 | 14.7 |
| 2000-2100 | * | 0 | 16 | 12 | 11 | 15 | 14 | 9.8 | 11.3 |
| 2100-2200 | * | 0 | 11 | 12 | 18 | **62<** | 6 | 10.3 | 18.2 |
| 2200-2300 | * | 0 | 9 | 8 | 14 | 29 | 6 | 7.8 | 11.0 |
| 2300-2400 | * | 0< | 9 | 2 | 8 | 6 | 6 | 4.8 | 5.2 |
| Totals | | | | | | | | | |
| 0700-1900 | * | * | 310 | 375 | 389 | 248 | 191 | 288.7 | 264.8 |
| 0600-2200 | * | * | 357 | 422 | 437 | 347 | 232 | 324.8 | 312.3 |
| 0600-0000 | * | * | 375 | 432 | 459 | 382 | 244 | 337.3 | 328.5 |
| 0000-0000 | * | * | 375 | 452 | 475 | 403 | 261 | 349.3 | 343.3 |
| AM Peak | * | * | 1000 | 1100 | 1000 | 1100 | 1000 | | |
| | * | * | 28 | 40 | 29 | 30 | 17 | | |
| PM Peak | * | 2300 | 1500 | 1300 | 1700 | 2100 | 1700 | | |
| | * | 0 | 47 | 41 | 54 | 62 | 24 | | |

* - No data.

# Weekly Vehicle Counts

**WeeklyVehicle-19**

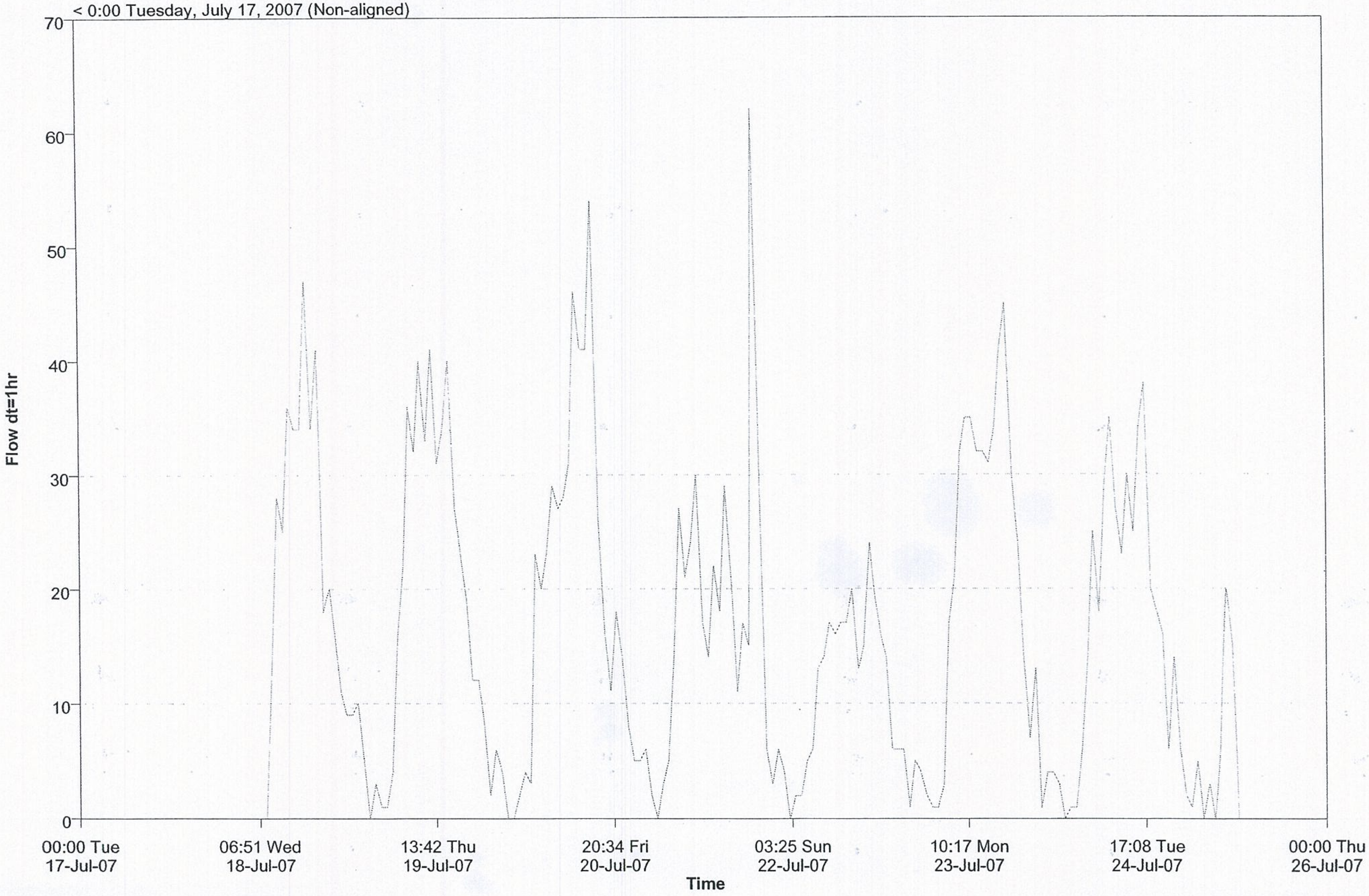
| | |
|---|---|
| **Site:** | Site-9.0W |
| **Description:** | **Gualo Rai (311),between middle rd. to beach rd** |
| **Filter time:** | **11:24 Tuesday, July 17, 2007 => 15:45 Wednesday, July 25, 2007** |
| **Scheme:** | Vehicle classification (ARX) |
| **Filter:** | Cls(1 2 3 4 5 6 7 8 9 10 11 12 ) Dir(NESW) Sp(10,160) Headway(>0) |

| | Mon<br>23 Jul | Tue<br>24 Jul | Wed<br>25 Jul | Thu<br>26 Jul | Fri<br>27 Jul | Sat<br>28 Jul | Sun<br>29 Jul | Averages<br>1 - 5 | <br>1 - 7 |
|---|---|---|---|---|---|---|---|---|---|
| Hour | | | | | | | | | |
| 0000-0100 | 1 | 4 | 2 | * | * | * | * | 2.3 | 2.3 |
| 0100-0200 | 5 | 4 | 1 | * | * | * | * | 3.3 | 3.3 |
| 0200-0300 | 4 | 3 | 5 | * | * | * | * | 4.0 | 4.0 |
| 0300-0400 | 2 | 0 | 0 | * | * | * | * | 0.7 | 0.7 |
| 0400-0500 | 1 | 1 | 3 | * | * | * | * | 1.7 | 1.7 |
| 0500-0600 | 1 | 1 | 0 | * | * | * | * | 0.7 | 0.7 |
| 0600-0700 | 3 | 6 | 6 | * | * | * | * | 5.0 | 5.0 |
| 0700-0800 | 17 | 14 | **20<** | * | * | * | * | 17.0 | 17.0 |
| 0800-0900 | 21 | 25 | 15 | * | * | * | * | 20.3 | 20.3 |
| 0900-1000 | 32 | 18 | 0 | * | * | * | * | 16.7 | 16.7 |
| 1000-1100 | 35 | 29 | 0 | * | * | * | * | 21.3 | 21.3 |
| 1100-1200 | **35<** | **35<** | 0 | * | * | * | * | **23.3<** | **23.3<** |
| 1200-1300 | 32 | 27 | 0 | * | * | * | * | 19.7 | 19.7 |
| 1300-1400 | 32 | 23 | 0 | * | * | * | * | 18.3 | 18.3 |
| 1400-1500 | 31 | 30 | 0 | * | * | * | * | 20.3 | 20.3 |
| 1500-1600 | 34 | 25 | 0 | * | * | * | * | 19.7 | 19.7 |
| 1600-1700 | 41 | 34 | * | * | * | * | * | 37.5 | 37.5 |
| 1700-1800 | **45<** | **38<** | * | * | * | * | * | **41.5<** | **41.5<** |
| 1800-1900 | 30 | 20 | * | * | * | * | * | 25.0 | 25.0 |
| 1900-2000 | 24 | 18 | * | * | * | * | * | 21.0 | 21.0 |
| 2000-2100 | 14 | 16 | * | * | * | * | * | 15.0 | 15.0 |
| 2100-2200 | 7 | 6 | * | * | * | * | * | 6.5 | 6.5 |
| 2200-2300 | 13 | 14 | * | * | * | * | * | 13.5 | 13.5 |
| 2300-2400 | 1 | 6 | * | * | * | * | * | 3.5 | 3.5 |
| Totals | | | | | | | | | |
| 0700-1900 | 385 | 318 | * | * | * | * | * | 280.7 | 280.7 |
| 0600-2200 | 433 | 364 | * | * | * | * | * | 328.2 | 328.2 |
| 0600-0000 | 447 | 384 | * | * | * | * | * | 345.2 | 345.2 |
| 0000-0000 | 461 | 397 | * | * | * | * | * | 357.8 | 357.8 |
| AM Peak | 1100 | 1100 | 0700 | * | * | * | * | | |
| | 35 | 35 | 20 | * | * | * | * | | |
| PM Peak | 1700 | 1700 | * | * | * | * | * | | |
| | 45 | 38 | * | * | * | * | * | | |

* - No data.

# Vehicle Flow

**VehicleFlow-20**(Metric) **Site:** Site-9.0W
**Description:**Gualo Rai (311),between middle rd. to beach rd
**Filter time:**11:24 Tuesday, July 17, 2007 => 15:45 Wednesday, July 25, 2007
**Filter:** Cls(1 2 3 4 5 6 7 8 9 10 11 12 ) Dir(NESW) Sp(10,160) Headway(>0)
**Scheme:**Vehicle classification (ARX)



# *Appendix C*
# *USFWS Reports*

# FINAL COORDINATION ACT REPORT
# GARAPAN FLOOD CONTROL STUDY
# SAIPAN, COMMONWEALTH OF
# THE NORTHERN MARIANA ISLANDS

UNITED STATES DEPARTMENT OF THE INTERIOR

FISH AND WILDLIFE SERVICE

HONOLULU FIELD OFFICE

July 1985

Prepared for the U.S. Army Engineer District, Honolulu

## PREFACE

This report was prepared by John Ford, Andy Yuen, and Yvonne Ching, and is based on data gathered from existing literature and from Service field investigations conducted by Thomas Hablett, Gerald Ludwig, and Peggy Kohl from April 30 to May 11, 1979; and by John Ford and Commonwealth of the Northern Mariana Islands (CNMI) biologists on November 20, 1984. Data from Service forest bird surveys were provided by John Engbring, Supervisory Wildlife Biologist. Project alternatives were provided by Rudy Mina, Planning Branch, Engineering Division, Honolulu District. We wish to acknowledge Drs. Tom Lemke and Thane Pratt of CNMI Division of Fish and Wildlife for their excellent logistical and field support, and for their assistance in impact identification and analysis. We also gratefully thank Mr. Nicholas Guerrero, Director of the CNMI Department of Natural Resources.

## DESCRIPTION OF PROJECT AREA

Garapan village is located on Saipan's west-central coast (Fig. 1). Prior to its nearly complete destruction during World War II, it was the principal population center on Saipan. Extensive rebuilding was completed after invasion by U. S. forces to facilitate administrative services and storage of war-related materials. Since the late 1940's, most of the U. S. military buildings have deteriorated or have been replaced by residential or light commercial buildings. Garapan is also the site of three major hotels. These are located along the white sand Micro Beach that borders Saipan Lagoon.

Inland from this coastal plain area, the land rapidly rises in a series of terraces that form Saipan's central limestone hill range. Mt. Tagpachau, Saipan's highest elevation (1,555 feet), is about 2.5 miles southeast of the village. The slopes of the geologically complex Tagpachau limestone ridge are dissected by steep ravines and occasional nearly vertical fault cliffs (Ref. 2). The narrow ravines and areas along the cliffs appear to have been shrub or forest vegetation in 1944. Many of the remaining terraces were cleared and cultivated in what appears to be sugar cane. Aerial photographs from 1978 show little evidence of farming along the slopes above Garapan.

There are no perennial streams within the project area. Deep valleys on the hillsides contain intermittent stream channels. The watershed within the project area covers 1.9 square miles (Ref. 15 and 16). Three wetland areas totalling about 32.1 acres in area are present within the Garapan watershed (Fig. 3). The largest is located in the American Memorial Park, just southwest of Tanapag Harbor (Fig. 3). This wetland covers an area of

Alternative C is similar to Alternative B except that the 1,800-foot long outlet channel would run along the Island Power Road (Fig. 5). The outlet channel would discharge into Saipan Lagoon south of the Hafa Adai Hotel. The channel would be trapezoidal in shape and would be riprap lined in areas of high water velocities. This alternative would affect 27 private lots and would require the relocation of 5 residences.

Alternative D has the same upland channel location as Alternative A (Fig. 6). This alternative would use the main Garapan wetland as a ponding basin for flood flows. The maximum storage capacity within the area is about 112 acre-feet over an area of 43 acres. The wetland would be graded to connect the ponds and create one large pond. The outflow channel would have an invert elevation set at +2.00 feet above mean sea level. The flood waters would discharge into Tanapag Harbor through four box culverts at Beach Road.

Alternative E has the same upland channel location as Alternative A (Fig. 7). However, the outlet channel is about 500 feet longer and detours around the main Garapan wetland. Flood waters would discharge into Tanapag Harbor.

Alternative F is a non-structural alternative that would require the permanent relocation of people and contents from flood prone areas or flood proofing buildings in the flood zone.

## TERRESTRIAL AND AQUATIC RESOURCES WITHOUT THE PROJECT

Previously cleared areas in the Garapan watershed have been revegetated with nearly pure stands of tangantangan (Leucaena leucocephala). The closed tangantangan canopy is 15-20 feet high and dense enough to inhibit extensive undergrowth in the more xeric hillside habitats. Ravines, however, have deeper soils that retain water better than the slopes. In these areas, undergrowth is more diversified with dense areas of grasses and tigre (Sansevieria trifasciata). Pago (Hibiscus tiliaceus), papao-apaka (Alocasia macrorrhiza) and kafu (Pandanus fragans) are also important constituents of the damper tangantangan areas. Dominant vegetation observed in the Garapan watershed is listed in Appendix 1.

The remaining forest vegetation is generally dominated by a mixture of introduced food or ornamental trees along with kafu, bamboo (Bambusa vulgaris), pago and ironwood (Casuarina litorea). Typical strand vegetation observed along the beach includes the beach morning glory (Ipomoea pes-caprae), pago, coconut (Cocos nucifera), ironwood and various grasses and shrubs. Urban vegetation includes many of the previously mentioned species as well as the flame tree (Delonix regia), a variety of garden vegetables and ornamental shrubs.

tidal flats along the shoreline of the lagoon. Lemke (1983, unpublished) listed six species of wading birds and 14 species of migratory shorebirds known from Saipan. Most of these species utilize the tidal flats adjacent to the American Memorial Park as resting and foraging habitat (Figure 16).

The Common Moorhen, Mariana Mallard (Anas oustaleti), Nightingale Reed Warbler, La Perouse's Megapode (Megapodius laperouse), and Vanikoro Swiftlet are listed endangered species. Although no endangered Micronesian Megapodes have been recorded from the Garapan watershed, a small population exists on Northern Saipan (Ref. 6). The upper Garapan watershed may be suitable habitat for this bird.

Marianas fruit bat (Pteropus mariannus mariannus) may be present in this area, but was not observed during the 1979 survey (Ref. 19). At one time, the endangered Mariana Mallard may have been found in the wetlands of the lower watershed; however, it is not known to reside there now.

Two Common Moorhens, a Black-Crowned Night Heron (Nycticorax nycticorax), two Mariana Fruit-Doves, two Nightingale Reed Warblers, and four Rufous Fronted Fantails were observed within the American Memorial Park wetland by Service and CNMI biologists during their survey on November 20, 1984.

A standing water body within the American Memorial Park provides a curious habitat for an estuarine fish. The small pond is linked with Tanapag Harbor by a drainage culvert during freshets. Apparently during these events, juveniles Megalops cyprinoides migrate into the pond and become trapped there by receding flows. At least 3 large adults (1.5 to 2 ft. in length) were observed in the shallow stagnant pond by Service and CNMI biologists in November 1984.

The nearshore marine environment within the study area can be generally described as sandy algae-sea grass (Enhalus acoroides and Halophila minor) habitat (Appendix 4) that is inhabited by at least 31 species of fish (Appendix 5) and an unknown variety of invertebrates (Ref. 1 and 19). The dock and shoreline substrate at the southern boundary of the site is rubble that appears to have resulted from previous dredging and deterioration of the dock and shoreline seawall. The rubble along the outer edge of the basin is often exposed at low tide. This habitat (Fig. 8) (Table 1) is frequented by schools of cardinal fish, juvenile squirrel fish, damselfish, surgeonfish, rabbitfish, snappers, goatfish, an occasional eel and a variety of gobies and blennies (Appendix 5). Approximately 5% of the bottom is covered with living coral (Pocillopora damicornis). The bottom of the dredged area is sandy and is about 90% covered by a variety of algae and sea grasses.

Besides A. formosa, the most obvious invertebrates present were sea cucumbers (0.5 per m2) (Fig. 11) found on sandy substrate between coral growths. Species observed included Holothuria atra (most common), H. axiologa, H. edulis, Synapta maculata, and Bohadchia argus. Also present were unidentified invertebrates including crabs, a variety of sponges (Fig. 12), hydrozoan corals, bryozoans, and various worms.

These patch reefs apparently represent a unique environment within Saipan Lagoon (Fig. 4). Amesbury et al (Ref. 1) highly recommended preservation of this area because of the great diversity of fish species present. Interviews with boat operators that cater to tourist skin divers indicated that this spot is highly valuable to them because of its beauty, easy accessibility, and safety. Threatened Green Sea Turtles (Chelonia mydas) and Endangered Hawksbill Turtles (Eretmochelys imbricata) are occasionally observed on the reef off Garapan Dock (Ref. 21).

The northern site for the outlet channel near the American Memorial Park, is presently being used as a small boat harbor (Fig. 13). Its protected nature and proximity to hotels and to Managasan Island make it a prime site for tour boats, three of which were present during the 1979 survey. The site also serves as a mooring area for pleasure crafts.

Erosion of coral fill, in areas where sheet piling and wood retaining walls have deteriorated, has resulted in excessive turbidity. Poor visibility made the site difficult to survey during 1979.

Most of the substrate is sand, silt or rubble with occasional small corals. The bottom has an abundance of scrap metal and other debris, possibly artifacts from World War II. A wrecked World War II barge was present at the harbor entrance. A small boat harbor under construction at the time of the American invasion lies just north of the entrance. The remains of many landing crafts, reminders of World War II, are strewn across the nearby reef (Fig. 14) and around Garapan Dock.

Benthic marine vegetation is primarily Halimeda spp., Padina spp. with scattered Sargassum spp., Halodule uninervis, and Enhalus acoroides (Table 4). Deeper into the anchorage, murky water prevented an accurate estimation of vegetation cover, but Halimeda spp. and Padina spp. appeared to be dominant. Sea cucumbers, most likely Holothuria atra, were scattered across the bottom. The most common invertebrates along the shore were neritid and littorine mollusks.

A concern discussed in our draft 2(b) Coordination Act Report (February 25, 1985) was that the periodic introduction of flood waters into the marsh would reduce the salinity of the marsh waters and would negatively affect the wetland fern *Acrostichum aureum* and other components of the endangered Mariana Gallinule habitat.

Our report stated that the fern *A. aureum* flourishes in brackish water wetlands. The fern is not an obligate brackish water plant and flourishes in *both* freshwater and brackish water wetlands (D. Herbst, pers. comm.). This fern is tolerant of brackish water and has been found on the landward edge of mangroves swamps and in other mixohaline coastal wetlands.

The decrease in salinity of marsh waters would be temporary since the outflow time for 112 acre-feet would range from 3.7 to 5.0 hours. The reduction in salinity in the wetland resulting from the periodic flood water input would not have an adverse effect on *A. aureum* or the other vegetation components of the Garapan Marsh.

The use of the Garapan Marsh as a flooding basin does have the potential for introducing and bioaccumulating toxic substances in wetland fauna. Urban growth within the watershed may introduce petrochemicals, biocides, and other hazardous materials to the wetland.

Relative to the other alternatives, this alternative would result in a lower suspended sediment load being introduced into Tanapag Harbor because of the ponding and settling effects within the Garapan Marsh. This would result in a reduced impact to nearshore water quality and seagrass beds.

The removal of the asphalt fill areas in the Garapan wetland would require the construction of temporary causeways into the marsh. This construction would have temporary negative impacts on wetland vegetation and waterbird habitats. However, the removal of the asphalt fill would result in a net gain of wetland and waterbird habitat by removing fast lands within the wetland. From a wildlife standpoint, however, the removal of the fill is not necessary.

### Alternative Plan E

In our draft 2(b) Coordination Act Report, the Service stated that the drainage channel alternative that skirted the marsh would have the least adverse impact on the Garapan wetland. An important qualifier to this recommendation was that the drainage channel be impervious to prevent sea water intrusion into the drainage channel and thereby increasing the salinity of the Garapan wetland. An impervious channel is necessary to maintain the existing water conditions within this wetland (Chuck Huxler, U.S. Geological Survey, pers. comm.).

## U.S. FISH AND WILDLIFE MITIGATION POLICY

The Service's Mitigation Policy (Federal Register, Vol. 46, No. 15, January 23, 1981) was formulated with the intent to ". . . protect and conserve the most important and valuable fish and wildlife resources while facilitating balanced development of the Nation's natural resources." The policy outlines internal guidance for Service staff and complements our participation under the Fish and Wildlife Coordination Act and National Environmental Policy Act. The Mitigation Policy does not apply to threatened or endangered species; specific requirements for these resources are covered in the Endangered Species Act of 1973 (50 CFR 17).

The policy focuses on the mitigation of habitat value, and on impacts to fish and wildlife populations. Our recommendations for mitigation/compensation will be based upon the habitat values adversely affected by the project, and not by loss of acreage alone. Our habitat valuations and recommendations will be based upon thorough consideration of all relevant biological data.

The Service considers the Garapan Marsh to be Resource Category 2. Under this category, the habitat to be impacted is of high value for the evaluation species and is relatively scarce or becoming scarce on a national basis or in the ecoregion setting. The mitigation goal for this category is no net loss of in-kind habitat value. Specific planning goals include (1) physical modification of the replacement habitat to convert it to the same type lost; (2) restoration or rehabilitation of previously altered habitat; (3) increased management of similar replacement habitat so that the in-kind habitat value of the lost habitat is replaced; or (4) a combination of the above.

The evaluation species were various migratory waterfowl including the Green-winged Teal (Anas creca), Northern Pintail (A. acuta), Garganey (A. querquedula), Northern Shoveler (A. clypeata), and Tufted Duck (Aythya fuligula) and migratory shorebirds including the Lesser Golden Plover (Pluvialis dominica), Common Greenshank (Tringa nebularia), Marsh sandpiper (T. stagnatilis), Wood Sandpiper (T. glareola), Gray-tailed Tattler (Heteroscelus brevipes), Bar-tailed Godwit (Limosa lapponica), and others (J. Engbring, pers. comm.).

## RECOMMENDATIONS

a. From the mouth of the channel to Station 44 + 98, the drainage channel will be impervious to seawater intrusion. This impervious channel is necessary to maintain the existing water quality conditions within the Garapan Marsh.

b. If the Corps determines that an impervious channel for Alternative E is economically unfeasible, the Service recommends the selection of Alternative D.

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## Appendix 1. Dominant plants observed in the Garapan Drainage during 1979 Service surveys (Ref. 19).

| COMMON NAME | SCIENTIFIC NAME |
|---|---|
| MONOCOTYLEDONS | |
| Bamboo | *Bambusa vulgaris* |
| Banana | *Musa xparadisiaca* |
| Betel nut | *Areca cathecu* |
| Coconut | *Cocos nucifera* |
| Crowfoot grass | *Dactyloctenium aegyptium* |
| Guinea grass | *Panicum maximum* |
| Kafu | *Pandanas fragans* |
| Lovegrass | *Eragrostis tenella* |
| Rat-tail dropseed | *Sporobolus elongatus* |
| Sedge | *Cyperus odoratus* |
| Sword grass | *Miscanthus floridulus* |
| Tigre | *Sansevieria trifasciata* |
| Upland taro (papao-apaka) | *Alocasia macrorrhiza* |
| DICOTYLEDONS | |
| Acacia | *Acacia confusa* |
| African tulip tree | *Spathodea campanulata* |
| Beach morning glory | *Ipomoea pes-caprae* |
| Breadfruit | *Artocarpus incisus* or *mariannensi* |
| Candlebrush | *Cassia alata* |
| Coffee-senna | *Cassia occidentalis* |
| False verbena | *Stachytarpheta indica* |
| Flame tree | *Delonix regia* |
| Indian pluchea | *Pluchea indica* |
| Ironwood | *Casuarina litorea* |
| Kapok tree | *Ceiba pentandra* |
| Lagundi | *Vitex trifolia* |
| Mango | *Mangifera indica* |
| Milo | *Thespesia populnea* |
| Nigas | *Pemphis acidula* |
| Pago | *Hibiscus tiliaceus* |
| Papaya | *Carica papaya* |
| Passion fruit | *Passiflora foetida* var. *hispida* |
| Tangan tangan | *Leucaena leucocophala* |

Appendix 3. Birds observed in the Garapan Drainage during Service surveys by Gerald Ludwig in May of 1979 (Ref. 19) and by Engbring & Ramsey in 1982 (Ref. 6). A number of other migratory shorebirds would be expected to occur on reef flats along the coast. Nomenclature is based on Owens, 1977 (Ref. 12).

| COMMON NAME | SCIENTIFIC NAME |
|---|---|
| Yellow Bittern | Ixobrychus sinensis |
| Marianas Crow[1] | Corvus kubaryi |
| Marianas Fruit-Dove | Ptilinopus roseicapilla |
| Philippine Turtle-Dove | Streptopelia bitorquata |
| White-throated Ground-Dove | Gallicolumba xanthonura |
| Rufous-fronted Fantail | Rhipidura rufifrons |
| Red Junglefowl | Gallus gallus |
| Cardinal Honeyeater | Myzomela cardinalis |
| Golden Honeyeater | Cleptornis marchei |
| Collared Kingfisher | Halcyon chloris |
| Common Moorhen | Gallinula chloropus |
| Rock Pigeon | Columba livia |
| Lesser Golden Plover | Pluvialis dominica |
| Nightingale Reed-Warbler | Acrocephalus luscinia |
| Common Sandpiper | Actitis hypoleucos |
| Wood Sandpiper | Tringa glareola |
| Eurasian Tree Sparrow | Passer montanus |
| Micronesian Starling | Aplonis opaca |
| Vanikoro Swiftlet | Collocalia vanikorensis |
| Gray-tailed Tattler | Heteroscelus brevipes |
| Wandering Tattler | Heteroscelus incanus |
| White Tern | Gygis alba |
| Ruddy Turnstone | Arenaria interpres |
| Bridled White-eye | Zosterops conspicillata |

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[1] Unconfirmed record

Appendix 5. Fishes recorded from offshore habitats near alternative sites for Garapan Flood Control Study by USFWS biologists, 1979 and Amesbury *et al*., 1979 (Ref. 1).

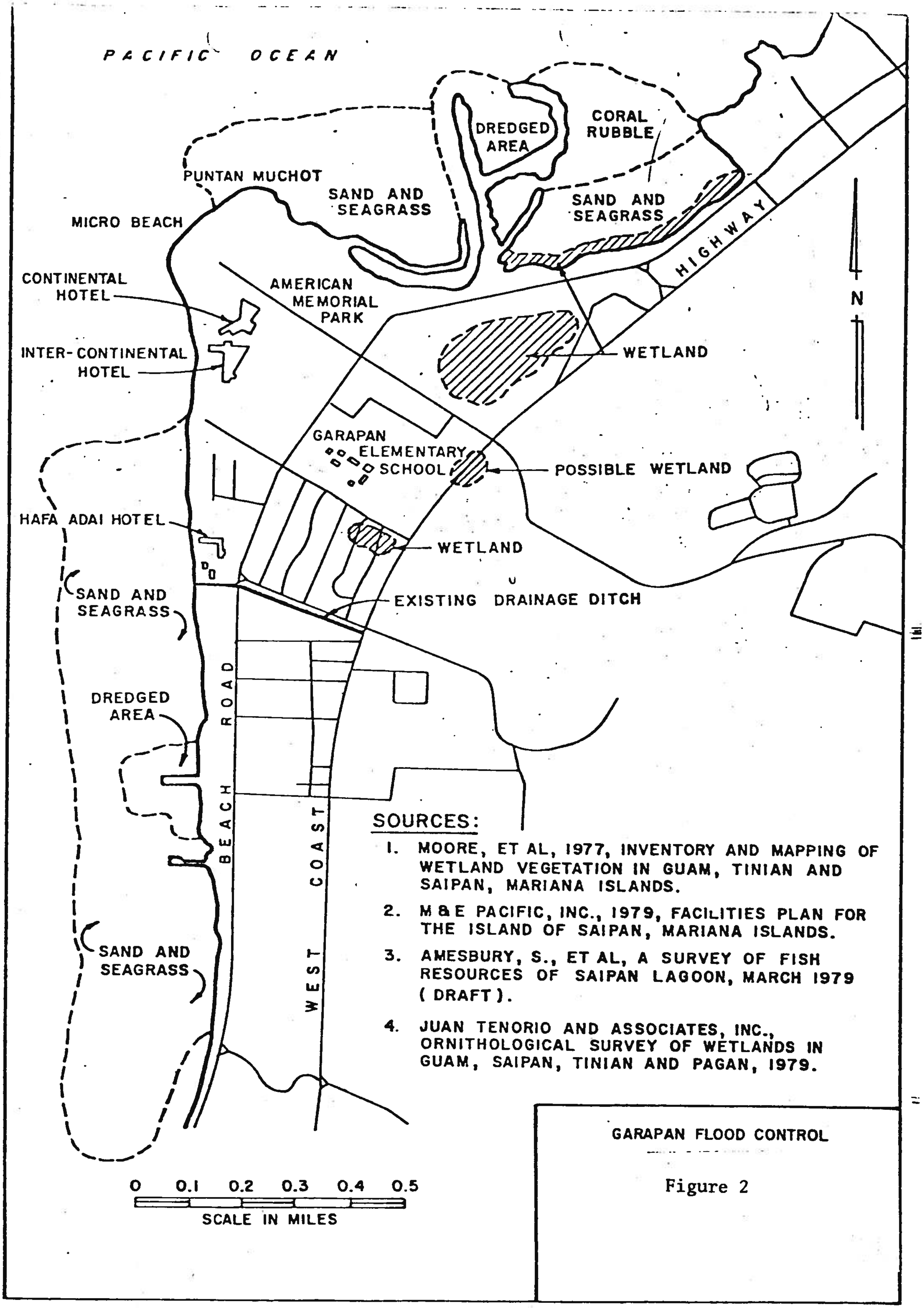
[1] Habitats sampled by Amesbury *et al*. Habitat description in Table 1 and Fig. 4.

[2] Collection sites of FWS biologists:
GR - Garapan Reef, includes Amesbury's habitat types 7, 11, 15
GD - Garapan Dock, includes Amesbury's habitat types 2, 7, 11, 15
MP - Memorial Park, includes Amesbury's habitat types 2, 9, 10.

| FAMILY<br>Species | HABITAT[1] | | | | | | COLLECTING SITE[2] | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2 | 7 | 9 | 10 | 11 | 15 | GR | GD | MP |
| DASYATIDAE - Sting Rays | | | | | | | | | |
| *Taeniura melanospila* | | | | | + | | | | |
| CHANIDAE - Milkfish | | | | | | | | | |
| *Chanos chanos* | | | | | + | | | | |
| MURAENIDAE - Moray Eels | | | | | | | | | |
| *Gymnothorax undulatus* | + | | | | | | | | |
| SYNODONTIDAE - Lizardfish | | | | | | | | | |
| *Saurida gracilis* | | | | | + | + | + | + | |
| HOLOCENTRIDAE - Squirrelfish | | | | | | | | | |
| *Adioryx diadema* | | | | | | + | | | |
| *Flammeo opercularis* | | | | | | + | | | |
| *F. sammara* | + | | | | | + | + | + | |
| *M. murdjan* | + | | + | | | + | | | |
| APOGONIDAE - Cardinalfish | | | | | | | | | |
| *Apogon coccineus* | | | | | | | | | |
| *A. novemfasciatus* | + | + | | | | | | | + |
| *A. nubilis* | + | | | | | | | | |
| *Apogon* sp. A | | + | | + | | | | | |
| *Apogon* spp. | + | | | | + | | | | |
| *Cheilodipterus macrodon* | | | | | | + | | | |
| *Paramia quinqurlineata* | + | + | | | | + | | | |
| SERRANIDAE - Groupers | | | | | | | | | |
| *Epinephelus merra* | | | | + | | | | | |

| FAMILY | HABITAT[1] | | | | | | COLLECTING SITE[2] | | |
|---|---|---|---|---|---|---|---|---|---|
| Species | 2 | 7 | 9 | 10 | 11 | 15 | GR | GD | MP |
| POMACANTHIDAE - Angelfish | | | | | | | | | |
| *Pomacanthus imperator* | | | | | + | | | | |
| POMACENTRIDAE - Damselfish | | | | | | | | | |
| *Abudefduf septemfasciatus* | | | | | | + | | | |
| *A. sexfasciatus* | | + | + | | | + | | + | |
| *Amphiprion clarkii* | | | | + | | | | | |
| *A. melanopus* | | | | | | + | | | |
| *Chromis atripectoralis* | | | | | | + | | | |
| *C. caerulea* | | + | + | + | | + | + | + | |
| *Xanthura* sp. | | | | + | | | | | |
| *Dascyllus aruanus* | | + | + | + | + | + | + | + | + |
| *D. reticulatus* | | | | + | | | | | |
| *D. trimaculatus* | + | | | + | + | | | | |
| *Eupomacentrus albifasciatus* | + | + | | | | + | | | |
| *E. fasciolatus* | | | | | | + | | | |
| *E. lividus* | | | | | | + | | | |
| *E. nigricans* | | + | + | | | + | | | |
| *Glyphidodontops leucopomus* | + | + | | | | | | | |
| *Plectrogyphidodon leucozona* | + | | | + | | | | | |
| *Pomacentrus pavo* | + | + | | + | + | | | | |
| *P. vaiuli* | | + | | + | + | + | | | |
| LABRIDAE - Wrasses | | | | | | | | | |
| *Cheilinus chlorurus* | | + | | + | | | | | |
| *C. trilobatus* | + | + | | + | | + | | | |
| *Cheilinus* sp. | + | | | | | | | | |
| *Cheilio inermis* | + | + | | | + | + | | | |
| *Cirrhilabrus* sp. | | | | + | | | | | |
| *Cymolutes praetextatus* | | | | | + | | | | |
| *Epibulus insidiator* | | | | | | + | + | | |
| *Comphosus varius* | | | | | | + | | | |
| *Halichoeres centriquadrus* | | | | | | + | | | |
| *H. hartzfeldi* | | | | + | | | | | |
| *H. margaritaceous* | | + | | | | | | | |
| *H. trimaculatus* | + | + | | + | + | + | | | |
| *H. melapterus* | | + | | | | + | | | |
| *Labrichthys unilineatus* | | | | | | + | | | |
| *Labroides dimidiatus* | | + | + | + | | + | + | | |
| *Pseudocheilinus evanidus* | | | | + | | | | | |
| *Stethojulis bandanensis* | | + | | + | | + | + | + | |
| *S. strigiventer* | + | | | | | | | | |
| *Stethojulis juveniles* | + | | | | | | | | |
| *Thalassoma hardwicke* | | | | | | + | | | |
| *T. lutescens* | | | | + | | + | + | | |
| *Xyrichtys macrolepidotus* | | | | | + | | | | |
| *X. taeniourus* | | | | | + | + | | | |

| FAMILY<br>Species | HABITAT[1] | | | | | | COLLECTING SITE[2] | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2 | 7 | 9 | 10 | 11 | 15 | GR | GD | MP |
| *Eusigobius neophytus* | | | | + | + | + | | | |
| *Gnatholepis* sp. | | | | | + | | | | |
| unidentified gobiids | | | | | | | + | + | + |
| ELEOTRIDAE - Gobies | | | | | | | | | |
| *Asterropteryx semipunctatus* | | + | | | | | | + | |
| *Plereleotris microlepis* | | + | | + | | | | | |
| *Valenciennes strigatus* | | | | | + | | | | |
| BOTHIDAE - Left-eyed Flounders | | | | | | | | | |
| *Bothus mancus* | | | | | | | + | + | |
| SOLEIDAE - Soles | | | | | | | | | |
| *Aseraggodes melanostictus* | | | | | + | | | | |
| BALISTIDAE - Triggerfish | | | | | | | | | |
| *Balistoides viridesces* | | | | | + | | | | |
| *Rhinecanthus aculeatus* | | + | | + | + | + | + | + | + |
| MONACANTHIDAE - Filefish | | | | | | | | | |
| *Oxymonacanthus longirostris* | | | | | | + | + | | |
| CANTHIGASTERIDAE - Sharp Nosed Puffers | | | | | | | | | |
| *Canthigaster cornatus* | | | | | | | + | + | |
| TETRADONTIDAE - Puffers | | | | | | | | | |
| *Arothrn nigropunctatus* | | | | | | | + | | |
| TOTAL SPECIES | 31 | 46 | 24 | 49 | 27 | 73 | 29 | 21 | 15 |



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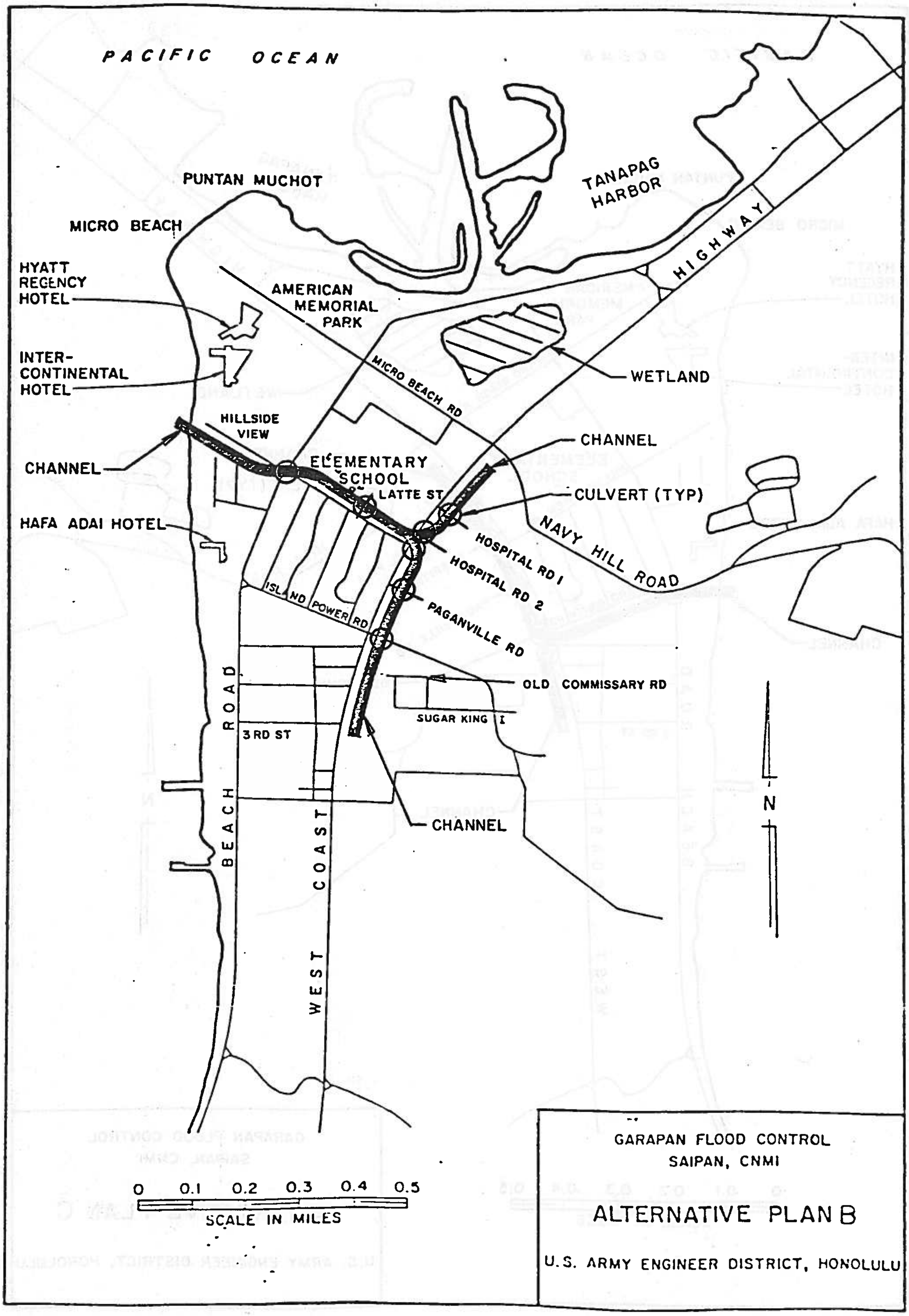
GARAPAN FLOOD CONTROL

Figure 2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HYATT REGENCY HOTEL
AMERICAN MEMORIAL PARK
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WETLAND
MICRO BEACH RD
HILLSIDE VIEW
CHANNEL
ELEMENTARY SCHOOL
LATTE ST
CHANNEL
CULVERT (TYP)
HAFA ADAI HOTEL
NAVY HILL ROAD
HOSPITAL RD 1
HOSPITAL RD 2
ISLAND POWER RD
PAGANVILLE RD
OLD COMMISSARY RD
SUGAR KING I
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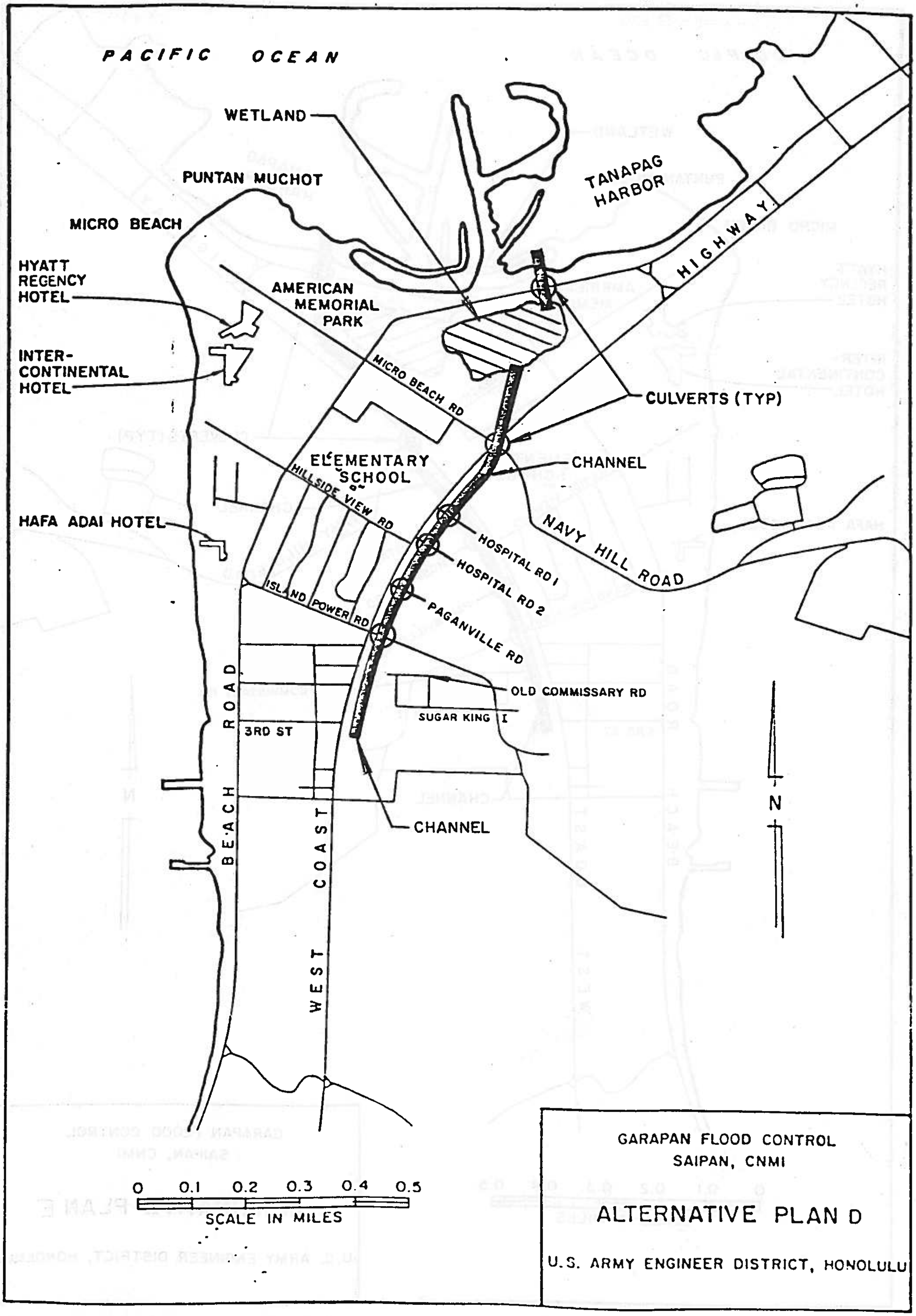
SCALE IN MILES
GARAPAN FLOOD CONTROL
SAIPAN, CNMI
ALTERNATIVE PLAN B
U.S. ARMY ENGINEER DISTRICT, HONOLULU

Figure 4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SCALE IN MILES
GARAPAN FLOOD CONTROL
SAIPAN, CNMI
ALTERNATIVE PLAN D
U.S. ARMY ENGINEER DISTRICT, HONOLULU

Figure 6

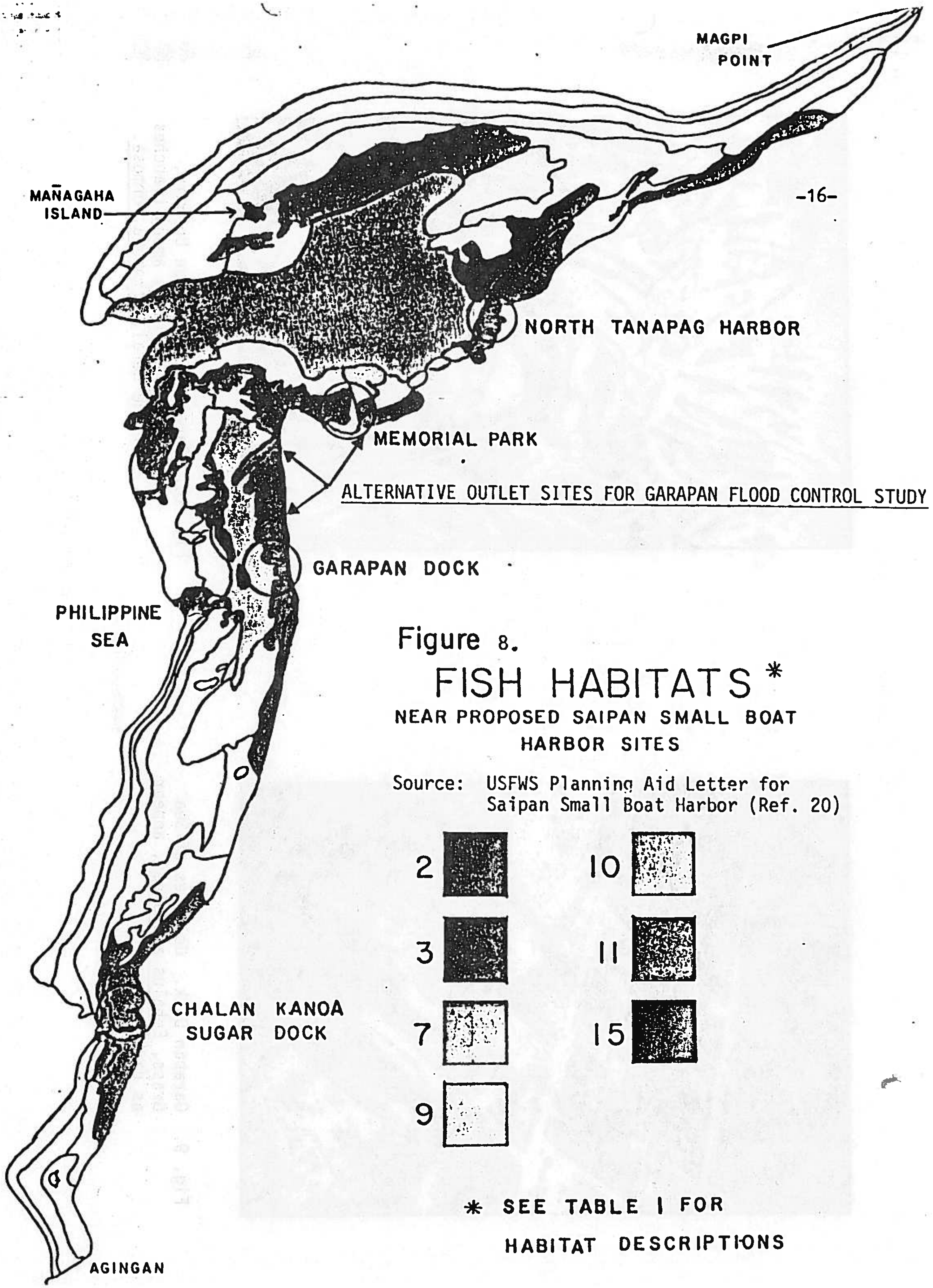

Figure 8.

FISH HABITATS *

NEAR PROPOSED SAIPAN SMALL BOAT HARBOR SITES

Source: USFWS Planning Aid Letter for Saipan Small Boat Harbor (Ref. 20)

* SEE TABLE I FOR HABITAT DESCRIPTIONS

Fig. 11. Garapan Channel. Sea cucumbers and feather duster worms.

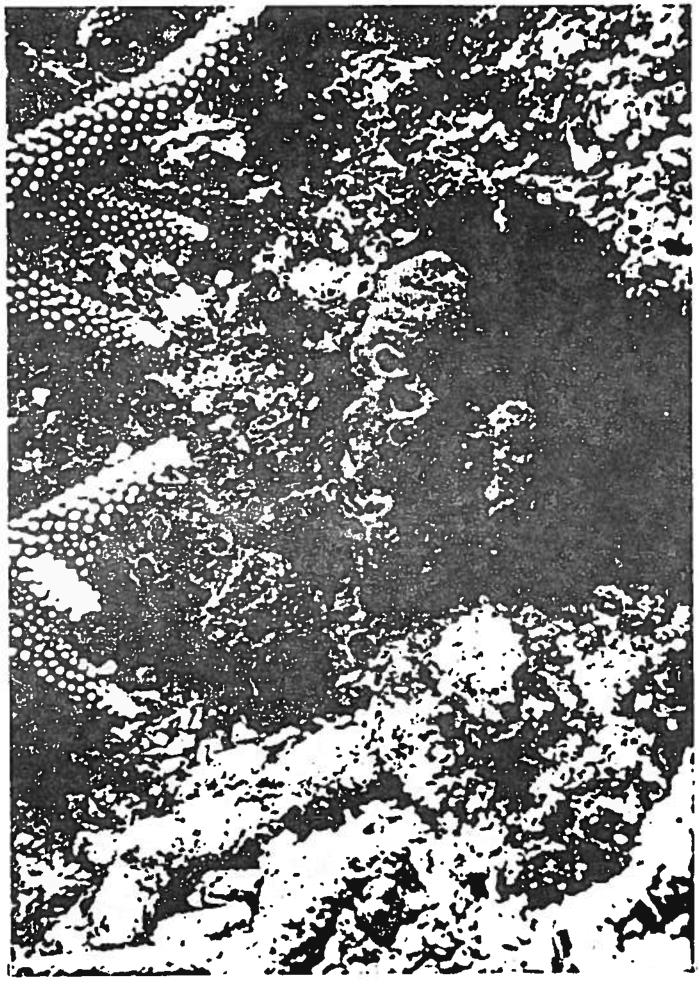

Fig. 12. Garapan Channel. Sponge in rubble-gravel adjacent to the reef.

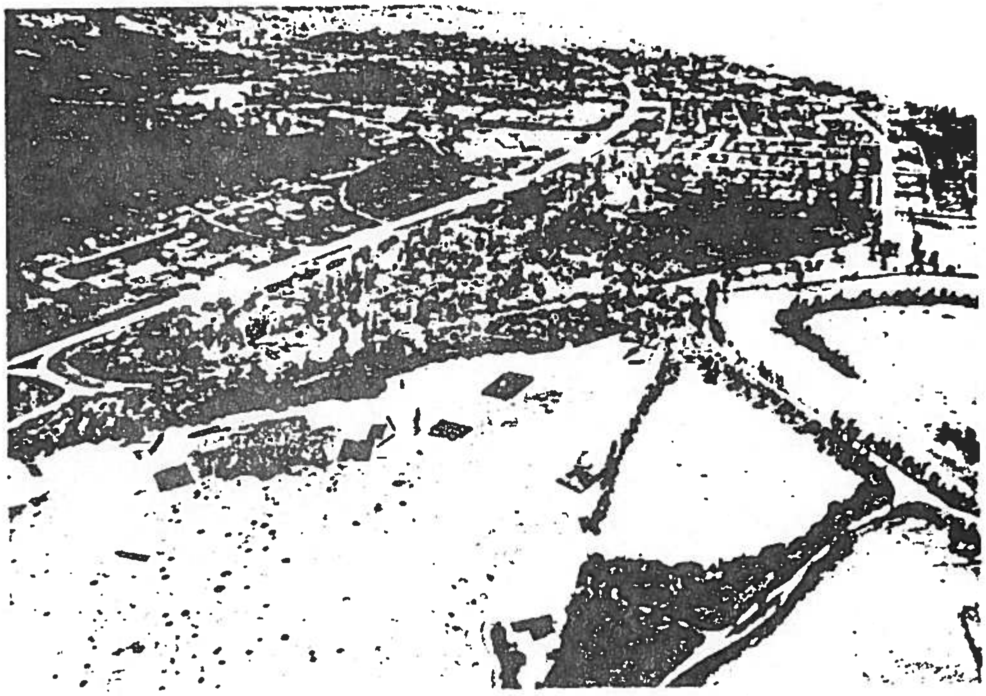

Figure 15. The American Memorial Park wetland. The blue lines illustrate the NEP Plan (solid line) and Alternative 5 (dotted line). The cleared area where a new hospital is being constructed would drain into the proposed channel.

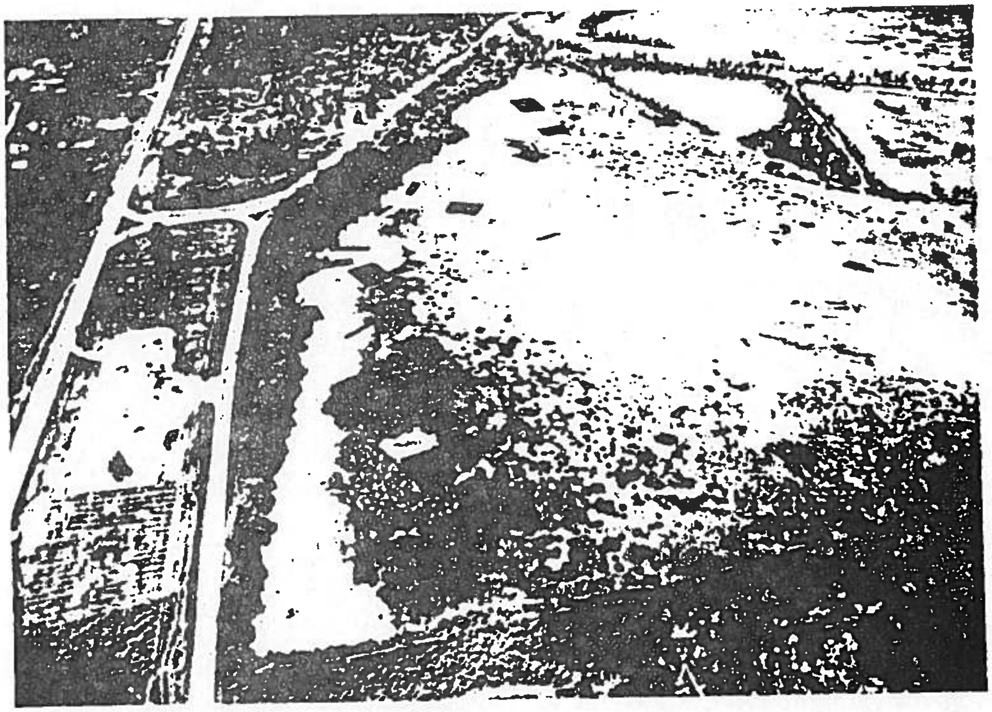

Figure 16. The mudlfats and seagrass beds of Tanapag Harbor adjacent to the American Memorial Park provide the premier feeding and loafing site for migratory shorebirds on Saipan.

# BIOLOGICAL OPINION
of the
U.S. FISH AND WILDLIFE SERVICE
for the
SAIPAN POWER CENTER, CHALAN LAULAU
SAIPAN, COMMONWEALTH OF THE NORTHERN MARIANA ISLANDS

December 14, 1994

# TABLE OF CONTENTS

# LIST OF FIGURES

MARCH 3, 1849

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Pacific Islands Ecoregion
300 Ala Moana Blvd, Room 6307
P.O. Box 50167
Honolulu, Hawaii 96850

In Reply Refer To: MWR/DLB

DEC 14 1994

Lt. Colonel Bruce Elliott
District Engineer
U.S. Army Corps of Engineers
Building 230
Fort Shafter, Hawaii 96858

Re: Biological Opinion (Log Number 1-2-95-F-01), PODCO GNW-95-008, Saipan Power Center, Chalan Laulau, Saipan, Commonwealth of the Northern Mariana Islands (CNMI).

Dear Lieutenant Colonel Elliott:

This report represents the biological opinion of the U.S. Fish and Wildlife Service (Service) in accordance with section 7 of the Endangered Species Act of 1973 (16 U.S.C. 1531-1544; Stat. 884), as amended, (Act) regarding potential impacts to the federally-listed, endangered Mariana common moorhen, *Gallinula chloropus guami*, and Nightingale reed-warbler, *Acrocephalus luscinia*, from the proposed issuance of Department of the Army (DOA) permit PODCO GNW-95-008. The Corps of Engineers (Corps) proposes to authorize J. C. Tenorio Enterprises, Inc. to fill 0.88 hectares (ha) [2.17 acres (ac)] of wetland in Chalan Laulau, Saipan, CNMI.

This biological opinion is based upon 1) review of the information presented in the permit application and proposed mitigation plan for the project, 2) information provided in the 1992 Recovery Plan for the Mariana Common Moorhen, 3) literature published on moorhens and reed-warblers, and 4) information gained during site visits to the project area.

The Corps requested initiation of section 7 consultation for the proposed permit action in a letter dated August 25, 1994, received by the Service on August 29, 1994. Service biologists conducted inspections of the project site and mitigation area on September 15 and November 2, 1994, with a biologist from the CNMI Division of Forestry and Wildlife (CNMI DFW). The log number for this consultation is 1-2-95-F-01. A complete administrative record of this consultation is on file in the Service's Pacific Islands Office (PIO) in Honolulu, Hawaii.

## BIOLOGICAL OPINION

It is the biological opinion of the Service that issuance of DOA permit GIN94-021, as described below, is not likely to jeopardize the continued existence of the Mariana common moorhen or Nightingale reed-warbler. Some level of incidental take for these species is anticipated, and the Service has specified reasonable/prudent measures and terms/conditions to minimize the impact of any takings.

### Description of the Proposed Action

The Corps proposes to issue a Nationwide Permit, PODCO GNW-95-008, to authorize J. C. Tenorio Enterprises, Inc. (the applicant) to fill 0.88 ha (2.17 ac) of wetlands to facilitate the development of the Saipan Power Center in the Chalan Laulau District along the west central coast of Saipan (Figure 1). The purpose of the project is to provide retail, financial, and entertainment facilities for the people of Saipan. These facilities include two retail buildings totaling 8,379 square (sq) meters (m) [90,100 sq feet (ft)], a movie theater that is 1,860 sq m (20,000 sq ft), a financial building that is 558 sq m (6,000 sq ft), and a restaurant that is 1,116 sq m (12,000 sq ft).

The project site is located on private property and is generally bounded by Beach Road to the west, Chalan Pale Arnold to the east, and Chalan Monsignor Guerrero (Airport Road) to the southwest (Figure 2). The project site encompasses 7.18 ha (17.73 ac) that are zoned as auto-urban and includes 2.37 ha (5.84 ac) of wetlands and 4.81 ha (11.86 ac) of uplands. Project-site wetlands are dominated by karriso, *Phragmites karka*, and pago, *Hibiscus tiliaceus*. Upland habitat at the project site includes scrubby secondary forest dominated by tangantangan, *Leucaena leucocephela*, and limestone forest dominated by *Barringtonia asiatica* with *Ficus prolixa* and *Hernandia nymphaeifolia*.

The project includes a conceptual wetland mitigation plan to offset the loss of 0.88 ha (2.17 ac) of wetlands. The mitigation plan involves wetland creation from project-site uplands [0.88 ha (2.17 ac)] and enhancement of the remaining 1.49 ha (3.68 ac) of project-site wetlands. The resulting created/enhanced mitigation wetland will be 2.37 ha (5.84 ac) in size (Figure 3).

The mitigation wetland will have an irregular bottom contour and be excavated to a depth that will insure that the site retains open water areas during the dry season. It will also include an island or islands and a deep moat. The mitigation wetland will be planted with sedges along the littoral zone and submergents in the open water zone and will include a vegetated buffer of karriso. These features are included in the design of the mitigation wetland to provide year-round nesting and foraging habitat for Mariana common moorhens.

Additional features included in the conceptual mitigation plan to insure that the wetland is maintained primarily as moorhen habitat include (1) the removal of karriso if it covers more than 20% of the wetland, (2) the removal of encroaching woody vegetation, (3) the control of submergent vegetation, and (4) documenting and monitoring of vegetation growth and control.

## Biology and Population Status of the Species

### a. Mariana Common Moorhen

Unless otherwise referenced, the following information on the status and habitat requirements of the Mariana common moorhen is taken from the Recovery Plan for the Mariana Common Moorhen (USFWS, 1992), unpublished field notes, published literature, and field surveys.

The Mariana subspecies of the common moorhen is endemic to the Mariana Archipelago. Adults are about 35 cm (14 in) in length, have slate-black plumage, red bills and frontal shields, white undertail coverts, white bands on their flanks, and olive-green legs. Immature birds have brown plumage, small frontal shields, and brownish bills and legs. Chicks have black plumage and black legs (Ritter, 1994).

Mariana common moorhens inhabit natural and human-made seasonal and permanent fresh water and occasionally brackish water wetlands. Moorhens also make use of recently flooded pastures and newly created wetlands (Stinson, 1993; Ritter and Sweet, 1993). Moorhens are secretive and seem to prefer wetlands with equal areas of open water and vegetation. They are opportunistic feeders and feed primarily on plant and animal matter in or near the water, including algae, seeds, and aquatic insects and their larvae.

Reproductive and nesting characteristics of the Mariana common moorhen have been described (Ritter, 1994) and are similar to those of more temperate region moorhen subspecies (Howard 1940; Wood, 1974). Active Mariana common moorhen nests have been found in all months of the year [USFWS unpubl. data, CNMI DFW (Tinian) unpubl. data, CNMI DFW (Saipan) unpubl. data, Guam Department of Aquatic and Wildlife Resources (DAWR) unpubl. data]. Nests are typically constructed within emergent vegetation but also may be placed on beds of submergent vegetation or protruding stumps and logs. Artificial platforms such as floating boards may also be used as nest sites (USFWS unpubl. data; Guam DAWR unpubl. data; Ritter, 1994). Average clutch size for the Mariana common moorhen is approximately six eggs (Guam DAWR unpubl. data), and incubation requires 18-22 days (Brown, 1940; Wood, 1974; Byrd and Zeillemaker, 1981).

The Mariana common moorhen was listed as endangered on August 27, 1984 (49 FR 33885) (USFWS, 1994). Habitat loss was identified as the primary factor influencing the decline of this subspecies (USFWS, 1992). Other factors potentially affecting moorhen populations in the Mariana Islands include competition with tilapia (Stinson et al., 1991), nest loss due to flooding (Ritter, 1994; USFWS unpubl. data), destruction of nesting habitat by feral ungulates (Guam DAWR unpubl. data), hunting pressure, and predation by the brown tree snake and feral cats and dogs.

Present populations of Mariana common moorhens are found on Guam, Tinian, and Saipan. Archaeological excavations indicate the presence of the moorhen on Rota between 1,500-2,000 years ago (Butler, 1988). The population on Pagan is likely extinct due to volcanic activity and feral ungulates (Stinson et al., 1991). No moorhens or wetlands exist on any of the other Mariana Islands.

Historically, moorhen populations on Guam were considered numerous and widely distributed. Moorhens were reported from fresh and brackish water wetlands, fallow rice paddies, and cultivated taro patches (Hartert, 1898; Seale, 1901; Baker, 1951; Beaty, 1967). Baker (1951) found large numbers of moorhens along the Ylig River and in the Agana Swamp. The most recent surveys (Ritter, 1989; Stinson et al., 1991) recorded moorhens at 18 wetlands on Guam, including 15 that are human-made.

Wetland habitats in the Northern Mariana Islands are not as diverse or abundant as those on Guam. Nevertheless, moorhen populations were considered abundant in high quality habitat such as Lake Hagoi on Tinian and Lake Susupe on Saipan (Stott, 1947; Marshall, 1949). The most recent surveys recorded moorhens at nine wetlands on Saipan (Stinson et al., 1991) and four wetlands on Tinian (USFWS unpubl. data).

The estimated total population of moorhens is 300-400 birds, including 100-125 birds on Guam, 100 birds on Saipan, and 75 birds on Tinian. An assessment of habitat loss and reviews of the literature and field notes indicate that the moorhen population in the Mariana Islands has been reduced by 36-52% in this century (Stinson et al., 1991).

b. Nightingale Reed-warbler

Unless otherwise referenced, the following information on the status and habitat requirements of the Nightingale reed-warbler is taken from unpublished field notes, published literature, and field surveys.

Three subspecies of the Nightingale reed-warbler are found in the Mariana Islands. *A. l. luscinia* is likely extinct on Guam but still found on Saipan and Alamagan (Reichel et al., 1992). The subspecies *A. l. nijoi* on Aguijan was thought to be extinct, but was recently rediscovered (Craig, 1992). The subspecies *A. l. yamashinae* known from Pagan is likely extinct (Reichel et al., 1992). Nightingale reed-warblers are not found on Rota or Tinian, but other subspecies are found in Micronesia on the islands of Chuuk, Pohnpei, and Nauru.

Reed-warblers are slender, long-billed, rather non-descript brownish/buff birds that inhabit dense vegetation around wetland/upland ecotones or other semi-open areas and second-growth forests. Reed-warblers feed on insects and their larvae, lizards, snails, and spiders (Seale, 1901; Marshall, 1949). Nightingale reed-warblers are territorial, and individual males are known to defend an area approximately 9000 sq m. Males have high site fidelity and appear to be monogamous while females may exhibit low mate fidelity between years. The breeding season is approximately January-June. (Craig, 1992).

The Nightingale reed-warbler was listed as an endangered species in 1970 (35 FR 8495 and 35 FR 18320) (USFWS, 1994). Loss of wetlands and understory vegetation by volcanic activity, land development, and feral ungulates; fires in wetlands; pesticides; and predation are cited as the primary reasons for these extinctions (Reichel et al., 1992).

Nightingale reed-warblers are still found on Alamagan where the conservative estimate of the population is 350 pairs (Reichel et al., 1992). The most recent surveys of reed-warblers on Saipan indicate that the birds are common over much of the island and are associated with karriso-dominated wetlands, native limestone forests, and habitats characterized by a dense understory, including wetland/upland ecotones and mixed tangantangan/grassland habitats (Craig, 1992; Reichel et al., 1992). Engbring et al. (1986) recorded 578 reed-warblers on Saipan during eight-minute counts. He estimated the average density of reed-warblers on Saipan to be 46 birds/sq km and the total population to be 4,867 birds.

## Environmental Baseline

The environmental baseline describes the status of the species and factors affecting the environment of the species or critical habitat in the proposed action area contemporaneous with the consultation in process. The baseline includes State, local, and private actions that affect a species at the time the consultation begins. Unrelated federal actions that have already undergone formal or informal consultation are also a part of the environmental baseline. Federal actions within the action area that may benefit listed species or critical habitat are included in the environmental baseline.

### a. Mariana Common Moorhen

Project-site wetlands are included in a complex of wetlands locally identified as the Chalan Laulau wetlands. The Chalan Laulau wetlands are generally dominated by dense stands of karriso and pago with limited open water areas. Nevertheless, smaller areas supporting an interspersion of open water and emergent and floating aquatic vegetation can be found along the outside edges of these karriso/pago-dominated wetlands. These small open areas represent suitable habitat for moorhens and are probably more frequently used by moorhens as sites for foraging and nesting than the dense karriso/pago dominated areas.

One such area, located outside the project boundary but contiguous to the project's mitigation area, was identified in the conceptual mitigation plan and visited by Service and CNMI DFW biologists on two occasions. During a September 15, 1994, visit, the area was dry, and no moorhens were observed using the wetland. However, on November 2, 1994, the site was flooded and approximately 0.3-0.6 m (1-2 ft) of surface water was present. One adult and three juvenile moorhens were observed during the November site visit. Based on these observations, it is likely that this area was used as nesting habitat during the 1994 rainy season.

To the best of our knowledge, no prior moorhen surveys have been conducted in wetland areas adjacent to or within the project site. Based on information gained during site visits and review of aerial photographs of the project-site wetlands, the Service estimates that less than one acre of wetland habitat is presently suitable for moorhen use within the project boundary. Since project-site wetlands are dominated by karriso and pago and have very limited open water areas, it is likely that these wetlands do not provide suitable nesting habitat for Mariana common moorhens. However, since moorhens have been observed within the contiguous wetland located just outside of the project boundary, they likely use project-site wetlands as escape cover and seasonally for foraging. Moorhens are more likely to use project-site wetlands during the rainy season when ponded areas are present and provide foraging habitat.

b. Nightingale Reed-warbler

Project-site habitats include both wetlands [2.37 ha (5.84 ac)] and uplands [4.81 ha (11.86 ac)]. Wetlands are dominated by karriso and pago. Uplands include a small area of *Barringtonia* forest but are predominantly scrubby secondary forest dominated by tangantangan. Transitional habitat comprised of both wetland and upland plant species occurs between the upland and wetland habitats.

Project-site habitats are contiguous with adjacent offsite habitats from the north to the southeast. Offsite habitats include *Barringtonia* and scrubby secondary forest as well as karriso and pago. The remainder of the surrounding land is commercially developed.

The entire project site represents reed-warbler habitat. Information provided in the permit application states that one Nightingale reed-warbler was recorded at the project site in January 1994. The bird was observed in the vegetation margin between the wetlands and *Barringtonia* forest. During a site visit on November 2, 1994, Service biologists observed that the adjacent wetland and upland habitats also represent potential foraging and nesting habitat for reed-warblers.

Engbring et al. (1986) estimated the average density of Nightingale reed-warblers as 46 birds/sq kilometers (km) on Saipan. Using this data, we estimate that the project site currently supports approximately four Nightingale reed-warblers. This number represents approximately 0.08% of the estimated population of reed-warblers on Saipan.

## Effects of the Action on Listed Species

a. Mariana Common Moorhen

The primary concerns of the Service with regard to the effects of the permit action on Mariana common moorhens are (1) the loss of approximately 0.88 ha (2.17 ac) of wetland and (2) the potential for recurring destruction of moorhen nests and eggs and mortality of moorhen chicks during maintenance activities at the mitigation site.

Approximately 0.88 ha (2.17 ac) of existing karriso-dominated wetland will be filled to facilitate the development of the Saipan Power Center. These wetlands are likely used by moorhens as escape and foraging habitat, particularly during the rainy season when ponded areas are present. Habitat loss is a primary reason for the decline of the Mariana common moorhen. Incremental wetland losses represent permanently removed habitat, which, if otherwise protected and managed, could contribute to the recovery goals of the species. Therefore, even the loss of small areas of the Chalan Laulau wetlands represents an adverse effect to Mariana common moorhens.

Nevertheless, any moorhens using project-site wetlands at the time of construction would likely disperse to the adjacent wetland habitat. Therefore, no harm to moorhens is anticipated as a result of construction activities associated with the filling of project-site wetlands.

The development of the Saipan Power Center includes a conceptual mitigation plan to offset the loss of project-site wetlands. Enhancement of existing wetlands and creation of wetland from uplands will result in 2.36 ha (5.84 ac) of managed and permanent open water wetland habitat at the project site. The development of the mitigation wetland will occur concurrently with the filling activities. Based on the proposed characteristics of the mitigation wetland (open water, vegetation, management) and the size of the mitigation site, it is anticipated that the mitigation wetland will provide year-round nesting and foraging habitat for an estimated two breeding pairs of Mariana common moorhens.

Recurring harassment of moorhens and potential loss of nests/eggs/chicks is anticipated to occur during periodic maintenance activities at the mitigation site. Adult and juvenile moorhens present within the mitigation wetland when these activities are initiated will likely be harassed by increased noise from machinery and human activity. These disturbance factors may disrupt normal foraging and nesting behaviors and cause moorhens to temporarily disperse from or to avoid using the mitigation wetland. If the maintenance activities occur when moorhen are nesting, then the loss of nests/eggs and chicks would be anticipated, as well as loss of reproductive capability of displaced adults that are not able to immediately establish new breeding territories. Harm and harassment of moorhens is more likely to occur during the rainy season when available nesting and foraging habitat is increased.

### b. Nightingale Reed-warbler

The primary concerns of the Service with regard to the effects of the permit action on the Nightingale reed-warbler are (1) the loss of reed-warbler habitat and (2) the potential loss of nests with eggs and/or chicks during construction of the project and the mitigation wetland.

Approximately 7.18 ha (17.73 ac) of potential reed-warbler habitat will be destroyed to facilitate construction of the Saipan Power Center. This includes (a) the loss (filling) of 0.88 ha (2.17 ac) of karriso wetland, (b) the loss (clearing) of 3.92 ha (9.60 ac) of *Barringtonia* and scrubby secondary forest for development of the Power Center, and (c) the conversion of

1.49 ha (3.67 ac) of karriso wetland and 0.88 ha (2.17 ac) of scrubby secondary forest to emergent vegetation/open water habitat to develop the mitigation wetland.

Based on observations made during site visits to the project area, reed-warbler habitat is known to exist on adjacent lands. The Service believes that any adult and juvenile reed-warblers displaced by the project could successfully disperse to unoccupied habitat within these adjacent areas. Therefore, no harm to adult or juvenile reed-warblers is anticipated as a result of construction activities associated with the filling of the project-site wetlands, clearing of upland forests, or construction of the mitigation wetland.

Harm to reed-warblers is more likely to occur if filling, clearing, and conversion activities are conducted during the breeding season (January-June). Loss of nests/eggs and chicks would be anticipated, as well as potential loss of reproductive capability of displaced adults that are not able to immediately establish new breeding territories.

## Cumulative Effects

Cumulative effects include the effects of future State, local, or private actions that are reasonably certain to occur in the area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act. The Service has not identified any cumulative effects in the project area that may impact Mariana common moorhen or Nightingale reed-warblers.

## Biological Opinion of the Service

After reviewing the current status of the Mariana common moorhen and the Nightingale reed-warbler, the environmental baseline of the species in the action area, the effects of the proposed action, including cumulative effects, it is the Service's biological opinion that issuance of PODCO GIN94-021 to facilitate the development of the Saipan Power Center, as proposed, is not likely to jeopardize the continued existence of the Mariana common moorhen or the Nightingale reed-warbler. No critical habitat has been designated for these species; therefore, none will be affected.

# INCIDENTAL TAKE

Sections 4(d) and 9 of the Act, as amended, prohibit the taking (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct) of a listed species of fish and wildlife without a special exemption. Harm is further defined to include significant habitat modification or degradation that results in the death or injury to listed species by significantly impairing behavioral patterns, such as breeding, feeding, or sheltering. Harass is defined as actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered a prohibited taking provided that such taking is in compliance with the terms and conditions of this incidental take statement. The measures described below are non-discretionary and must be implemented by the Corps or become binding conditions of any grant or permit issued to the applicant, as appropriate, in order for the exemption in section 7(o)(2) to apply.

The Corps has a continuing duty to regulate the activity that is covered by this incidental take statement. If the Corps fails to adhere or require the applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. This exemption only applies to the Endangered Species Act, as amended, and does not supersede the requirements of the Migratory Bird Treaty Act.

### Amount or Extent of Take

a. Mariana Common Moorhen

Incidental take in the form of harassment of adult and juvenile moorhens and potential harm to moorhen nests/eggs and chicks may occur during maintenance activities at the mitigation wetland. Based on the above information, the following levels of incidental take are anticipated:

1. Harassment of four adult moorhens and four juvenile moorhens during as-needed maintenance activities at the mitigation wetland.

2. Loss of three moorhen chicks and one moorhen nest per maintenance event at the mitigation wetland.

b. Nightingale Reed-warbler

Incidental take in the form of harm to adult Nightingale reed warblers and their nests with eggs and/or chicks may occur as a result of loss and modification of upland and wetland habitats within the project area.

Based on the above information, the following levels of incidental take are anticipated:

1. Loss of 7.18 ha (17.73 ac) of foraging and potential nesting habitat for Nightingale reed-warblers.

2. Loss of one Nightingale reed-warbler nest with eggs/chicks as a result of forest and wetland habitat loss and modification within the Saipan Power Center development site.

## Effect of the Take

### a. Mariana Common Moorhen

The Service has determined that this level of impact is not likely to result in jeopardy to the Mariana common moorhen because (1) no harm to adult or juvenile moorhens is anticipated, (2) the mitigation wetland will provide year-round foraging and nesting habitat for moorhens and offset the loss of wetland habitat filled for project construction, and (3) the applicant has committed to provide periodic maintenance at the mitigation wetland, which will provide stable moorhen habitat and promote the recovery of this subspecies.

### b. Nightingale Reed-warbler

The Service has determined that this level of impact is not likely to result in jeopardy to the Nightingale reed-warbler because (1) no harm to adult or juvenile reed-warblers is anticipated and (2) the potential loss of nests with eggs and/or chicks due to filling of wetland habitats and conversion of wetland and upland habitats represents a one time loss in reproduction for the birds in the project area.

## Reasonable and Prudent Measures

The Service believes that the following reasonable and prudent measures are necessary and appropriate to minimize take:

1. The Corps shall insure that the applicant fully complies with the special conditions of the permit.

2. The Corps shall require the applicant to minimize the destruction of moorhen and reed-warbler nests/eggs and mortality of moorhen and reed-warbler chicks during (1) filling of the existing wetland, (2) enhancement and creation of the mitigation wetland, and (3) maintenance activities at the mitigation wetland.

3. In order to preserve the remaining reed-warbler habitat at the project site, the Corps shall require the applicant to maintain the vegetation margin between the wetland and the development in its existing condition by not landscaping this area.

## Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, it is mandatory that the Corps comply with the following terms and conditions, which implement the reasonable and prudent measures described above:

1. The Corps shall require the applicant to have a qualified biologist conduct moorhen and reed-warbler censuses and nest searches within the project-site wetlands prior to filling and conversion activities. Results of the surveys shall be provided to the CNMI DFW and the PIO. Resource agencies will provide additional instructions for protecting any nests/eggs/chicks identified.

2. The Corps shall require the applicant to instruct contractors to avoid destroying active moorhen and reed-warbler nests with eggs. Contractors observing nests in any work area are to notify the Saipan DFW (670/233-9095) and the PIO (808/541-3441) for additional instructions for protecting nests/eggs/chicks.

3. The Corps shall require the applicant to conduct the filling of wetlands for development of the Saipan Power Center during the middle to latter portion of the dry season, if possible.

4. The Corps shall require the applicant to conduct wetland enhancement and creation of the mitigation site during the middle to latter portion of the dry season, if possible.

5. The Corps shall require the applicant to schedule maintenance activities within the mitigation wetland during the middle to latter portion of the dry season.

6. The Corps shall require the applicant to have a qualified biologist conduct a moorhen census and nest search within the mitigation wetland prior to each maintenance event. Results of the surveys shall be provided to the CNMI DFW and the PIO. Resource agencies will provide additional instructions for protecting any nests/eggs/chicks identified.

7. The Corps shall require the applicant to instruct contractors working within the mitigation wetland to avoid destroying active moorhen nests/eggs or harming chicks. Contractors observing nests/eggs or chicks in any work area are to notify the CNMI DFW (670/233-9095) and the PIO (808/541-3441) for additional instructions for protecting nests/eggs/chicks.

8. The Corps shall inform the applicant that the mitigation plan is conceptually approved by the Service, but the applicant should, within budgetary confines, implement any additional measures recommended by the Service and CNMI DFW to modify or rectify the mitigation wetland for the benefit of endangered species in the area.

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the impacts of the incidental take that might otherwise result from the proposed action. With implementation of these measures, the Service believes that harassment of moorhens and reed-warblers will be minimized and no moorhens or reed-warblers will be harmed during maintenance activities at the mitigation wetland. If, during the course of the action, the amount or extent of incidental take is exceeded, such incidental take would represent new information requiring review of the reasonable and prudent measures provided. The Corps must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modifications of the reasonable and prudent measures.

Disposition of Sick, Injured, or Dead Individuals

The Service's Law Enforcement office in Guam (671/472-7146) or the CNMI DFW (760/233-9095) should be notified immediately for care instructions regarding any sick or injured Mariana common moorhens or Nightingale reed-warblers found within the project area. If dead individuals are found, the Service's Law Enforcement Office in Guam or the CNMI DFW should be notified within one working day. Dead moorhens or reed-warblers should be wrapped in aluminum foil and refrigerated (dead birds should not be wrapped in plastic or placed in a freezer). The Service's Law Enforcement Office or the CNMI DFW will provide further instructions on the proper disposal of the animals, including shipping requirements to facilities to determine cause of death, if the cause is not known. The Service's Law Enforcement Office in Guam, the PIO in Honolulu, and the CNMI DFW should be provided with a written report describing the events surrounding the demise or injury of the species, if known.

## CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to use their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The recommendations provided here relate only to the proposed action and do not necessarily represent complete fulfillment of the Service's Section 7(a)(1) responsibilities for the species.

Suitable moorhen habitat is limited in the Mariana Islands and loss of habitat is cited as the primary reason contributing to the decline of this subspecies. Protection of existing wetlands and long-term management of vegetation to create more open water habitats would promote the recovery of moorhens. The Service recommends that the Corps encourage the applicant to consider the acquisition of the wetland immediately adjacent (southwest) to the mitigation site. This wetland currently provides excellent nesting and foraging habitat for moorhens. The Service is willing to provide technical assistance to J. C. Tenorio Enterprises, Inc. in designing a wetland enhancement plan and developing wetland management objectives for the benefit of the endangered Mariana common moorhen and other wetland-dependant species at this wetland. This action would represent the initial effort by a private wetland owner in the CNMI to acquire additional wetland area and manage it for the benefit of moorhens.

Incremental development of scrub/tangantangan upland represents loss of existing and potential Nightingale reed-warbler habitat. The Service is concerned that the loss of upland habitat for wetland creation that benefits moorhens may negatively impact reed-warblers. The Service recommends that in the future the Corps require applicants to conduct thorough reed-warbler surveys in upland habitats where mitigation actions are being considered.

In order for the Service to be kept informed of actions that either minimize or avoid adverse effects or that benefit listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

## CONCLUSION

This concludes formal section 7 consultation on this action. As required by 50 CFR 402.16, reinitiation of formal consultation is required if (1) the amount or extent of incidental take is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion, (3) the agency action is subsequently modified in a manner that causes an adverse effect to the listed species or critical habitat that was not considered in this opinion, or (4) a new species is listed or critical habitat designated that may be affected by this action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

If you have questions concerning any of the information contained in this biological opinion, please contact Fish and Wildlife Biologists Michael Ritter (808/541-3441) or Dianne Bowen (808/541-2749).

Sincerely,

Margo Stahl

Acting Brooks Harper
Field Supervisor
Ecological Services

cc: CNMI DFW, Saipan
J. C. Tenorio Enterprises, Inc.
Corps, Guam
Richard Hill, USFWS, Portland

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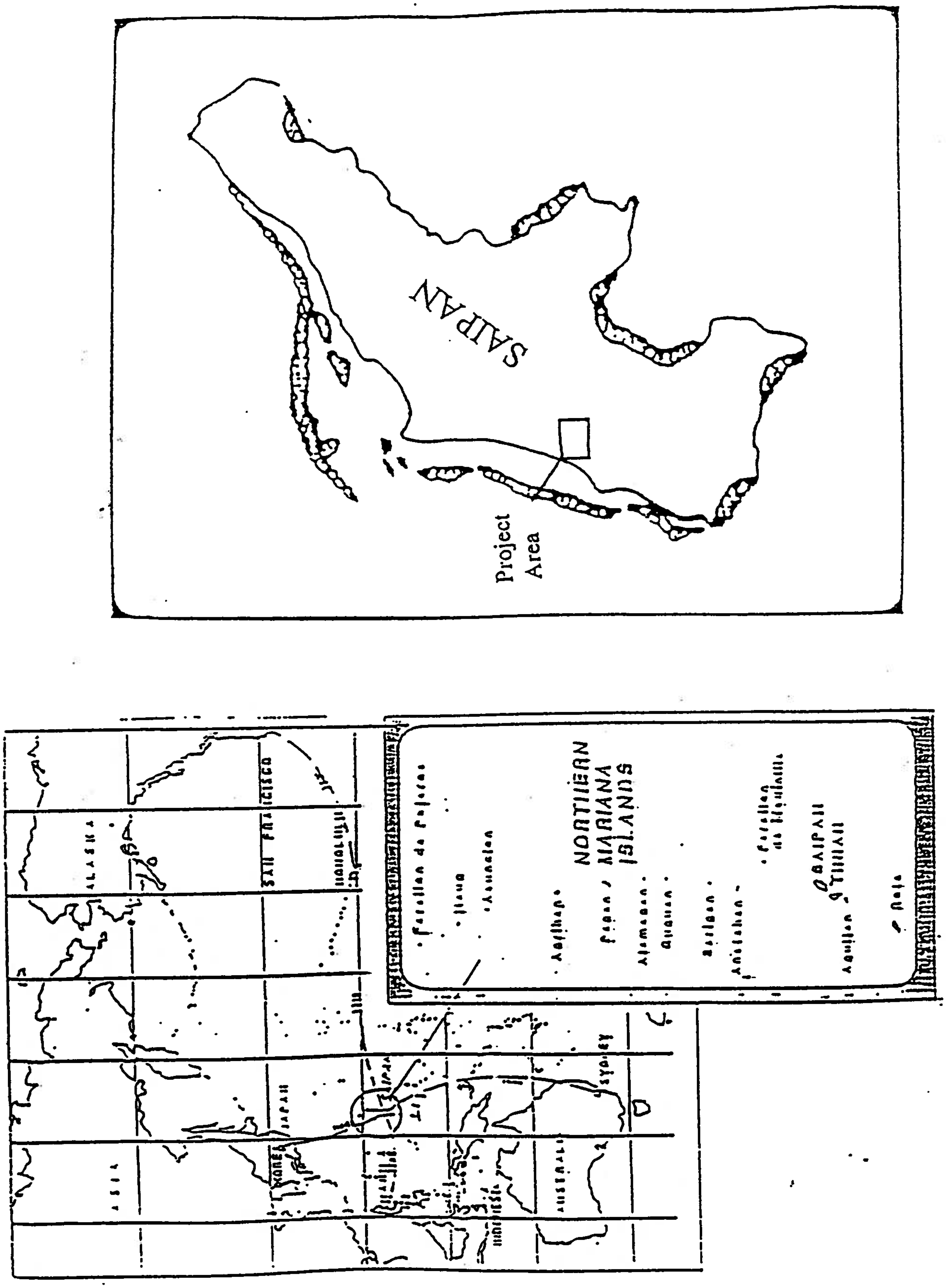


Adapted from: Storm Water Control Handbook, CNMI, 1989

Figure 1. Project area of the Saipan Power Center on the Island of Saipan. Commonwealth of the Northern Mariana Islands (Source: SCS. 1993). (Not to scale)

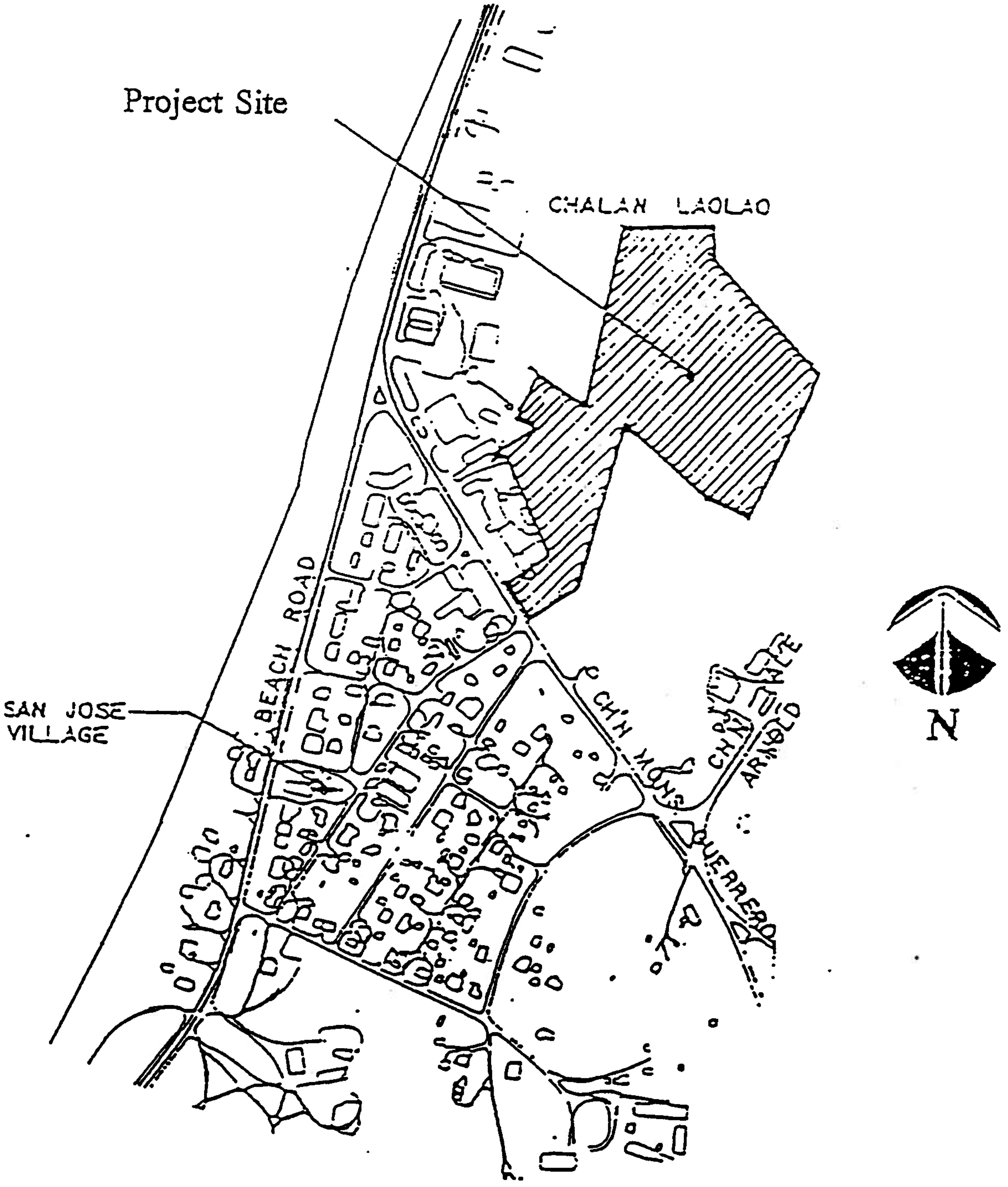


Figure 2. Project site of the Saipan Power Center on the Island of Saipan, Commonwealth of the Northern Mariana Islands (Source: J. C. Tenorio & Assoc., Inc., 1994). (Not to scale)

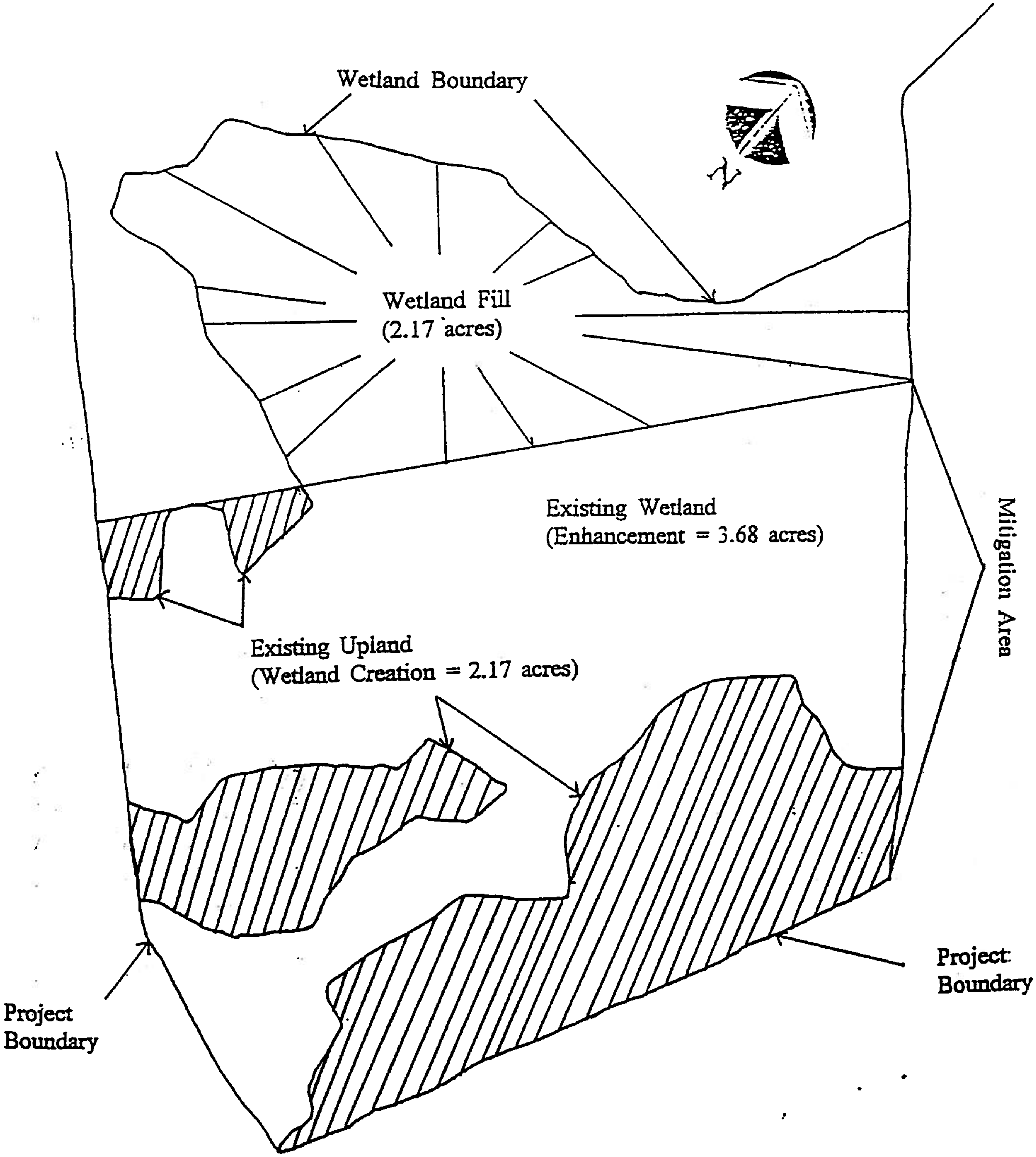


Figure 3. Areas of wetland fill and wetland creation/enhancement for the Saipan Power Center, Commonwealth of the Northern Mariana Islands. (Not to scale)

# *Appendix D*
# *Agency Consultation Letters*

Commonwealth of the Northern Mariana Islands
Department of Lands and Natural Resources
**Division of Fish and Wildlife**
P.O. Box 10007, Saipan, MP 96950
Telephone: (670) 664-6000/664-6001

October 31, 2011

FW-L-11-096

Environet, Inc
650 Iwilei Road, Suite 204
Honolulu, HI 96817

Subject: Request for listed species regarding the Saipan Lagoon Aquatic Ecosystem Restoration Plan

To Whom It May Concern:

Thank you for your request for listed species. The species of concern in the CNMI, and federally listed endangered species are as follows;

Nightingale Reed-Warbler (*Acrocephalus luscinia*)
Mariana Common Moorhen (*Gallinula chloropus guami*)
Micronesian Megapode (*Megapodius laperouse*)
Mariana Fruit Bat (*Pteropus mariannus*)
Mariana Swiftlet (*Aerodramus bartschi*),
Rota Bridled White-eye (*Zosterops rotensis*)
Mariana Crow (*Corvus kubaryi*)

Note, not all species are found on each island. DFW coordinates with the United State Fish and Wildlife Service (USFWS) on all matters concerning federally listed species. In all cases of development, surveys are necessary to ensure that there is no impact to these species of concern or to determine necessary mitigation measures.

Once specific areas for development are flagged and appropriate permit applications and survey requests completed, DFW will discuss surveys for a project area. If there are any questions please contact the wildlife division at 664-6012.

Sincerely,

Arnold I. Palacios
DFW Director

cc: CRM
USFWS
DEQ

DEPARTMENT OF DEFENSE
UNITED STATES OF AMERICA

**DEPARTMENT OF THE ARMY**
**U.S. ARMY CORPS OF ENGINEERS, HONOLULU DISTRICT**
**FORT SHAFTER, HAWAII 96858-5440**

REPLY TO
ATTENTION OF:

October 30, 2012

Environmental Programs Branch
Programs and Project Management Division

Ms. Merti Kani
Acting Director
Division of Historic Preservation
Department of Community and Cultural Affairs
Commonwealth of the Northern Mariana Islands
P.O. Box 500090
Saipan MP 96950

Dear Ms. Kani:

The U.S. Army Corps of Engineers, Honolulu District (USACE-POH), is proposing an undertaking to restore the Saipan Lagoon aquatic ecosystem as closely as possible to its natural state. The lagoon is located on the western shoreline of the island of Saipan, Commonwealth of the Northern Mariana Islands (CNMI). The project area extends from the Quartermaster Road north to just past the Fishing Base in Garapan and it includes the entire watershed that contributes ground and surface water runoffs to the approximately two-mile length of shoreline as well as to the adjacent offshore lagoon area out to the fringing coral reef (See enclosed Figures 1 through 3). Restoration alternatives are being formulated with the goal of restoring the ecosystem to be self-sustaining in the substantially modified environment. The purpose of this letter is to initiate Section 106 coordination and consultation with your office in compliance with the National Historic Preservation Act of 1966, as amended, and implementing regulations 36 CFR Part 800 (NHPA) for the proposed undertaking.

Three alternative drainage detention basin sites are being considered to achieve the overall project restoration goal. The proposed locations for the three retention basins are at the China House (Alternative 1), the Quartermaster Site (Alternative 2), and the Cock Fight Arena (Alternative 3) (See enclosed Figure 4). Three sizes of the basin are being designed for each of the three sites, corresponding to the expected influx of water during a two-year, five-year, and ten-year rainfall event; there are a total of nine possible scenarios for the three different site locations.

Background research of the project location identified archaeological remains that included features attributed to the Japanese and American World War II periods in the history of Saipan as well as subsurface prehistoric pottery-bearing cultural deposits. Garapan is also known for the presence of human burial remains, which were recorded during the development of shopping areas along Garapan's main thoroughfare. The Quartermaster Site location appeared to have been extensively used as a warehouse area by the military during the World War II era while the Cock Fight Arena consisted of an abandoned modern-day quarry. A preliminary reconnaissance level walk-through survey of the three locations was conducted in 2003 by a two-person USACE-POH archaeological team who identified no surface archaeological sites; however, three concrete warehouse remnants were located in the Quartermaster Site area. All superficial structural remains of the warehouses had been completely destroyed and the warehouses themselves lacked any integrity and they were determined not eligible for nomination to the National Register of Historic Places.

The exact location and design of the three retention basins have yet to be determined. In any case, their locations shall be re-surveyed to ensure that no cultural resources are present anywhere near those areas. Because of the potential that subsurface cultural deposits, including human burial remains, may be present in the project areas, all construction activities shall be monitored by a qualified archaeologist in compliance with the Secretary of the Interior's Standards and Guidelines and who has at least two years of continuous archaeological experience working in the CNMI. Prior to the start of any ground breaking construction activities associated with this project, an Archaeological Monitoring Plan (AMP) shall be compiled by the archaeologist and submitted to your office for review and comments before its finalization. A full archaeological report documenting the results of the archaeological monitoring shall also be submitted at the end of all construction activities to your office for your library and files.

Based on our knowledge of the project area, we believe that the presence of a qualified archaeologist during construction will ensure the protection of potentially significant cultural resources including human burial remains that may be present subsurface within the project's area of potential effect. The USACE-POH, therefore, is of the opinion that, with the presence of a qualified archeologist monitor during all new ground breaking construction activities as well as the submittal of a final AMP and post-monitoring archaeological report to your office, a determination can be made that the proposed ecosystem restoration undertaking shall have 'no adverse effect to historic properties.' In compliance with Section 106 of the NHPA, your concurrence to this determination is respectfully being sought.

Should your office have any questions, please contact Mr. Kanalei Shun, Archaeologist of my Environmental Program Branch, by telephone at (808) 835-4097 or e-mail kanalei.shun@usace.army.mil.

Sincerely,

Anthony J. Paresa, P.E.
Deputy District Engineer for
Programs and Project Management

Enclosures

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
**Pacific Islands Regional Office**
**1601 Kapiolani Boulevard, Suite 1110**
**Honolulu, Hawaii 96814-0047**

August 26, 2003

Milton Yoshimoto, Project Manager
Department of the Army
U.S. Army Engineer District, Honolulu
Fort Shafter, HI 96858-5440

Re: Saipan Lagoon Aquatic Ecosystem Restoration Project
Consultation No. I-PI-03-290

Mr. Yoshimoto:

This responds to your request for a current list of threatened and endangered species located in and around the area of the proposed Saipan Lagoon Aquatic Ecosystem Restoration project located on the island of Saipan, Commonwealth of the Northern Mariana Islands (CNMI). We provide the following comments and information under our statutory authorities under the Endangered Species Act of 1973, as amended, 16 U.S.C. 1531 *et seq*., and the Marine Mammal Protection Act of 1972, as amended 16 U.S.C. 1361 *et seq.* (MMPA).

Threatened green turtles (*Chelonia mydas*), endangered leatherback turtles (*Dermochelys coriacea*) and endangered hawksbill turtles (*Eretmochelys imbricata*) occur in the nearshore waters around Saipan. Endangered humpback whales (*Megaptera novaeangliae*) may be found offshore during the winter season. Other endangered marine mammals that have been sighted in the waters off Saipan include the sei whale (*Balaenoptera borealis*) and sperm whale (*Physeter macrocephalus*).

Marine mammals protected under the MMPA (not endangered or threatened under the ESA) that are found in the waters off Saipan include:

Bryde's whale (*Balaenoptera edeni*)
Cuvier's beaked whale (*Ziphius cavirostris*)
Pygmy sperm whale (*Kogia breviceps*)
Melon-headed whale ( *Peponocephala electra*)
Pygmy killer whale (*Feresa attenuata*)
False killer whale (*Pseudorca crassidens*)
Killer whale (*Orcinus orca*)
Short finned pilot whale (*Globicephala macrorhynchus*)
Spinner dolphins (*Stenella longirostris*)
Striped dolphin (*Stenella coeruleoalba*)
Pantropical spotted dolphin (*Stenella attenuata*)
Common dolphin (*Delphinus delphis*)
Risso's dolphin (*Grampus griseus*)

Critical habitat has not been designated or proposed for any listed species under the jurisdiction of National Marine Fisheries Service (NOAA Fisheries) in Saipan. Also, at this time there are no candidate species in the Saipan area.

Information regarding proposed mitigation measures incorporated into the project will be important in determining whether formal or informal consultation is required for this project. Once our office receives more information regarding the proposed action and an assessment of impact of the proposed action on the applicable species, we can initiate section 7 consultation with your agency.

We appreciate your conscientious efforts to comply with Federal requirements. Should you have further questions regarding our comments for the proposed project and/or the section 7 process, please contact Margaret Akamine or David Nichols at (808) 973-2937.

Sincerely,

For Margaret Akamine
Protected Species Program

**Commonwealth of the Northern Mariana Islands**
**Department of Community & Cultural Affairs**
**Office of the Secretary**
**Saipan, Mariana Islands 96950**

*Reply to:*
*DIV. OF HISTORIC*
*PRESERVATION*
*TEL. 664-2120/5*
*FAX. 664-2139*
*E-mail: cnmihpo@itecnmi.com*

Serial: 20145
File: Sect. 106

18 February 2003

Kanalei Shun
CEPOD-ET-ES
U.S. Army Corp of Engineers
Pacific Ocean Division
Building 230
Fort Shafter, Hawaii 96858-5440

Dear Dr. Shun,

This letter is to document the meeting of 5 February 2003 between yourself and Lon Bulgrin, the CNMI Staff Archaeologist, regarding the proposed Saipan Lagoon Remediation Project. Three separate locations were discussed that would be impacted by the project, the Quartermaster Road area, the China House/ I' Liyang area, and the Cock Fighting Ring area.

The Quartermaster Road area was extensively modified by the American military during World War II. A 1951 map depicting immediate post-war conditions on Saipan shows multiple large warehouse building in the area of the proposed earthmoving. It is very likely that concrete foundation pads and other structural elements remain from this logistical complex. Location and documentation of these historical resources will need to occur previous to mechanical clearing or excavation within this area. There is a procedure for requesting demolition of historical structures and structural remnants within the Commonwealth. Measured plan and profile drawings, 5 inch by 7 inch photographs taken from a minimum of two different directions, and a letter of justification are all required in a formal request for the demolition of historical structures. The Historic Preservation Officer then makes a decision whether to concur with the request for demolition or to enter into further negotiations with the client to mitigate the undertaking.

The World War II grading and construction activities make it unlikely that surface or shallow archaeological deposits remain intact. However, deeper cultural deposits may still survive. Therefore, monitoring by a qualified archaeologist of earthmoving to a depth of 120 centimeters (4 feet) below surface will be required. Two archaeological technicians from the CNMI HPO will be available to assist in the monitoring.

The Liyang Site, an Ancient Chamorro archaeological site dating to the Latte Period is located within the China House/I' Liyang area. In addition, an historic cemetery dating from the late 1920s into the 1950s is located in proximity to the project. My experience with the earlier cemetery in South Garapan is that non-Christian Carolinian burials may extend in a fairly wide radius outside of the cemetery bounds.

A systematic subsurface survey will need to be conducted in order to determine the vertical and horizontal boundaries of the Liyang Site within the project area. I recommend a 10-15 meter interval for the test unit locations but this could vary depending on the archaeological research design. Backhoe test units will need to be excavated to a depth of 1.5 meters or 30 centimeters below the level that water is encountered. The archaeological site, as defined by the subsurface survey, should be avoided (with a suitable buffer zone) during excavation within the area. If excavation within the archaeological site is unavoidable a data recovery plan will need to be composed and implemented by a qualified archaeologist. Two CNMI HPO staff members will be made available to assist the ACOE archaeologist or contractor in this survey.

The proximity of the Liyang Site and the historic Liyang Cemetery indicates a high probability that Ancient Chamorro archaeological deposits and historical burials are located within portions of this project area. However, not all of this extensive land parcel has the same likelihood of cultural remains being present. Therefore, the project area could be stratified based on assigned probability for the presence of historical and archaeological remains. Archaeological monitoring for all earthmoving activities will need to be conducted in areas of high probability. Archaeological monitoring to a depth of 120 centimeters (4 feet) can be conducted for the lower probability areas. Two archaeological technicians from the CNMI HPO staff will assist in the archaeological monitoring.

Human remains discovered in the course of earthmoving will need to be treated in accordance with the **Procedures for the Treatment of Human Remains in the Commonwealth of the Northern Mariana Islands**. The CNMI HPO will facilitate the excavation and treatment of any human remains discovered.

The Cock Fighting Ring area is a low probability area for historical or archaeological resources. A surface survey to identify any resources within the land parcel should suffice to investigate this portion of the project area, assuming that no significant sites are discovered. Again, two staff members of the CNMI HPO will be available to assist this survey.

Thank you for consulting with our office well in advance of this important project. Early consultation allows problems to be addressed well in advance of the construction phase and serves to limit costly delays. Our office is pleased to assist the Army Corp of Engineers in this project through our trained archaeological staff. If we can be of further assistance or if you have further comments or questions in regards to this project please feel free to contact either myself or Lon Bulgrin.

Sincerely,

Epiphanio E. Cabrera Jr.
Historic Preservation Officer

c.c. Secretary DCCA

DEC 10 2003

Commonwealth of the Northern Mariana Islands
**Coastal Resources Management**
P.O. Box 10007, 2nd Floor, Morgen Building
San Jose Saipan, MP 96950

COASTAL RESOURCES MANAGEMENT
Tels.: (670) 8300/14
Fax: (670) 664-8315

November 19, 2003

Milton T. Yoshimoto
Project Engineer
U.S. Army Corps of Engineers
Honolulu District
Bldg. 230, Fort Shafter, Hi 96858-5440

Dear Mr. Yoshimoto:

CRMO is providing the additional information you requested in your project update of October 2003 and received by CRMO on November 3, 2003. The items of concern or information needing clarification prior to the completion of the conceptual design of the project restoration alternatives are as follows:

1. CRMO conducted a wetland site assessment in both the Quartermaster and the China House sites as specified in the US Department of Defense Figure (Saipan FUD Sites and CRM Areas of Particular Concern, 1999). On November 10, 2003, a wetland investigation was conducted in the Quartermaster and the China House sites. CRMO finds no evidence of wetland in these areas.

2. The tradewinds come from the north to northeast. Generally, the air quality around the Quartermaster and the China House sites is good. There are periods of degradation due to traffic in the form of dust and vehicular emissions. Air pollution can be mitigated by the retention of frontage vegetation and by developing dust control measures onsite during construction of the storm water infiltration/retention system.

3. The proposed project noise impact can be considered insignificant based on other EIA studies conducted for CRMO major siting permit in adjacent areas. It is understandable that heavy equipment creates noise. However, this work can be restricted to daylight hours and therefore, noise would not be a real concern.

4. Traffic congestion will most likely not be a problem. The proposed project should be able to develop its traffic control system to mitigate and avoid traffic congestion during peak hours.

5. The CRMO Marine Monitoring Team (MMT) has submitted its detailed biological lagoon analysis on seagrass transect studies. On November 17, 2003, Mr. Peter Houk send an email to Dr. Spengler, Environet, to contact him should he needs further information on the MMT lagoon studies.

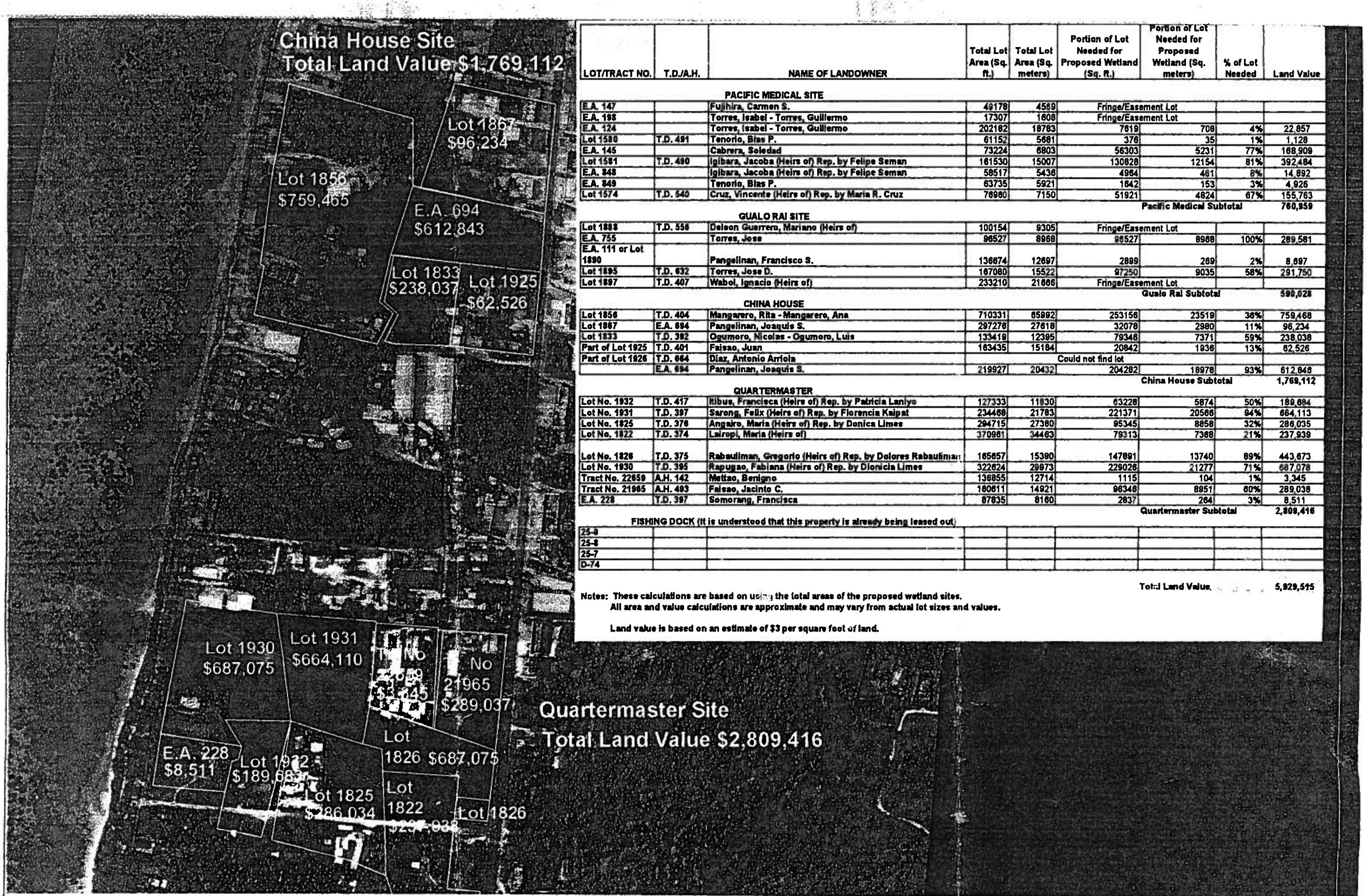
6. The attached Saipan aerial photo shows land values.

Should you need additional information, please let us know.

Sincerely,

Joaquin D. Salas
Director

Attachment



| LOT/TRACT NO. | T.D./A.H. | NAME OF LANDOWNER | Total Lot Area (Sq. ft.) | Total Lot Area (Sq. meters) | Portion of Lot Needed for Proposed Wetland (Sq. ft.) | Portion of Lot Needed for Proposed Wetland (Sq. meters) | % of Lot Needed | Land Value |
|---|---|---|---|---|---|---|---|---|
| | | PACIFIC MEDICAL SITE | | | | | | |
| E.A. 147 | | Fujihira, Carmen S. | 49178 | 4569 | Fringe/Easement Lot | | | |
| E.A. 198 | | Torres, Isabel - Torres, Guillermo | 17307 | 1608 | Fringe/Easement Lot | | | |
| E.A. 124 | | Torres, Isabel - Torres, Guillermo | 202162 | 18783 | 7619 | 708 | 4% | 22,857 |
| Lot 1580 | T.D. 491 | Tenorio, Blas P. | 61152 | 5681 | 376 | 35 | 1% | 1,128 |
| E.A. 145 | | Cabrera, Soledad | 73224 | 6803 | 56303 | 5231 | 77% | 168,909 |
| Lot 1581 | T.D. 490 | Igibara, Jacoba (Heirs of) Rep. by Felipe Seman | 161530 | 15007 | 130828 | 12154 | 81% | 392,484 |
| E.A. 848 | | Igibara, Jacoba (Heirs of) Rep. by Felipe Seman | 58517 | 5436 | 4964 | 461 | 8% | 14,892 |
| E.A. 849 | | Tenorio, Blas P. | 63735 | 5921 | 1642 | 153 | 3% | 4,926 |
| Lot 1574 | T.D. 540 | Cruz, Vincente (Heirs of) Rep. by Maria R. Cruz | 76960 | 7150 | 51921 | 4824 | 67% | 155,763 |
| | | | | | | Pacific Medical Subtotal | | 760,959 |
| | | GUALO RAI SITE | | | | | | |
| Lot 1888 | T.D. 556 | Deleon Guerrero, Mariano (Heirs of) | 100154 | 9305 | Fringe/Easement Lot | | | |
| E.A. 755 | | Torres, Jose | 96527 | 8968 | 96527 | 8968 | 100% | 289,581 |
| E.A. 111 or Lot 1890 | | Pangelinan, Francisco S. | 136674 | 12697 | 2899 | 269 | 2% | 8,697 |
| Lot 1895 | T.D. 632 | Torres, Jose D. | 167080 | 15522 | 97250 | 9035 | 58% | 291,750 |
| Lot 1897 | T.D. 407 | Wabol, Ignacio (Heirs of) | 233210 | 21666 | Fringe/Easement Lot | | | |
| | | | | | | Gualo Rai Subtotal | | 590,028 |
| | | CHINA HOUSE | | | | | | |
| Lot 1856 | T.D. 404 | Mangarero, Rita - Mangarero, Ana | 710331 | 65992 | 253156 | 23519 | 36% | 759,468 |
| Lot 1867 | E.A. 694 | Pangelinan, Joaquis S. | 297276 | 27618 | 32078 | 2980 | 11% | 96,234 |
| Lot 1833 | T.D. 392 | Ogumoro, Nicolas - Ogumoro, Luis | 133419 | 12395 | 79346 | 7371 | 59% | 238,038 |
| Part of Lot 1925 | T.D. 401 | Faisao, Juan | 163435 | 15184 | 20842 | 1936 | 13% | 62,526 |
| Part of Lot 1926 | T.D. 664 | Diaz, Antonio Arriola | Could not find lot | | | | | |
| | E.A. 694 | Pangelinan, Joaquis S. | 219927 | 20432 | 204282 | 18978 | 93% | 612,846 |
| | | | | | | China House Subtotal | | 1,769,112 |
| | | QUARTERMASTER | | | | | | |
| Lot No. 1932 | T.D. 417 | Ribus, Francisca (Heirs of) Rep. by Patricia Laniyo | 127333 | 11830 | 63228 | 5874 | 50% | 189,684 |
| Lot No. 1931 | T.D. 397 | Sarong, Felix (Heirs of) Rep. by Florencia Kaipat | 234468 | 21783 | 221371 | 20566 | 94% | 664,113 |
| Lot No. 1825 | T.D. 376 | Angairo, Maria (Heirs of) Rep. by Donica Limes | 294715 | 27380 | 95345 | 8858 | 32% | 286,035 |
| Lot No. 1822 | T.D. 374 | Lairopi, Maria (Heirs of) | 370961 | 34463 | 79313 | 7368 | 21% | 237,939 |
| Lot No. 1826 | T.D. 375 | Rabauliman, Gregorio (Heirs of) Rep. by Dolores Rabauliman | 165657 | 15390 | 147891 | 13740 | 89% | 443,673 |
| Lot No. 1930 | T.D. 395 | Rapugao, Fabiana (Heirs of) Rep. by Dionicia Limes | 322624 | 29973 | 229026 | 21277 | 71% | 687,078 |
| Tract No. 22659 | A.H. 142 | Mettao, Benigno | 136855 | 12714 | 1115 | 104 | 1% | 3,345 |
| Tract No. 21965 | A.H. 493 | Faisao, Jacinto C. | 160611 | 14921 | 96346 | 8951 | 60% | 289,038 |
| E.A. 228 | T.D. 397 | Somorang, Francisca | 87835 | 8160 | 2837 | 264 | 3% | 8,511 |
| | | | | | | Quartermaster Subtotal | | 2,809,416 |
| | | FISHING DOCK (It is understood that this property is already being leased out) | | | | | | |
| 25-9 | | | | | | | | |
| 25-8 | | | | | | | | |
| 25-7 | | | | | | | | |
| D-74 | | | | | | | | |
| | | | | | | Total Land Value | | 5,929,515 |

Notes: These calculations are based on using the total areas of the proposed wetland sites.
All area and value calculations are approximate and may vary from actual lot sizes and values.

Land value is based on an estimate of $3 per square foot of land.

# *Appendix E*
# *Documented Meetings on Saipan*

**May 18, 2002**

## Subject: Summary of Work Tasks Completed during Environet's May 2002 Trip to Saipan

Steve Spengler and Matt Neal of Environet arrived on Saipan on Monday, May 6th. Dr. Spengler stayed in Saipan until Wednesday May 15th while Mr. Neal stayed on the island until May 12th. Dr. Spengler spent a day on Guam on May 15th, returning to Honolulu on May 16th.

The table below lists the people who were contacted during this visit to discuss various aspects of the Saipan Aquatic Ecosystem Restoration project.

| NAME | | AGENCY AND TITLE | PHONE | NOTES |
|---|---|---|---|---|
| Jack | Salas | CRM, Chief Enforcement | 670-234 6623 | Co-Sponser |
| Doug | Mauro | CRM | 670-234-6623 | GIS / CAD |
| Brian | Bearden | DEQ | 670-664 8510 | |
| Clarrissa | Tanaka | DEQ, Chemist | 670-664 8500 | Water Quality Data |
| Peter | Houk | DEQ, Marine Fishery | 670-664 8504 | Aquatic Biologist |
| Vince | Castro | DLNR | 670-234-3751 | GIS Atlas / Dept of Public Lands |
| Robert | Carruth | USGS | 670-322 2060 | Rainfall Data |
| John | Starmer | CRM | 670-234-6623 | Aquatic Biologist |
| Thorne | Abbott | U.S. Fish and Wildlife Service | 670-664-6025 | Wetlands Specialist |
| Kate | Moots | Dept of Fish and Wildlife | 670-664-6019 | Fisheries Biologist III |
| Michael | Trianni | Dept of Fish and Wildlife | 670-664-6018 | Sea Cucumbers / survey info |
| Steve | Spengler | Environet | 808-833-2225 | Environet Project Manager |
| Matthew | Neal | Environet | 808-833-2225 | Environet Task Manager |
| Joe | Kaipat | Safe Drinking Water Branch Manager | 670-664-8509 | DEQ: Manager Safe Drinking Water |
| Robert | York | Northern Mariana Islands Museum | 670-664-2160 | Curator |
| Gigi | York | Northern Mariana Islands Museum | 670-664-2160 | Collection Curator |
| Lon | Bulgrin | Division of Historic Preservation | 670-664-2122 | Consulting Archaeologist |
| Becky | Lazama | CRM-Wetlands Material | | Geotechnical Company: Perc Test |
| Scott | Russell | Council of the Humanities | | Archaeology Expert and Author |
| Jun | Beltran | Geotesting | 670-235-6000 | |
| Ike | Cabrera | Former DEQ head | 670-483-8426 | |
| Pete | Baubata | Head of CUC Laboratory | | |
| Harold | Wood | Laboratory Manager for WERI | 671-735-2688 | 303 University Dr. UOG Station<br>Mangilao, Guam 96923 |
| | | | | |

Division of Fish & Wildlife, PMB 2761, P.O. Box 10002, Saipan MP 96950
Division of Environmental Quality, P.O. Box 501304, Saipan MP 96950
Northern Mariana Islands Museum, P.O. Box 504570, Saipan MP 96950
Division of Historic Preservation, SPS #741, Box 10006, Saipan, MP 96950

The major tasks completed during this site visit are summarized below:

¾ Downloaded pressure transducer and rainfall data from monitoring locations at the Hariguchi and Pizza Hut Buildings as well as from beneath the intersection of Quartermaster and Middle roads.

¾ Reviewed aerial and other photograph database available at the University of Northern Marianas Pacific Collection laboratory.

¾ Retrieved AutoCAD images for the shoreline delta areas from Meridian Surveying.

¾ Reviewed As-Build Drawings from the Phase 4 road improvements along Middle Road that were completed in 1992.

¾ Discussed potential restoration alternatives with three employees of the Fish and Wildlife Service and the Department of Fisheries.

¾ Installed a pressure transducer in the drainage culvert beneath Middle road across the street from the Subway Sandwich shop.

¾ Talked with Jun Beltran of Geotesting about compiling percolation data for the project watershed.

¾ Installed a third automated rain guage on top of the Geotesting Building.

¾ Collected stormwater samples from Drains Number 6, 11 and 13 between 6 to 6:30 AM. Submitted samples to DEQ laboratory (left with Marvin) for nutrient and microbial analysis at about 8:30 AM.

¾ Did a quick reconnaissance tour of four potential future wetlands/retention basin sites present within the project watershed: Fishing Dock area, Drain 7 Area (located south of Wendy's), Quartermaster Road Area, and Gualo Rai wetland area. A fifth potential site exists just to the south of the new emergency medical facility located along Middle road.

¾ Collected 21 groundwater samples from along the shoreline at low tide between 13:40 and 15:57. Primary sample locations were located at 0.2-mile intervals in moving south from the Fishing Dock. Secondary locations were located at 0.1-mile and 262-foot intervals in the vicinity of the Drain 7 wetland and the Drain 6 site. Analyzed samples in the field for temperature, conductance and pH. The following nine shallow, near-shore groundwater samples were submitted to DEQ for nitrate analysis: GWI-24, GWI-26, GWI-14, GWI-28, GWI-29, GWI-17, GWI-19, GWI-21 and GWI-23.

# Summary of Work Tasks Completed during Environet's June 2002 Trip to Saipan

Steve Spengler and Anson Murayama of Environet arrived on Saipan on Tuesday, June 25th. Dr. Spengler stayed in Saipan until Tuesday July 2nd while Mr. Murayama stayed on the island until June 29th. Milton Yoshimoto, Carl Larson and Ronald Pang of the USACE also traveled to Saipan on the same flight to attend project related meetings. A chronological summary of work completed during the visit is given below:

## Wednesday, June 26th

Environet and Corp personnel met with four people (Henry Hofschneider, Mike Sablan, Jude Dickson and Frank Eliptico) from the Office of Public Lands, Northern Mariana Islands during a meeting which began at 9 AM. The main topic of the conversation, which lasted approximately one hour and a half, was to ascertain whether the office of public lands considers acquisition of land for construction of retention basins to be feasible. According to Deputy Director Hofschneider, acquisition of land will be possible but difficult. Mike Sablan agreed to contact various politicians to see if they would be willing to attend the meeting to be held at the CRM office tomorrow at 10:00. Mike will also work with Jesus Takai, the Director of the Division of Lands Registration and Survey, to determine the ownership of the parcels present within the proposed wetland and retention basin locations.

Environet personnel took Corp personnel to the five proposed retention structures to allow them to view each site.

Provided Clarissa Tanaka with a list of the dates of stormwater and groundwater samples that were previously submitted to the DEQ laboratory for analysis.

## Thursday, June 27th

Gave a Powerpoint presentation at the CRM conference room at 10:00 AM. A total of 14 people attended the meeting (Ronald Pang, Carl Larson, Anson Murayama, Steve Spengler, Keith Aughenbaugh, Arnold Palacios, Frank Eliptico, Jude Dickinson, Milton Yoshimoto, Kerry Pate, Clarissa Bearden, Ray Tebuteb, Haidre Eugenio, and Thorne Abbott). Fielded a few questions from meeting participants. Milton and Steve talked with reporter from the Marianas Variety and Steve was interviewed by correspondent from local television station.

Downloaded rainfall data from the Hariguchi, Pizza Hut and Geotesting Building sites. Discussed getting infiltration data from Geotesting. I will revisit Geotesting personnel tomorrow afternoon. I will also revisit Clarissa Tanaka tomorrow afternoon to obtain all of the analytical data that has been generated by the DEQ laboratory on stormwater and groundwater samples previously submitted to the laboratory. Will also revisit Alfred Pangalinian tomorrow morning to obtain the second round of surveying data and to get

Meridian to shoot the elevations of the drainage culverts located in front of the Subway Sandwich shop and at the intersection of Middle and Quartermaster road.

## Friday, June 28th

Visited the constructed wetland located at American Memorial Park. Discussed the project with Chuck Sayon, the site manager/park ranger for this park. He photocopied some of the operation and maintenance documents prepared for the project site by Winzler and Kelly. Talked with Brian Bearden about this site. Unfortunately, there is no water quality data available for the project. The wetland currently receives brine generated from the Hyatt's desalinization unit. This leads to a high salinity environment which limits the type of vegetation that can grow in the area to mangrove type vegetation. They are currently trying to grow the indigenous mangrove that is found in adjoining wetland areas. The desalinization process appears to lead to concentrated levels of phosphate and nitrates in the brine generated by the desalinization process.

At 13:00, a meeting was held at the office of the legislature for members of a legislative committee (Department of Land and Natural Resources?). Attendees at the meeting included the following legislators: Arnold Palacios, Pedro Castro, Frank Aldam, Tom Tebutub, Danny Quitugua, and Manuel Tenorio. In addition, the governors assistant, Mr. Bob Schwalbach, attended the meeting. Steve Spengler, Anson Murayama, Milton Yoshimoto, Ron Pang, Carl Larson, and Kerry Pate also attended this meeting. The legislators expressed strong support for the project. The meeting lasted two hours.

Collected percolation test data from the files of Geotesting. Unfortunately, the location of individual percolation tests were not generally available. I recorded the following data from the Geotesting files: calculated percolation rate (inches/hour), lithology encountered in test pit, and location, if available.

## Monday, July 1st

Held a meeting with Brian Bearden of DEQ to discuss the status of the project. Went through the project powerpoint presentation with Brian. Brian suggested that as part of the beneficial impact analysis that we look at utilizing the Uplands Mitigation Bank, which was signed into legislation in January 2002. This program allows a developer to buy credits for use of land that will impact bird habitat. The Fish and Wildlife Service has identified 97 breeding pairs of Reed Warblers for the purposes of the Upland Mitigation Bank. They have suggested that 2.5 hectacres of land are required per breeding pair, but Throne suggests that an area as little as 1/3 acre per pair might be sufficient. A value of $55,200 per breeding pair was established in a Memorandum of Understanding document signed between CNMI and the Fish and Wildlife Service. Tina De Cruz (DFW) is the local expert on the reed warbler. Met with Throne Abbott of DFW. He provided some additional information about mitigation banks. They are apparently well established for wetland areas on the mainland, especially California. A possible point of contact for more information would be Steve Morgan of Wetlands, Inc. (916-331-8810). Relevant reference for the reed warbler: Recovery Plan for the Nightingale

Reed-Warbler (Acrocephalus luscinia). Published by Region 1, U.S. Fish and Wildlife Service, Portland, Oregon, April 1998, 62 pp.

Met with Rob Carruth of the USGS to discuss the hydrogeology of the inland part of the project watershed. A hydraulic conductivity value of 1,200 feet/day for the Tagpochau/Mariana Limestone is being used in the on-going USGS modeling efforts. The water levels along Middle road are estimated to be approximately 1 feet above sea level, whereas the water levels measured in the Gualo Rai wells range from 3.5 to 4.0 feet above sea level.

Met with Clarissa Tanaka of DEQ. Clarissa provided me with the analytical data that DEQ has been collecting from near-shore monitoring locations within the project watershed and from periodic near-shore groundwater and stormwater samples collected during previous visits.

Met with Max and Mark of AES to show them where to collect stormwater samples for this study. They will provide water quality monitoring equipment. The first samples will be collected from Drains 4, 6, and 11. Additional samples will be collected from the Hafa Adai and Dai Ichi drainage canals. The samples will be collected from an area below the discharge points where concentrated brine enters both drainage channel.

Downloaded the pressure transducer beneath Quartermaster/Middle Road intersection at 18:00. Reinstalled the transducer at 18:30 and reset the sampling interval to 3 minutes from 1 minute.

Downloaded the pressure transducer beneath road in front of Subway at 18:40. Reinstalled the transducer at 18:45 and reset the sampling interval to 3 minutes from 1 minute.

### Tuesday, July 2nd

Left the island early this morning.

## Saipan AER Project Status Report: June, 2002

# List of People with Whom Discussions were Held During the June Visit to Saipan

| NAME | | AGENCY AND TITLE | PHONE | E-MAIL | NOTES | FAX |
|---|---|---|---|---|---|---|
| Jesus | D.L.G. Takai | Director, Div Lands Reg. & Survey | 670-322-9018 | divlrsgovt@vzpacifica.net | DLNR | 322-4039 |
| Keith | Aughenbaugh | U.S. Dept. of Interior, OIA | 670-233-9439 | | | |
| Arnold I. | Palacios | CNMI Legislature | 670-664-8830 | | Chariman | |
| Kerry | Pate | Deputy Director of CRM | 670-664-8300 | | | |
| Clarissa T. | Bearden | DEQ Laboratory | 670-664-8500 | | | |
| Ray A. | Tebuteb | CNMI Legislature | 670-664-8887 | | | |
| Haidee | Eugenio | Mariana Variety | 670-234-6341 | | | |
| Elaine | Apatang | Correspondent, KMCV7 News | 670-235-6369 | kmcv.eapatang@saipan.com | Cellular phone: 670-483-0130 | 235-0965 |
| Thorne | Abbott | Natural Resource Planner | 670-664-6025 | Thornea@coastalzone.com | Division of Fish & Wildlife | 664-6060 |
| Henry S. | Hofschneider | Deputy Commisioner, | 670-234-3751 | henryhofschneider@yahoo.com | Marianas Public Lands Authority | 234-3755 |
| Frank M. | Eliptico | Chief, Real Estate Division | 670-234-3751 | fme99@hotmail.com | Office of Public Lands, NMI | 234-3755 |
| Carl | Larson | CEPOH, RE | 808-438-3201 | | Real Estate Guy for Corp | |
| Ronald | Pang | Corps of Engineers | 808-438-9530 | | | |
| Mike | Sablan | Marianas Public Land Authority | 670-234-3751 | | | |
| Jude | Dickinson | Marianas Public Land Authority | 670-234-3751 | | | |
| Chuck | Sayon | Site Manager / Park Ranger | 670-234-7207 | chuck_f._sayon@nps.gov | | 234-6698 |
| Manuel A. | Tenorio | Vice Speaker, House of Representatives | 670-664-8939 | repten@saipan.com | 13th Northern Marianas Legislature | 664-8896 |
| Pedro | Castro | Vice Chairman | | | Vice Chariman | |
| Frank | Aldam | Committee Member | | | | |
| Tom | Tebuteb | Committee Member | | | | |
| Danny | Quitugua | Committee Member | | | | |
| Bob | Schwalbach | Assistant to President | | | | |

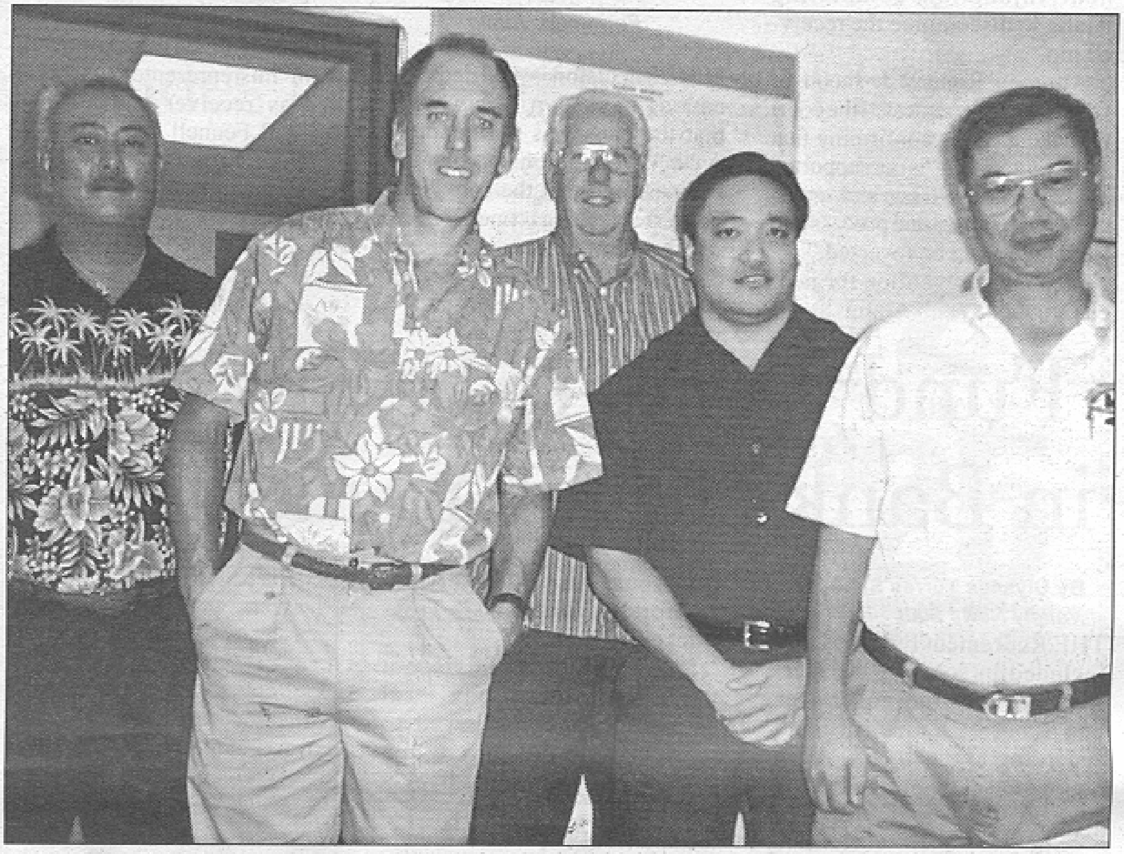
Office of Public Lands, Northern Mariana Islands. P.O. Box 500380 Saipan, MP 96950

DEQ Laboratory, P.O. Box 501304, Saipan, MP

National Park Service, American Memorial Park. P.O. Box 5198 CHRB, Saipan, MP 96950

Manuel Tenorio, P.O. Box 500586, Saipan, MP 96950

Thorne Abbott, PMB #4162, P.O. Box #10002, Saipan, MP 96950



**RESTORE THE LAGOON.** *Officials of the U.S. Army Corps of Engineers and its Hawaii-based contractor Environet, Inc. are on-island for the Saipan lagoon restoration project. From left, Anson Murayama and Dr. Steven Spengler, both from Environet, Carl Larson, Milton Yoshimoto and Ronald Pang of the Army Corps.*

Photo by **Haidee V. Eugenio**

**From Mariana's Variety, July 1, 2002**

# Army Corps presents options to restore Saipan lagoon

By Haidee V. Eugenio
*Variety News Staff*

THE U.S. Army Corps of Engineers and its Hawaii-based contractor Environet Inc. are urging the CNMI government to help in the planned major restoration of Saipan's degrading lagoon.

Yesterday, federal and local officials convened at the Coastal Resources Management to discuss the five available options to restore the ''hmd lagoon.

Milton Yoshimoto, project manager of the Army Corps Honolulu District's civil works branch, said the requirements — like providing lands, easements, right-of-way and necessary relocation — need to be enforced before the actual project construction.

"Without local assistance, this project may not be realized," said Yoshimoto during the one-hour meeting.

For example, there are five potential sites for the construction of retention/detention basins and wetlands.

The CNMI government needs to ensure that all the private and public lands covered in the project will be made available along with providing all access routes and relocation of utilities necessary for the project construction, its operation and maintenance.

Rep. Arnold Palacios, R-Saipan and chairman of the House Committee on Natural Resources, said the Legislature and the administration support this project, and look forward to its completion.

"We are all one in saying that we need to do something to protect and restore our marine environment," said Palacios, adding that his committee may introduce a bill appropriating local funds for the project.

The options presented by the Army Corps and Environet include: no action; collect and convey stormwater offshore; construct retention/detention basins; create constructed wetlands; and construct combination of retention/detention basins and constructed wetlands.

The area under consideration covers a 1.5-mile length of shoreline in western Saipan, from the Garapan fishing base to the Quarter Master Road intersection.

Dr. Steven R. Spengler, senior hydrogeologist of Environet, said a draft CO'' analysis for each one of the options is expected to be completed in Jan. 2003.

"That analysis would include which of the options will give the best benefit to the environment, and how much would it cost," said Spengler.

In his presentation, Spengler said the overall project objective is to restore degraded ecosystem structure, function and dynamic processes to a less degraded, more natural condition.

"Specifically, an attempt will be made to re-establish, as closely as possible, conditions which would occur in the area in the absence of human changes to the landscape and hydrology," he said.

The analysis will then be presented to the CNMI which will decide which of the options to take.

Representatives from the Marianas Public Lands Authority, the Division of Fish and Wildlife and the Division of Environmental Quality were also present during the meeting.

**From Mariana's Variety, June 29, 2002**

# Summary of Work Tasks Completed during Environet's August 2002 Trip to Saipan

Steve Spengler and Matt Neal of Environet arrived on Saipan on Thursday, August 8th. Dr. Spengler and Mr. Neal stayed in Saipan until Saturday August 10th at which time they traveled back to Guam for the weekend. They returned to Saipan on the evening of August 11th. Ms. Colette Sakoda joined them in Saipan on the evening of August 13th. Mr. Spengler, Neal and Ms. Sakoda returned to Honolulu on Friday morning, August 16th. A chronological summary of work completed during the visit is given below:

## Friday, August 9th

Environet personnel installed pressure transducers in monitoring wells located at the Mobil/McDonalds gas station located along Beach Road and the inland Mobil station located along Middle road in Garapan. Survey elevation for the top of casing for both wells used was supplied by Max Simian of AGS. The transducer data will be used to monitor changes in groundwater elevation over a five day period to allow a calculation of overall groundwater gradient for the shallow basal aquifer that underlies the southern portion of Garapan.

At 11:30, we removed the transducer that was in the drainage culvert fronting the Subway sandwich shop along Middle road. We were unsuccessful at downloading the pressure information, since we constantly got an error message as the transducer was completing its download of information. We also apparently overwrote the last months data present on the transducer. We reprogrammed the transducer and installed in the McDonalds well.

Starting at about 2:00 PM, we began sampling 21 near-shore groundwater locations located along the shoreline region of our project area. The samples were collected around the time of low tide. Field measurements were made on the collected groundwater samples as well as samples in Whirlpacks and sample jars to allow us to measure Enterococci, nitrate, phosphate and TDS levels using the colorimetric and turbidity meters supplied by DEQ. A subset of the samples collected was submitted to the DEQ laboratory for microbiological analysis (enterococci).

## Monday, August 12th

Collected stormwater runoff from an early morning rain event that occurred at about 8:30 AM. Stormwater samples were collected from drains 6, 11 and 14 (Hakubaton Building) as well as from the drainage ditch located in front of the Dai Ichi Hotel.

Stormwater discharge rates were measured at a number of drainage channels during a follow-on rain burst that took place around 9:30 AM. Runoff measurements were also collected from the Quartermaster drainage culvert during the end of this rain event.

Max Simian of AES also sampled this particular storm event. We will submit both sets of stormwater data to Sequoia Analytical for analysis of priority pollutants metals levels (including Barium).

Successfully downloaded the pressure transducer beneath Quartermaster Road. Unfortunately, all of the rain gauges had been inadvertently turned off on June 27th and thus no rainfall record is available for the intervening time period. The rain gauges were reactivated around 4:30 PM.

Talked with Peter Houk about the write-up for the historic aerial photograph review and offshore lagoon habitat write-up for the project. Peter will begin working on the write-up this week and will e-mail us the remainder prior to him leaving for Florida.

## Wednesday, August 14th

Held a meeting at 9:00 AM at the offices of CRM. Discussed the land acquisition aspects of the project with members of CRM and the Marianas Public Land Committee? People in attendance included: John Starmer, Vince Castro, Philip Sablan and Benny Pangalinan. Others in attendance include: Steve Spengler, Matt Neal, Colette Sakoda, Milton Yoshimoto and Karl Larson. Discussed any possible land use restrictions for the five tentative locations for retention basins/constructed wetlands. Vince told us that we do not have to consider the Fishing Dock site because of future lease obligations for the site.

Steve and Colette visited Vince Castro to obtain information about land use aspects of the future project. Vince also explained the organization of the CNMI government. Vince informally suggested that a land value of around $30 a square meter might be more representative for the areas that will be potentially acquired. Steve showed Colette around the island. Photocopied the drainage study that had been previously completed for the Garapan region of Saipan by the Army Corps in1987.

## Thursday, August 15th

Held an information meeting at the chambers of the CNMI legislature to discuss the progress of the project. The legislators had numerous questions about the project. Many of the questions centered around the funding requirements of the project. The majority of the comments came from the speaker and vice-speaker of the house as well as from representative Atta.

Decided to eliminate the Gualo Rai and Pacific Medical Sites from future consideration. Rather, we will consider evaluating the natural sinkhole site located behind the cock fighting complex which is located Mauka of Middle road.

Steve, Colette and Carl visited the following agencies to obtain additional information about the EIS aspects of the future ecosystem restoration project: DEQ (Brian Beardon), DPW (nobody showed), Division of Historic Preservation (Lon Bulgrin).

### Friday, August 16th

Left the island early this morning.

### Key Players from August 2002 Trip

| NAME | | AGENCY AND TITLE | PHONE | E-MAIL | NOTES |
|---|---|---|---|---|---|
| Philip G. | Sablan | Dept. of Public Works | 670-322-9828 | phil_tsd@yahoo.com | Highway Planning/Fiscal Coordinator |
| Vince T. | Castro | Marianas Public Lands Authority | 670-234-3751 | MPLA@vzpacifica.net | Land Use Manager |
| Lon | Bulgrin | Division of Historic Preservation | 670-664-2122 | cnmihpo@itecnmi.com | Consulting Archaeologist |
| Joseph P. | Deleon Guerrero | House of Representative | 670-664-8879 | rep.joeguerrero@saipan.com | Representative, 13th CNMI Legislature |
| Heinz S. | Hofschneider | House of Representative | 670-664-6969 | hsh.legis@saipan.com | Speaker, 13th CNMI Legislature |
| Peter | Houk | DEQ | 670-286-5303 | p_houk@hotmail.com | Biologist |
| Steven | Spengler | Environet | 808-864-3953 | srspengler@hawaii.rr.com | Consultant |
| Matthew | Neal | Environet | 808-833-2225 | mneal@hawaii.rr.com | Consultant |
| Colette | Sakoda | Environet | 808-732-8602 | sakodac001@hawaii.rr.com | Consultant |
| Milton | Yoshimoto | USACE | 808-438-2250 | Milton.T.Yoshimoto@usace.army.mil | Project Coordinator |
| Melchor | Mendiola | House of Representative | 670-664-8845 | melchormendiola@hotmail.com | Representative, 13th CNMI Legislature |
| Jessica | Tomokitne | Speakers Office | 670-664-6969 | tomokanej@saipan.com | |
| Ray | Tebuteb | House of Representative | 670-664-8887 | rtebuteb@pacifica.vz.com | Representative, 13th CNMI Legislature |
| Peter | Castro | House of Representative | 670-664-8870 | | Representative, 13th CNMI Legislature |
| Frank | Aldan | House of Representative | 670-664-8928 | falkan@vzpacifica.net | Representative, 13th CNMI Legislature |
| Ben M. | Taitano | Concerned Citizen | 670-234-6004 | benmag@usa.com | |
| Ray | Quichocho | Marianas Public Lands Authority | 670-234-3751 | rayq@vzpacifica.net | Attorney, Interim Director? |
| Juan P. | Tenorio | House of Representative | 670-233-8730 | | Representative, 13th CNMI Legislature |
| Mike A. | Bonah? | House of Representative | 670-664-8830 | | |
| Benny K. | Pangelinian | CRM | 670-664-8304 | crm.wahoo@saipan.com | |
| Benjamin B. | Saman | House of Representative | 670-664-8890 | repseman@vzpacifica.net | Representative, 13th CNMI Legislature |
| Pete P. | Reyes | CNMI Senate | 670-664-8807 | pete.reyes@saipan.com | |
| Stanley | Torres | House of Representative | | | Representative, 13th CNMI Legislature |

## Saipan AER Project Status Report: August, 2002

| NAME | | AGENCY AND TITLE | PHONE | E-MAIL | NOTES |
|---|---|---|---|---|---|
| Jesus | Attao | House of Representative | | | Representative, 13th CNMI Legislature |
| Arnold I. | Palacios | House of Representative | 670-664-8830 | aipalacios@yahoo.com | Chariman, Natural Resources Committee |
| Clarissa T. | Bearden | DEQ Laboratory | 670-664-8500 | | |
| Ray A. | Tebuteb | CNMI Legislature | 670-664-8887 | | |
| Carl | Larson | CEPOH, RE | 808-438-3201 | carl.a.larson@usace.army.mil | Real Estate Guy for Corp |
| Manuel A. | Tenorio | Vice Speaker, House of Representatives | 670-664-8939 | repten@saipan.com | 13th Northern Marianas Legislature |
| Pedro | Castro | Vice Chairman | | | Vice Chariman |
| Frank | Aldam | Committee Member | | | |
| Tom | Tebuteb | Committee Member | | | |
| Danny | Quitugua | Committee Member | | | |

Office of Public Lands, Northern Mariana Islands. P.O. Box 500380 Saipan, MP 96950

DEQ Laboratory, P.O. Box 501304, Saipan, MP

National Park Service, American Memorial Park. P.O. Box 5198 CHRB, Saipan, MP 96950

Department of Public Works, Lower Base, Saipan, MP 96950

Division of Historic Preservation, Department of Community and Cultural Affairs, SPS #741, Box 10006, Saipan, MP 96950
Joseph P. Deleon Guerrero, Representative, P.O. Box 500586, Saipan, MP 96950: web site: www.dreamwater.org/repjguerrero

Heinz. S. Hofschneider, Speaker, P.O. Box 500586, Saipan, MP 96950

Peter Houk, Pacific Marine Resource Institute, PMB 1156, P.O. Box 10003, Saipan, MP 96950

**Saipan AER Project Status Report: August, 2004**

## Summary of Visit to Saipan from 4/4/04 to 4/7/04.

Flew to Saipan on 4/4/04.

4/5/04: Met with Jack Salas, Steve Tilley, Milton Yoshimoto at the CRM office from 7:30 to 8:30 to discuss the Saipan AER project. It was decided at this meeting to extend the project area to the northern property boundary of the Hafa Adai hotel, so that the Cock Fighting Arena site could be included in the restoration analysis.

Gave a powerpoint presentation to members of the Saipan legislature from 9:15 to 10:45. Attendees at the meeting included Jack Salas, Steve Tilley, Milton Yoshimoto, Uyen Tran, Steve Spengler, Timothy Villagomez, Clyde Norita, Miram Seman, and three other legislators who did not provide business cards. After the powerpoint presentation, there was a lot of talk about the funding aspect of the project and the timing of when funds needed to be committed.

From 11:00 to 11:30, Milton, Steve, Uyen, Jack and Steve Tilley went to the shoreline in front of the Hafa Adai in order to verify the location of the extended northern boundary of the project.

Steve, Uyen Hilary and Kathy visited the cock fighting arena site and the ephemeral stream gulch to view the proposed restoration system for this area.

4/6/04: Met with Brian and returned the copy of his design plan for the wetlands informational trail. Obtained a copy of a prior Corp reconnaissance trip report for Lake Susupe. Obtained a copy of a detailed shape file for Saipan from Ken Cochrain. Got some new publications from the technician (George?) who was present at the USGS office. Talked with Genevieve Cabrera of the Division of Historic Preservation about the previous work that has been conducted in the Lake Susupe area. She said that a detailed study and analysis of cores collected by archaeologists from the middle of Lake Susupe, which will describe the flora and changes that have occurred within the Lake over the past 7000 years, will be submitted by Steve Athens and his archaeological firm within the next month. Genevieve also said that she would e-mail me some files of previous stratigraphic chronology work conducted by other researchers.

Noticed that the proposed China House site had been extensively cleared of vegetation recently. This area is apparently owned by Perry Tenorio who would like to turn the area into a driving range. There is a retention basin present at the site but the temporary weir installed to hold back runoff crossing the property is woefully inadequate.

## List of Key Players from the April 2004 Trip

| NAME | | AGENCY AND TITLE | PHONE | E-MAIL | NOTES |
|---|---|---|---|---|---|
| Pete | Palacios | Assistant Director, DEQ | 670-664-8500 | pete.palacios@saipan.com | DLNR |
| John L. | Castro, Jr. | Director, DEQ | 670-664-8500 | deq.director@saipan.com | |
| Genevieve S. | Cabrera | Historian, Division of Historic Preservation | 670-664-2120 | gscab63@vzpacifica.net | Division of Historic Preservation |
| Epi | Cabrera | Director, Division of Historic Preservation | 670-664-2120 | | |
| Steve | Tilley | Deptuy Director, CRM | 670-664-8307 | steve.tilley@crm.gov.mp | www.crm.gov.mp |
| Hilary | Stevens | Natural Resources Specialist | 670-664-8300 | hilary.stevens@crm.gov.mp | |
| Kathy | Yuknavage | Natural Resource Planner | 670-664-8300 | kathy.yuknavage@crm.gov.mp | |
| Jack D. | Salas | Director, CRM | 670-664-8300 | crm.director@saipan.com | |
| Clyde K. | Norita | Chairman, Committee on Federal and Foreign Relations | 670-664-8987 | clydenorita@aol.com | P.O. Box 500341<br>Saipan, MP 96950 |
| Timothy P. | Villagomez | Vice Speaker and Chariman, Public Utilities, Transportation and Communication, PUTC | 670-664-8820 | tpvillagomez@itecnmi.com | P.O. Box 500586<br>Saipan, MP 96950 |
| Miriam K. | Seman | Executive Assistant, Office of the Speaker | 670-664-8971 | mkseman@saipan.com | P.O. Box 501182<br>Saipan MP 96950 |
| Brian | Bearden | DEQ | | | |
| Ken | Cochran | CRM | | ken.cochran@crm.gov.mp | GIS guy for CRM |
| Steve | Spengler | Environet, Inc. | | | |
| Milton | Yoshimoto | Army Corps | | | |
| Uyen | Tran | Army Cpros | | | |

Meetings held on April 6, 2004

Division of Environmental Quality, CNMI, 3rd Floor Morgen Building, San Jose, P.O. Box 501304, Saipan, MP 96950
Division of Historic Preservation, Department of Community and Cultural Affairs, Caller Box 10007, Airport Road, Saipan, MP 96950

Coastal Resources Management, P.O. Box 10007, Second Floor Morgen Bldg., San Jose, Saipan, MP 96950.

Environet, Inc.
PRESERVING EARTH'S RESOURCES FOR THE FUTURE

**Project:** **Saipan Aquatic Ecosystem Restoration Study**
**Project No.:** **F01-009**
**Date:** **July 27, 2004**

**Subject:** **July 20th Site Visit – Trip Summary**

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**Summary:**

Site Visit – 20 July 2004
James Pennaz, USACE and Ryan Yamauchi, EI

09:00 Met with CRM at CRM Office Conference Room
Attendees: Mr. Jack Salas, CRM; Mr. Benny Pangelinan, CRM; Mr. Michael Tenorio, Equitable Realty

Discussion of Mr. Tenario's property (China House Detention Basin Site):

- Mr. Tenario is currently working with DPW to get a permit for the development of a driving range on the property.
- Mr. Tenario is willing to grant a 10-foot drainage easement along the southern and western boundaries to allow for transport of storm water.
- A small detention basin has been already been constructed in the northwestern corner of the property. Mr. Tenario is willing to allow continued use of this corner as a detention basin and may be able to get two additional adjacent family parcels for use as a detention basin.
- Drainage from the detention basin is the existing natural drainage way.

Discussion of Design:

- Mr. Yamauchi discussed complexities with CRM regarding the lack of a master plan for the storm drainage system and potential creation of new flooding areas should the transport system be altered. Mr. Salas suggested that we discuss this with DEQ.
- CRM wants EI to identify which of the parcels are required for the three different areas identified. CRM would like to start the process of property acquisition soon, so that further developments are not planned within the parcels required.

10:00 – 12:00
Escorted by Benny to the China House site. Walked the site to observe the construction on Mr. Tenario's property. Observed that the downstream drainage way was overtopped during the last heavy rainfall event.

Escorted by Benny to the Arena site. Observed that the majority of the excavated quarry area has been filled. Drove the area upgradient from the Arena site.

Observed that a few unpaved roads were washed out/damaged due to last heavy rainfall event. Drainage in this area is overland flow in a number of directions. There are no distinct drainage features.

13:30 Met with Brian Bearden, DEQ.

Brian mentioned that DPW was starting on a drainage master plan for the study area, but this may be a few years away from completion.

The drainage standards/manuals will be adopted sometime next year.

The western side of the island will be considered Section 303 impaired, thus requiring establishment of TMDLs.

Brian understands the complexities of not having an existing drainage system and master plan for study area. Brian suggested that we try to design basins that best fit based on the constraints given to us.

14:30

Escorted by Benny to the Quartermaster site. Observed that the grade difference between Middle Road and the underlying parcels would allow for development of a detention basin.

Based on the discussions with CRM and DEQ, Jim and Ryan discussed the options and decided that the design should incorporate the design of the detention basins only, since the intent of this project is to affect water quality in the lagoon rather than flood control. This may be accomplished a number of ways. One suggestion from Jim would be to put a low flow pipe to the detention pond, which would capture the first flush flows with larger flows overflowing to the existing natural drainage ways. This would allow for treatment without causing new and different flooding areas. An evaluation of the portion of treatment expected/achievable for the different storm events (i.e. 1-yr, 2-yr, 10-yr) will be conducted (see attached sketch). Costs and benefits will also be considered.

The lots for each of the sites were generally evaluated to determine the optimum placement of the detention basins. Selected lots were identified during the site visit.

## Summary of Visit to Saipan from 10/24/11 to 10/28/11.

The project team arrived in Saipan on 10/23/11.

10/24/11: Meeting at the Commonwealth of the Northern Mariana Islands (CNMI) Coastal Resources Management (CRM) office.

Attendees:

CNMI CRM: Rose Pangelinan, Ana C. Agulto, Rita Chang, Rachel Zuercher
CNMI Department of Public Works (DPW): Oscar Pangelinan
CNMI Department of Environmental Quality (DEQ): Ryan Okano, Clarissa T. Bearden
National Oceanic and Atmospheric Administration (NOAA): Dana Okano
CNMI Department of Public Lands (DPL): Patricia Seman Rasa
CNMI OMB: Virginia Villagomez
United States Army Corps of Engineers (USACE): Milton Yoshimoto, Kevin Nishimura
Community Planning and Engineering (CPE): Anson Murayama, Frank Camacho
Environet: Sonia Shjegstad, Miya Akiba, Max Solmssen

13:40- meeting began

USACE presented the project history to the group, as well as plans for the project moving forward. The project lost funding prior to the completion of the draft Environmental Assessment (EA)/Environmental Restoration Report (ERR) in 2007. The project has received funding again and has restarted. USACE is anticipated to fund the completion of the EA/ERR, as well as the design of the detention/retention basins. The USACE may be able to fund 65 percent of construction costs, but the CNMI will be responsible for the remainder of construction costs, along with the ongoing operation and maintenance of the detention/retention basins.

Environet gave a power point presentation detailing the project location, history and plans for moving forward.

NOAA asked how the project area was determined since there were runoff issues affecting the lagoon from locations outside the project area.

USACE responded that there were limited public lands available for the project, and that the best available sites were chosen given these land use restraints.

Environet then discussed data needs in preparing the EA/ERR with several members of the attendees, and informal meetings to exchange data later in the week were established.

USACE advised that funding for the construction of the project from USACE is limited, but it may be possible for the CNMI to secure federal funds from outside the USACE to finance their portion of the project costs.

CPE identified the following top three local cooperator responsibilities identified in the presentation as the primary project goals that would help to avoid runoff within the project site conjunction with the construction of the detention/retention basins:

1. Pave or armor unpaved roads that contribute majority of sediment to lagoon
2. Conduct sanitary sewer surveys and repair damaged portions of sewer system
3. Extend sewer lines to replace septic and cesspool systems in watershed

CNMI DPW stated that the implementation of the project should be coordinated with the CNMI Commonwealth Utilities Corporation (CUC).
CRM agreed to coordinate a meeting with CPE, USACE and the CUC on Wednesday, October 26, 2011.
15:00- meeting adjourned.

10/25/2011: Meeting at CNMI Legislator

Attendees:

CNMI Legislature: Representative Joseph M. Palacios, Chairman;
Speaker Eliceo D. Cabrera;
Floor Leader George N. Camacho;
Representative Ramon A. Tebuteb, SNILD Chair Representative;
Stanley T. McGinnis Torres, PUTC Chair Representative;
Ramon S. Basa, Ways & Means Chair Representative;
Rafael S. Demapan, JGO Chair;
Representative Fredrick P. Deleon Guerrero, FFA Chair;
Representative Joseph P. Deleon Guerrero, Minority Leader; and
Representative Antonio P. Sablan.
USACE: Milton Yoshimoto, Kevin Nishimura
CNMI CRM: Rachael Zuercher
CPE: Anson Murayama, Frank Camacho
Environet: Sonia Shjegstad, Miya Akiba, Max Solmssen

10:00-Meeting began.
Chairman Palacios welcomed committee members and presenters, and formal introductions were made.
Chairman Palacios called on USACE to conduct the presentation on the Saipan Lagoon Aquatic Ecosystem Restoration Project.
USACE gave a brief project history.
Environet and USACE gave power point presentation detailing project history and planned schedule for current project. USACE outlined the proposed cost sharing for the project budget, and stated that USACE funds are limited to support the design phase of the project, and possibly portions of the construction phase. The CNMI would be responsible for securing funds for a portion of the construction costs, as well as all of the costs associated with ongoing operation and maintenance of the retention/detention basins.
Floor Leader Camacho asked if USACE was planning to address runoff in the Garapan area.
USACE responded that the current project area does not include the Garapan runoff areas.
Chairman Palacios voiced concern for investigating possibly contaminated soil areas on Saipan.
USACE responded that the USACE environmental division should be contacted and may be able to help.
11:00: meeting was adjourned.

**Saipan Lagoon Restoration Project Status Report: October, 2011**

10/25/2011: meeting at CNMI DPW

Attendees:

CNMI DPW: Martin Sablan, Sonya Dancoe, Tony Camacho
CNMI CRM: Rachael Zuercher
USACE: Milton Yoshimoto, Kevin Nishimura
CPE: Anson Murayama, Frank Camacho
Environet: Sonia Shjegstad, Miya Akiba, Max Solmssen

13:30-Meeting began

Introductions
USACE delivered brief project background.
Environet and USACE gave power point presentation detailing project history and planned schedule for current project. USACE outlined the proposed cost sharing for the project budget, and stated that USACE funds are limited to support the design phase of the project, and possibly portions of the construction phase. The CNMI would be responsible for securing funds for a portion of the construction costs, as well as all of the costs associated with ongoing operation and maintenance of the retention/detention basins.
CNMI DPW informed USACE of the CNMI Hazard Reduction Project that is planned to include repaving and striping of Beach Road. CNMI DPW stated that identifying lands for the proposed project will be a challenge.
CPE and CNMI DPW agreed to share information and stay in close communication regarding the planning and implementation of both the proposed detention/retention basins, and the CNMI DPW hazard reduction project.
CNMI DPW stated that the operation and maintenance of the detention/retention basins may be a problem due to lack of funding.
CPE stated that they will work to incorporate specifications in the design of the basins to allow for less maintenance. However, the design must also adhere to current CNMI DEQ standards.
CNMI DPW provided CPE with the scope of work for a portion of the Hazard Reduction Project, and stated that there may be opportunities for partial funding of the detention/retention basin project as a capital improvement project.
CNMI DPW and CPE discussed different design options that would work. CNMI DPW suggested detention basin at American Memorial Park as a good example of an acceptable "wet pond" that adheres to CNMI DEQ standards.
14:40-Meeting adjourned.

10/26/2011
9:30-Environet and CNMI CRM met with Marine Biologist Mr. Peter Hauk of the Pacific Marine Resources Institute to obtain data for the project.
10:15- Environet and CNMI CRM met with Michael C. Tenorio from CNMI Division of Fish & Wildlife Fisheries Research Section to gather data.
10:30- Environet and CNMI CRM met with Lee Perlow from CNMI Department of Lands and Natural Resources, Division of Fish and Wildlife to consult regarding the presence of important biological species at the proposed retention/detention basin sites.
11:00-11:30- Environet, CPE and CRM conducted site visits to the Arena Site, China House Site and Quartermaster Site.

14:00- Meeting at Legislator
Attendees:
CNMI Governor: Mr. Benigno Repeki Fitial
CNMI CRM: Rachael Zuercher
USACE: Milton Yoshimoto, Kevin Nishimura
CPE: Anson Murayama, Frank Camacho
Environet: Miya Akiba, Max Solmssen

14:30-Meeting began
Introductions
Environet and USACE gave power point presentation detailing project history and planned schedule for current project. USACE outlined the proposed cost sharing for the project budget, and stated that USACE funds are limited to support the design phase of the project, and possibly portions of the construction phase. The CNMI would be responsible for securing funds for a portion of the construction costs, as well as all of the costs associated with ongoing operation and maintenance of the retention/detention basins.
Governor Fitial made inquiries regarding budget, and concerns about sedimentation in the lagoon. He stated that land acquisition of private lands for a public purpose is allowed under CNMI laws.
15:30-Meeting adjourned.

10/27/2011

8:30: Environet met with CNMI CRM to obtain additional data needs.
9:15: Environet met with Clarissa T. Bearden from CNMI DEQ to obtain water quality data needs. Environet contacted CNMI Historical Preservation Office (HPO) to begin the Section 106 consultation process.
10:00-14:00: Environet conducted site visits to previously identified potentially contaminating activities (PCAs) within the project area, as well as searched for any new PCAs within the project area.

10/28/2011
8:30-11:30: Environet continued search of the project area for existing and new PCAs
End of Trip Report.

**May 18, 2002**

**Subject:** **Summary of Work Tasks Completed during Environet's May 2002 Trip to Saipan**

Steve Spengler and Matt Neal of Environet arrived on Saipan on Monday, May 6th. Dr. Spengler stayed in Saipan until Wednesday May 15th while Mr. Neal stayed on the island until May 12th. Dr. Spengler spent a day on Guam on May 15th, returning to Honolulu on May 16th.

The table below lists the people who were contacted during this visit to discuss various aspects of the Saipan Aquatic Ecosystem Restoration project.

| NAME | | AGENCY AND TITLE | PHONE | NOTES |
|---|---|---|---|---|
| Jack | Salas | CRM, Chief Enforcement | 670-234 6623 | Co-Sponser |
| Doug | Mauro | CRM | 670-234-6623 | GIS / CAD |
| Brian | Bearden | DEQ | 670-664 8510 | |
| Clarrissa | Tanaka | DEQ, Chemist | 670-664 8500 | Water Quality Data |
| Peter | Houk | DEQ, Marine Fishery | 670-664 8504 | Aquatic Biologist |
| Vince | Castro | DLNR | 670-234-3751 | GIS Atlas / Dept of Public Lands |
| Robert | Carruth | USGS | 670-322 2060 | Rainfall Data |
| John | Starmer | CRM | 670-234-6623 | Aquatic Biologist |
| Thorne | Abbott | U.S. Fish and Wildlife Service | 670-664-6025 | Wetlands Specialist |
| Kate | Moots | Dept of Fish and Wildlife | 670-664-6019 | Fisheries Biologist III |
| Michael | Trianni | Dept of Fish and Wildlife | 670-664-6018 | Sea Cucumbers / survey info |
| Steve | Spengler | Environet | 808-833-2225 | Environet Project Manager |
| Matthew | Neal | Environet | 808-833-2225 | Environet Task Manager |
| Joe | Kaipat | Safe Drinking Water Branch Manager | 670-664-8509 | DEQ: Manager Safe Drinking Water |
| Robert | York | Northern Mariana Islands Museum | 670-664-2160 | Curator |
| Gigi | York | Northern Mariana Islands Museum | 670-664-2160 | Collection Curator |
| Lon | Bulgrin | Division of Historic Preservation | 670-664-2122 | Consulting Archaeologist |
| Becky | Lazama | CRM-Wetlands Material | | Geotechnical Company: Perc Test |
| Scott | Russell | Council of the Humanities | | Archaeology Expert and Author |
| Jun | Beltran | Geotesting | 670-235-6000 | |
| Ike | Cabrera | Former DEQ head | 670-483-8426 | |
| Pete | Baubata | Head of CUC Laboratory | | |
| Harold | Wood | Laboratory Manager for WERI | 671-735-2688 | 303 University Dr. UOG Station<br>Mangilao, Guam 96923 |

Division of Fish & Wildlife, PMB 2761, P.O. Box 10002, Saipan MP 96950
Division of Environmental Quality, P.O. Box 501304, Saipan MP 96950
Northern Mariana Islands Museum, P.O. Box 504570, Saipan MP 96950
Division of Historic Preservation, SPS #741, Box 10006, Saipan, MP 96950

The major tasks completed during this site visit are summarized below:

- Downloaded pressure transducer and rainfall data from monitoring locations at the Hariguchi and Pizza Hut Buildings as well as from beneath the intersection of Quartermaster and Middle roads.

- Reviewed aerial and other photograph database available at the University of Northern Marianas Pacific Collection laboratory.

- Retrieved AutoCAD images for the shoreline delta areas from Meridian Surveying.

- Reviewed As-Build Drawings from the Phase 4 road improvements along Middle Road that were completed in 1992.

- Discussed potential restoration alternatives with three employees of the Fish and Wildlife Service and the Department of Fisheries.

- Installed a pressure transducer in the drainage culvert beneath Middle road across the street from the Subway Sandwich shop.

- Talked with Jun Beltran of Geotesting about compiling percolation data for the project watershed.

- Installed a third automated rain guage on top of the Geotesting Building.

- Collected stormwater samples from Drains Number 6, 11 and 13 between 6 to 6:30 AM. Submitted samples to DEQ laboratory (left with Marvin) for nutrient and microbial analysis at about 8:30 AM.

- Did a quick reconnaissance tour of four potential future wetlands/retention basin sites present within the project watershed: Fishing Dock area, Drain 7 Area (located south of Wendy's), Quartermaster Road Area, and Gualo Rai wetland area. A fifth potential site exists just to the south of the new emergency medical facility located along Middle road.

- Collected 21 groundwater samples from along the shoreline at low tide between 13:40 and 15:57. Primary sample locations were located at 0.2-mile intervals in moving south from the Fishing Dock. Secondary locations were located at 0.1-mile and 262-foot intervals in the vicinity of the Drain 7 wetland and the Drain 6 site. Analyzed samples in the field for temperature, conductance and pH. The following nine shallow, near-shore groundwater samples were submitted to DEQ for nitrate analysis: GWI-24, GWI-26, GWI-14, GWI-28, GWI-29, GWI-17, GWI-19, GWI-21 and GWI-23.

## Summary of Work Tasks Completed during Environet's August 2002 Trip to Saipan

Steve Spengler and Matt Neal of Environet arrived on Saipan on Thursday, August 8th. Dr. Spengler and Mr. Neal stayed in Saipan until Saturday August 10th at which time they traveled back to Guam for the weekend. They returned to Saipan on the evening of August 11th. Ms. Colette Sakoda joined them in Saipan on the evening of August 13th. Mr. Spengler, Neal and Ms. Sakoda returned to Honolulu on Friday morning, August 16th. A chronological summary of work completed during the visit is given below:

### Friday, August 9th

Environet personnel installed pressure transducers in monitoring wells located at the Mobil/McDonalds gas station located along Beach Road and the inland Mobil station located along Middle road in Garapan. Survey elevation for the top of casing for both wells used was supplied by Max Simian of AGS. The transducer data will be used to monitor changes in groundwater elevation over a five day period to allow a calculation of overall groundwater gradient for the shallow basal aquifer that underlies the southern portion of Garapan.

At 11:30, we removed the transducer that was in the drainage culvert fronting the Subway sandwich shop along Middle road. We were unsuccessful at downloading the pressure information, since we constantly got an error message as the transducer was completing its download of information. We also apparently overwrote the last months data present on the transducer. We reprogrammed the transducer and installed in the McDonalds well.

Starting at about 2:00 PM, we began sampling 21 near-shore groundwater locations located along the shoreline region of our project area. The samples were collected around the time of low tide. Field measurements were made on the collected groundwater samples as well as samples in Whirlpacks and sample jars to allow us to measure Enterococci, nitrate, phosphate and TDS levels using the colorimetric and turbidity meters supplied by DEQ. A subset of the samples collected was submitted to the DEQ laboratory for microbiological analysis (enterococci).

### Monday, August 12th

Collected stormwater runoff from an early morning rain event that occurred at about 8:30 AM. Stormwater samples were collected from drains 6, 11 and 14 (Hakubaton Building) as well as from the drainage ditch located in front of the Dai Ichi Hotel.

Stormwater discharge rates were measured at a number of drainage channels during a follow-on rain burst that took place around 9:30 AM. Runoff measurements were also collected from the Quartermaster drainage culvert during the end of this rain event.

Max Simian of AES also sampled this particular storm event. We will submit both sets of stormwater data to Sequoia Analytical for analysis of priority pollutants metals levels (including Barium).

Successfully downloaded the pressure transducer beneath Quartermaster Road. Unfortunately, all of the rain gauges had been inadvertently turned off on June 27th and thus no rainfall record is available for the intervening time period. The rain gauges were reactivated around 4:30 PM.

Talked with Peter Houk about the write-up for the historic aerial photograph review and offshore lagoon habitat write-up for the project. Peter will begin working on the write-up this week and will e-mail us the remainder prior to him leaving for Florida.

### Wednesday, August 14th

Held a meeting at 9:00 AM at the offices of CRM. Discussed the land acquisition aspects of the project with members of CRM and the Marianas Public Land Committee? People in attendance included: John Starmer, Vince Castro, Philip Sablan and Benny Pangalinan. Others in attendance include: Steve Spengler, Matt Neal, Colette Sakoda, Milton Yoshimoto and Karl Larson. Discussed any possible land use restrictions for the five tentative locations for retention basins/constructed wetlands. Vince told us that we do not have to consider the Fishing Dock site because of future lease obligations for the site.

Steve and Colette visited Vince Castro to obtain information about land use aspects of the future project. Vince also explained the organization of the CNMI government. Vince informally suggested that a land value of around $30 a square meter might be more representative for the areas that will be potentially acquired. Steve showed Colette around the island. Photocopied the drainage study that had been previously completed for the Garapan region of Saipan by the Army Corps in1987.

### Thursday, August 15th

Held an information meeting at the chambers of the CNMI legislature to discuss the progress of the project. The legislators had numerous questions about the project. Many of the questions centered around the funding requirements of the project. The majority of the comments came from the speaker and vice-speaker of the house as well as from representative Atta.

Decided to eliminate the Gualo Rai and Pacific Medical Sites from future consideration. Rather, we will consider evaluating the natural sinkhole site located behind the cock fighting complex which is located Mauka of Middle road.

Steve, Colette and Carl visited the following agencies to obtain additional information about the EIS aspects of the future ecosystem restoration project: DEQ (Brian Beardon), DPW (nobody showed), Division of Historic Preservation (Lon Bulgrin).

## Friday, August 16th

Left the island early this morning.

### Key Players from August 2002 Trip

| NAME | | AGENCY AND TITLE | PHONE | E-MAIL | NOTES |
|---|---|---|---|---|---|
| Philip G. | Sablan | Dept. of Public Works | 670-322-9828 | phil_tsd@yahoo.com | Highway Planning/Fiscal Coordinator |
| Vince T. | Castro | Marianas Public Lands Authority | 670-234-3751 | MPLA@vzpacifica.net | Land Use Manager |
| Lon | Bulgrin | Division of Historic Preservation | 670-664-2122 | cnmihpo@itecnmi.com | Consulting Archaeologist |
| Joseph P. | Deleon Guerrero | House of Representative | 670-664-8879 | rep.joeguerrero@saipan.com | Representative, 13th CNMI Legislature |
| Heinz S. | Hofschneider | House of Representative | 670-664-6969 | hsh.legis@saipan.com | Speaker, 13th CNMI Legislature |
| Peter | Houk | DEQ | 670-286-5303 | p_houk@hotmail.com | Biologist |
| Steven | Spengler | Environet | 808-864-3953 | srspengler@hawaii.rr.com | Consultant |
| Matthew | Neal | Environet | 808-833-2225 | mneal@hawaii.rr.com | Consultant |
| Colette | Sakoda | Environet | 808-732-8602 | sakodac001@hawaii.rr.com | Consultant |
| Milton | Yoshimoto | USACE | 808-438-2250 | Milton.T.Yoshimoto@usace.army.mil | Project Coordinator |
| Melchor | Mendiola | House of Representative | 670-664-8845 | melchormendiola@hotmail.com | Representative, 13th CNMI Legislature |
| Jessica | Tomokitne | Speakers Office | 670-664-6969 | tomokanej@saipan.com | |
| Ray | Tebuteb | House of Representative | 670-664-8887 | rtebuteb@pacifica.vz.com | Representative, 13th CNMI Legislature |
| Peter | Castro | House of Representative | 670-664-8870 | | Representative, 13th CNMI Legislature |
| Frank | Aldan | House of Representative | 670-664-8928 | falkan@vzpacifica.net | Representative, 13th CNMI Legislature |
| Ben M. | Taitano | Concerned Citizen | 670-234-6004 | benmag@usa.com | |
| Ray | Quichocho | Marianas Public Lands Authority | 670-234-3751 | rayq@vzpacifica.net | Attorney, Interim Director? |
| Juan P. | Tenorio | House of Representative | 670-233-8730 | | Representative, 13th CNMI Legislature |
| Mike A. | Bonah? | House of Representative | 670-664-8830 | | |
| Benny K. | Pangelinian | CRM | 670-664-8304 | crm.wahoo@saipan.com | |
| Benjamin B. | Saman | House of Representative | 670-664-8890 | repseman@vzpacifica.net | Representative, 13th CNMI Legislature |
| Pete P. | Reyes | CNMI Senate | 670-664-8807 | pete.reyes@saipan.com | |
| Stanley | Torres | House of Representative | | | Representative, 13th CNMI Legislature |

## Saipan AER Project Status Report: August, 2002

| NAME | | AGENCY AND TITLE | PHONE | E-MAIL | NOTES |
|---|---|---|---|---|---|
| Jesus | Attao | House of Representative | | | Representative, 13th CNMI Legislature |
| Arnold I. | Palacios | House of Representative | 670-664-8830 | aipalacios@yahoo.com | Chariman, Natural Resources Committee |
| Clarissa T. | Bearden | DEQ Laboratory | 670-664-8500 | | |
| Ray A. | Tebuteb | CNMI Legislature | 670-664-8887 | | |
| Carl | Larson | CEPOH, RE | 808-438-3201 | carl.a.larson@usace.army.mil | Real Estate Guy for Corp |
| Manuel A. | Tenorio | Vice Speaker, House of Representatives | 670-664-8939 | repten@saipan.com | 13th Northern Marianas Legislature |
| Pedro | Castro | Vice Chairman | | | Vice Chariman |
| Frank | Aldam | Committee Member | | | |
| Tom | Tebuteb | Committee Member | | | |
| Danny | Quitugua | Committee Member | | | |

Office of Public Lands, Northern Mariana Islands. P.O. Box 500380 Saipan, MP 96950

DEQ Laboratory, P.O. Box 501304, Saipan, MP

National Park Service, American Memorial Park. P.O. Box 5198 CHRB, Saipan, MP 96950

Department of Public Works, Lower Base, Saipan, MP 96950

Division of Historic Preservation, Department of Community and Cultural Affairs, SPS #741, Box 10006, Saipan, MP 96950
Joseph P. Deleon Guerrero, Representative, P.O. Box 500586, Saipan, MP 96950: web site: www.dreamwater.org/repjguerrero

Heinz. S. Hofschneider, Speaker, P.O. Box 500586, Saipan, MP 96950

Peter Houk, Pacific Marine Resource Institute, PMB 1156, P.O. Box 10003, Saipan, MP 96950

September Saipan Trip Summary

Arrive Monday September 16, at 9:00 PM.

Tuesday, September 17

1) Met with Jack Salas to deliver new wetland site landowner figures. CRM will continue pursuing Right of Entry information from the revised list of landowners.
2) Met with John Starmer to discuss lagoon sediment sampling strategy.
3) Began stormwater collection system inventory.
4) Met with Starmer to turn over sampling gear and containers for the lagoon sediment sampling.

Wednesday, September 18

1) Completed lagoon sediment sampling, a total of 18 composite samples were collected from six transects ranging from the near-shore enhalus beds to the offshore enhalus beds located beyond the current channel. The purpose of this exercise is to help determine the extent of contamination within sediment in the lagoon. Four sampling transects were located corresponding to the most heavily sedimented stormwater outfalls along Beach Road within the project area. A single transect was located north of the project site, corresponding to the Dai Ichi Hotel drainage outfall, typically one of the most heavily contaminated areas of the lagoon. Finally, a single transect was located south of the project site, corresponding to the San Jose wetland.

Thursday, September 19

1) Continued storm water system inventory and measurement (measured culverts, catch basins, retention swales, etc).
2) Observed and document stormwater drainage channels, ponding areas within the project site.
3) Measured stormwater volume at the Quartermaster/Middle Road intersection.
4) Removed pressure transducers from both the Quartermaster and Subway sites.

Friday, September 20

1) Due to heavy rain and flooding, Proceeded to measure and record stormwater flow volumes along both Beach and Middle Roads several times during the duration of the heavy rain.
2) Downloaded data from three rainguages (Harahuchi Bldg, Pizza Hut Bldg, and Geotesting Bldg).
3) Downloaded data from both the Quartermaster and Subway transducers and returned them to their respective locations.

Saturday, September 21

1) Conduct reconnaissance and documentation of flood debris from heavy rains that occurred on Friday.
2) Conducted reconnaissance and measurements of the Cock Fight potential constructed wetland site.
3) Completed final check of the rainguages, returned field gear to DEQ laboratory.

## Summary of Visit to Saipan from 4/4/04 to 4/7/04.

Flew to Saipan on 4/4/04.

4/5/04: Met with Jack Salas, Steve Tilley, Milton Yoshimoto at the CRM office from 7:30 to 8:30 to discuss the Saipan AER project. It was decided at this meeting to extend the project area to the northern property boundary of the Hafa Adai hotel, so that the Cock Fighting Arena site could be included in the restoration analysis.

Gave a powerpoint presentation to members of the Saipan legislature from 9:15 to 10:45. Attendees at the meeting included Jack Salas, Steve Tilley, Milton Yoshimoto, Uyen Tran, Steve Spengler, Timothy Villagomez, Clyde Norita, Miram Seman, and three other legislators who did not provide business cards. After the powerpoint presentation, there was a lot of talk about the funding aspect of the project and the timing of when funds needed to be committed.

From 11:00 to 11:30, Milton, Steve, Uyen, Jack and Steve Tilley went to the shoreline in front of the Hafa Adai in order to verify the location of the extended northern boundary of the project.

Steve, Uyen Hilary and Kathy visited the cock fighting arena site and the ephemeral stream gulch to view the proposed restoration system for this area.

4/6/04: Met with Brian and returned the copy of his design plan for the wetlands informational trail. Obtained a copy of a prior Corp reconnaissance trip report for Lake Susupe. Obtained a copy of a detailed shape file for Saipan from Ken Cochrain. Got some new publications from the technician (George?) who was present at the USGS office. Talked with Genevieve Cabrera of the Division of Historic Preservation about the previous work that has been conducted in the Lake Susupe area. She said that a detailed study and analysis of cores collected by archaeologists from the middle of Lake Susupe, which will describe the flora and changes that have occurred within the Lake over the past 7000 years, will be submitted by Steve Athens and his archaeological firm within the next month. Genevieve also said that she would e-mail me some files of previous stratigraphic chronology work conducted by other researchers.

Noticed that the proposed China House site had been extensively cleared of vegetation recently. This area is apparently owned by Perry Tenorio who would like to turn the area into a driving range. There is a retention basin present at the site but the temporary weir installed to hold back runoff crossing the property is woefully inadequate.

## List of Key Players from the April 2004 Trip

| NAME | | AGENCY AND TITLE | PHONE | E-MAIL | NOTES |
|---|---|---|---|---|---|
| Pete | Palacios | Assistant Director, DEQ | 670-664-8500 | pete.palacios@saipan.com | DLNR |
| John L. | Castro, Jr. | Director, DEQ | 670-664-8500 | deq.director@saipan.com | |
| Genevieve S. | Cabrera | Historian, Division of Historic Preservation | 670-664-2120 | gscab63@vzpacifica.net | Division of Historic Preservation |
| Epi | Cabrera | Director, Division of Historic Preservation | 670-664-2120 | | |
| Steve | Tilley | Deptuy Director, CRM | 670-664-8307 | steve.tilley@crm.gov.mp | www.crm.gov.mp |
| Hilary | Stevens | Natural Resources Specialist | 670-664-8300 | hilary.stevens@crm.gov.mp | |
| Kathy | Yuknavage | Natural Resource Planner | 670-664-8300 | kathy.yuknavage@crm.gov.mp | |
| Jack D. | Salas | Director, CRM | 670-664-8300 | crm.director@saipan.com | |
| Clyde K. | Norita | Chairman, Committee on Federal and Foreign Relations | 670-664-8987 | clydenorita@aol.com | P.O. Box 500341<br>Saipan, MP 96950 |
| Timothy P. | Villagomez | Vice Speaker and Chariman, Public Utilities, Transportation and Communication, PUTC | 670-664-8820 | tpvillagomez@itecnmi.com | P.O. Box 500586<br>Saipan, MP 96950 |
| Miriam K. | Seman | Executive Assistant, Office of the Speaker | 670-664-8971 | mkseman@saipan.com | P.O. Box 501182<br>Saipan MP 96950 |
| Brian | Bearden | DEQ | | | |
| Ken | Cochran | CRM | | ken.cochran@crm.gov.mp | GIS guy for CRM |
| Steve | Spengler | Environet, Inc. | | | |
| Milton | Yoshimoto | Army Corps | | | |
| Uyen | Tran | Army Cpros | | | |

Meetings held on April 6, 2004

Division of Environmental Quality, CNMI, 3rd Floor Morgen Building, San Jose, P.O. Box 501304, Saipan, MP 96950
Division of Historic Preservation, Department of Community and Cultural Affairs, Caller Box 10007, Airport Road, Saipan, MP 96950

Coastal Resources Management, P.O. Box 10007, Second Floor Morgen Bldg., San Jose, Saipan, MP 96950.

## Summary:

Site Visit – 20 July 2004
James Pennaz, USACE and Ryan Yamauchi, EI

09:00 Met with CRM at CRM Office Conference Room
Attendees: Mr. Jack Salas, CRM; Mr. Benny Pangelinan, CRM; Mr. Michael Tenorio, Equitable Realty

Discussion of Mr. Tenario's property (China House Detention Basin Site):

- Mr. Tenario is currently working with DPW to get a permit for the development of a driving range on the property.
- Mr. Tenario is willing to grant a 10-foot drainage easement along the southern and western boundaries to allow for transport of storm water.
- A small detention basin has been already been constructed in the northwestern corner of the property. Mr. Tenario is willing to allow continued use of this corner as a detention basin and may be able to get two additional adjacent family parcels for use as a detention basin.
- Drainage from the detention basin is the existing natural drainage way.

Discussion of Design:

- Mr. Yamauchi discussed complexities with CRM regarding the lack of a master plan for the storm drainage system and potential creation of new flooding areas should the transport system be altered. Mr. Salas suggested that we discuss this with DEQ.
- CRM wants EI to identify which of the parcels are required for the three different areas identified. CRM would like to start the process of property acquisition soon, so that further developments are not planned within the parcels required.

10:00 – 12:00
Escorted by Benny to the China House site. Walked the site to observe the construction on Mr. Tenario's property. Observed that the downstream drainage way was overtopped during the last heavy rainfall event.

Escorted by Benny to the Arena site. Observed that the majority of the excavated quarry area has been filled. Drove the area upgradient from the Arena site. Observed that a few unpaved roads were washed out/damaged due to last heavy rainfall event. Drainage in this area is overland flow in a number of directions. There are no distinct drainage features.

13:30 Met with Brian Bearden, DEQ.

Brian mentioned that DPW was starting on a drainage master plan for the study area, but this may be a few years away from completion.

The drainage standards/manuals will be adopted sometime next year.

The western side of the island will be considered Section 303 impaired, thus requiring establishment of TMDLs.

Brian understands the complexities of not having an existing drainage system and master plan for study area. Brian suggested that we try to design basins that best fit based on the constraints given to us.

14:30

Escorted by Benny to the Quartermaster site. Observed that the grade difference between Middle Road and the underlying parcels would allow for development of a detention basin.

Based on the discussions with CRM and DEQ, Jim and Ryan discussed the options and decided that the design should incorporate the design of the detention basins only, since the intent of this project is to affect water quality in the lagoon rather than flood control. This may be accomplished a number of ways. One suggestion from Jim would be to put a low flow pipe to the detention pond, which would capture the first flush flows with larger flows overflowing to the existing natural drainage ways. This would allow for treatment without causing new and different flooding areas. An evaluation of the portion of treatment expected/achievable for the different storm events (i.e. 1-yr, 2-yr, 10-yr) will be conducted (see attached sketch). Costs and benefits will also be considered.

The lots for each of the sites were generally evaluated to determine the optimum placement of the detention basins. Selected lots were identified during the site visit (see attached sketch).

## Summary of Visit to Saipan from 10/24/11 to 10/28/11.

The project team arrived in Saipan on 10/23/11.

10/24/11: Meeting at the Commonwealth of the Northern Mariana Islands (CNMI) Coastal Resources Management (CRM) office.

Attendees:

CNMI CRM: Rose Pangelinan, Ana C. Agulto, Rita Chang, Rachel Zuercher
CNMI Department of Public Works (DPW): Oscar Pangelinan
CNMI Department of Environmental Quality (DEQ): Ryan Okano, Clarissa T. Bearden
National Oceanic and Atmospheric Administration (NOAA): Dana Okano
CNMI Department of Public Lands (DPL): Patricia Seman Rasa
CNMI OMB: Virginia Villagomez
United States Army Corps of Engineers (USACE): Milton Yoshimoto, Kevin Nishimura
Community Planning and Engineering (CPE): Anson Murayama, Frank Camacho
Environet: Sonia Shjegstad, Miya Akiba, Max Solmssen

13:40- meeting began

USACE presented the project history to the group, as well as plans for the project moving forward. The project lost funding prior to the completion of the draft Environmental Assessment (EA)/Environmental Restoration Report (ERR) in 2007. The project has received funding again and has restarted. USACE is anticipated to fund the completion of the EA/ERR, as well as the design of the detention/retention basins. The USACE may be able to fund 65 percent of construction costs, but the CNMI will be responsible for the remainder of construction costs, along with the ongoing operation and maintenance of the detention/retention basins.

Environet gave a power point presentation detailing the project location, history and plans for moving forward.

NOAA asked how the project area was determined since there were runoff issues affecting the lagoon from locations outside the project area.

USACE responded that there were limited public lands available for the project, and that the best available sites were chosen given these land use restraints.

Environet then discussed data needs in preparing the EA/ERR with several members of the attendees, and informal meetings to exchange data later in the week were established.

USACE advised that funding for the construction of the project from USACE is limited, but it may be possible for the CNMI to secure federal funds from outside the USACE to finance their portion of the project costs.

CPE identified the following top three local cooperator responsibilities identified in the presentation as the primary project goals that would help to avoid runoff within the project site conjunction with the construction of the detention/retention basins:

1. Pave or armor unpaved roads that contribute majority of sediment to lagoon
2. Conduct sanitary sewer surveys and repair damaged portions of sewer system
3. Extend sewer lines to replace septic and cesspool systems in watershed

CNMI DPW stated that the implementation of the project should be coordinated with the CNMI Commonwealth Utilities Corporation (CUC).
CRM agreed to coordinate a meeting with CPE, USACE and the CUC on Wednesday, October 26, 2011.
15:00- meeting adjourned.

10/25/2011: Meeting at CNMI Legislator

Attendees:

CNMI Legislature: Representative Joseph M. Palacios, Chairman;
Speaker Eliceo D. Cabrera;
Floor Leader George N. Camacho;
Representative Ramon A. Tebuteb, SNILD Chair Representative;
Stanley T. McGinnis Torres, PUTC Chair Representative;
Ramon S. Basa, Ways & Means Chair Representative;
Rafael S. Demapan, JGO Chair;
Representative Fredrick P. Deleon Guerrero, FFA Chair;
Representative Joseph P. Deleon Guerrero, Minority Leader; and
Representative Antonio P. Sablan.
USACE: Milton Yoshimoto, Kevin Nishimura
CNMI CRM: Rachael Zuercher
CPE: Anson Murayama, Frank Camacho
Environet: Sonia Shjegstad, Miya Akiba, Max Solmssen

10:00-Meeting began.
Chairman Palacios welcomed committee members and presenters, and formal introductions were made.
Chairman Palacios called on USACE to conduct the presentation on the Saipan Lagoon Aquatic Ecosystem Restoration Project.
USACE gave a brief project history.
Environet and USACE gave power point presentation detailing project history and planned schedule for current project. USACE outlined the proposed cost sharing for the project budget, and stated that USACE funds are limited to support the design phase of the project, and possibly portions of the construction phase. The CNMI would be responsible for securing funds for a portion of the construction costs, as well as all of the costs associated with ongoing operation and maintenance of the retention/detention basins.
Floor Leader Camacho asked if USACE was planning to address runoff in the Garapan area.
USACE responded that the current project area does not include the Garapan runoff areas.
Chairman Palacios voiced concern for investigating possibly contaminated soil areas on Saipan.
USACE responded that the USACE environmental division should be contacted and may be able to help.
11:00: meeting was adjourned.

10/25/2011: meeting at CNMI DPW

Attendees:

CNMI DPW: Martin Sablan, Sonya Dancoe, Tony Camacho
CNMI CRM: Rachael Zuercher
USACE: Milton Yoshimoto, Kevin Nishimura
CPE: Anson Murayama, Frank Camacho
Environet: Sonia Shjegstad, Miya Akiba, Max Solmssen

13:30-Meeting began

Introductions
USACE delivered brief project background.
Environet and USACE gave power point presentation detailing project history and planned schedule for current project. USACE outlined the proposed cost sharing for the project budget, and stated that USACE funds are limited to support the design phase of the project, and possibly portions of the construction phase. The CNMI would be responsible for securing funds for a portion of the construction costs, as well as all of the costs associated with ongoing operation and maintenance of the retention/detention basins.
CNMI DPW informed USACE of the CNMI Hazard Reduction Project that is planned to include repaving and striping of Beach Road. CNMI DPW stated that identifying lands for the proposed project will be a challenge.
CPE and CNMI DPW agreed to share information and stay in close communication regarding the planning and implementation of both the proposed detention/retention basins, and the CNMI DPW hazard reduction project.
CNMI DPW stated that the operation and maintenance of the detention/retention basins may be a problem due to lack of funding.
CPE stated that they will work to incorporate specifications in the design of the basins to allow for less maintenance. However, the design must also adhere to current CNMI DEQ standards.
CNMI DPW provided CPE with the scope of work for a portion of the Hazard Reduction Project, and stated that there may be opportunities for partial funding of the detention/retention basin project as a capital improvement project.
CNMI DPW and CPE discussed different design options that would work. CNMI DPW suggested detention basin at American Memorial Park as a good example of an acceptable “wet pond” that adheres to CNMI DEQ standards.
14:40-Meeting adjourned.

10/26/2011
9:30-Environet and CNMI CRM met with Marine Biologist Mr. Peter Hauk of the Pacific Marine Resources Institute to obtain data for the project.
10:15- Environet and CNMI CRM met with Michael C. Tenorio from CNMI Division of Fish & Wildlife Fisheries Research Section to gather data.
10:30- Environet and CNMI CRM met with Lee Perlow from CNMI Department of Lands and Natural Resources, Division of Fish and Wildlife to consult regarding the presence of important biological species at the proposed retention/detention basin sites.
11:00-11:30- Environet, CPE and CRM conducted site visits to the Arena Site, China House Site and Quartermaster Site.

14:00- Meeting at Legislator
Attendees:
CNMI Governor: Mr. Benigno Repeki Fitial
CNMI CRM: Rachael Zuercher
USACE: Milton Yoshimoto, Kevin Nishimura
CPE: Anson Murayama, Frank Camacho
Environet: Miya Akiba, Max Solmssen

14:30-Meeting began
Introductions
Environet and USACE gave power point presentation detailing project history and planned schedule for current project. USACE outlined the proposed cost sharing for the project budget, and stated that USACE funds are limited to support the design phase of the project, and possibly portions of the construction phase. The CNMI would be responsible for securing funds for a portion of the construction costs, as well as all of the costs associated with ongoing operation and maintenance of the retention/detention basins.
Governor Fitial made inquiries regarding budget, and concerns about sedimentation in the lagoon. He stated that land acquisition of private lands for a public purpose is allowed under CNMI laws.
15:30-Meeting adjourned.

10/27/2011

8:30: Environet met with CNMI CRM to obtain additional data needs.
9:15: Environet met with Clarissa T. Bearden from CNMI DEQ to obtain water quality data needs. Environet contacted CNMI Historical Preservation Office (HPO) to begin the Section 106 consultation process.
10:00-14:00: Environet conducted site visits to previously identified potentially contaminating activities (PCAs) within the project area, as well as searched for any new PCAs within the project area.

10/28/2011
8:30-11:30: Environet continued search of the project area for existing and new PCAs
End of Trip Report.

# Appendix B
# Phase I Report, Saipan Lagoon Aquatic Ecosystem Restoration Study

**FINAL**

# PHASE 1
# SAIPAN LAGOON
# AQUATIC ECOSYSTEM RESTORATION PROJECT

Report Prepared for:

U.S. Army Corps of Engineers,
Honolulu Engineer District
Fort Shafter, HI 96858-5440

June 2001

**United States Army Corps of Engineers**
**Honolulu Engineering District**
**Environmental Engineering**

# Phase 1
# Aquatic Ecosystem Restoration Study
**at**
# Saipan Lagoon
# Saipan, Commonwealth of Northern Marianas Islands

**Prepared for:** U.S. Army Corps of Engineer, Honolulu Engineering District

**Prepared by:** Environet Inc., Honolulu, Hawaii

**Contract No. DACA83-00-D-0037**
**Delivery Order 02**

**June 2001**

# TABLE OF CONTENTS

# TABLE OF CONTENTS

## LIST OF FIGURES

## LIST OF TABLES

# EXECUTIVE SUMMARY

A Phase I Aquatic Ecosystem Restoration (AER) Study was prepared for a 1.5-mile length of shoreline located in western Saipan, Commonwealth of Northern Marianas Islands (CNMI). The project site extends from Quartermaster Road to the Fishing Base and encompasses the entire inland watershed that contributes groundwater and surface water runoff to this 1.5-mile length of shoreline as well as the adjacent offshore lagoon area out to the fringing coral reef.

This report provides preliminary restoration alternatives as well as suggestions for additional studies required to establish baseline environmental conditions within the study area. The restoration alternatives discussed include regulatory approaches, improved watershed management, and undertaking infrastructure improvements to reduce the amount of sediments and contaminants that discharge into the ocean.

The baseline data that would be collected in the studies recommended in this report would be used to monitor the progress of future environmental restoration efforts conducted in the area. It is believed that implementation of the recommended remedial measures will lead to an increase in nearshore fish population (as a result of habitat improvement) and a reduction in the frequency of closures of beach recreational areas due to microbiological contamination.

A December 2000 draft Phase 1 AER report was reviewed by representatives from the U.S. Army Corps of Engineers, and employees of the CNMI Departments of Public Works, Coastal Resources Management and Environmental Quality. A total of ten studies were initially recommended in the draft report. The decision was made at a meeting held in Saipan in early March 2001 to focus on the following seven studies during the Phase II portion of this study:

1) Stormwater Quality Investigation
2) Analyze Lagoon Sediments for Physical and Chemical Parameters
3) Marine Habitat Mapping from Historical and Current Aerial Photographs
4) Inshore Lagoon Area Seagrass and Associated Fauna Survey
5) Inventory of Potentially Contaminating Activities in Watershed
6) Hydrologic Study of Runoff Processes in Watershed
7) Lagoon Water Quality Investigation

The CNMI Department of Environmental Quality has agreed to assist the U.S. Army Corps of Engineers and their contractors with the offshore monitoring and sample collection portions of these studies.

This report presents the results of the Phase I portion of the Section 206 Aquatic Ecosystem Restoration Study for a 1.5-mile length of shoreline in western Saipan, Commonwealth of Northern Marianas Islands (CNMI) (Figure 1). The overall project objective is to develop restoration actions that would provide a cost-effective means of restoring the degraded nearshore lagoon environment in this area.

The study described in this report was performed for the U.S. Army Corps of Engineers, Honolulu Engineer District (USACE-HED). The project was conducted by Environet Incorporated (EI) under U.S. Army Corps of Engineers contract number DACA83-00-D-0037, Delivery Order No. 0002. Oceanit Incorporated (OI) was subcontracted by EI to conduct a preliminary assessment of the offshore environment within the project area.

## 1.1 GOALS AND OBJECTIVES OF THE PHASE 1 RESTORATION STUDY

The purpose of this Phase 1 portion of the Aquatic Ecosystem Restoration Study is to: 1) review existing data and identify gaps in the existing scientific data that need to be addressed to establish baseline conditions in the nearshore lagoon environment; and 2) identify potential restoration alternatives for a 1.5-mile stretch of shoreline located between Quartermaster Road and the Fishing Base on the west side of Saipan.

The restoration of tropical marine habitats requires several components to be successful including:

- The natural state of the habitat needs to be known and described;
- Key indicator species that can be monitored during proposed remedial activities need to be identified;
- The proposed remedial method must be cost effective; and
- The effectiveness of the remedial method must be measurable in terms of how well the affected habitat converges in form or function with natural intact habitat.

The scope of work followed the work items described in a cost proposal letter dated September 26, 2000 from EI to Mr. Kent Tamai, the Contracting Officer for the USACE-HED. The following tasks were conducted during this study:

- A reconnaissance survey of the project site was conducted during a week-long field visit to Saipan. Interviews were conducted with local residents and regulatory personnel who possessed pertinent information for the lagoon and contributory watershed.
- Provided a general description of the project area (Section 2.0).
- Reviewed water quality and environmental data available for the Saipan lagoon and the watershed that contribute groundwater, storm water runoff, and sediment to the project shoreline (Section 3.0).

- Evaluated the existing scientific information available for the lagoon and identified gaps in the existing scientific database (Section 3.6).
- Recommended additional studies required to obtain the missing data identified during the literature search and interviews with knowledgeable individuals (Section 4.0).
- Identified Preliminary Potential Restoration Alternatives for mitigating the current environmental degradation occurring within the Saipan lagoon (Section 5.0).

## 1.2 KNOWLEDGEABLE PEOPLE INTERVIEWED

A number of people who work for various Federal and Local government agencies were interviewed between October 23 and October 28, 2000 in Saipan. Table 1 contains the names and phone numbers of the people contacted during the site visit to Saipan. The concerns expressed by the individuals interviewed are summarized in Section 1.3.

## 1.3 LOCAL ENVIRONMENTAL CONCERNS

There is great concern over any threat to the natural ecology of the reef lagoon system because a large percentage of Saipan's economy is based upon foreign tourist who are attracted to the island by the spectacular reefs and marine life surrounding the island. Local fishermen who depend upon the reef for subsistence as well as recreational and commercial fishing interests are similarly concerned about the perceived degradation to the nearshore reef system. The following concerns were expressed about the health of the lagoon environment by individuals during the field reconnaissance:

- Sea grass beds are deteriorated in the vicinity of stormwater outlets to the lagoon.
- The nearshore environment is perceived to support a greater abundance of fast growing algae species (Enteromorpha and Hypnea) than previously noted, and this could point to increased nutrient influx into the lagoon.
- The previously white sand beach along Garapan is now tinged with the browns and grays of terrestrial sediments.
- Once plentiful lagoon fisheries are now perceived to be a dwindling resource.
- Lagoon waters that used to be clear in all but the heaviest rainfalls, are now typically discolored brown after every rainfall.
- Sediments from upslope erosion are forming deltas of brown sediments into the lagoon.
- Deterioration in the function of the sea grass beds could allow pollutants to reach and impact the outer coral reef ecosystem.

## 1.4 REGULATORY FRAMEWORK

Section 206 of the Water Resources Development Act (WRDA) of 1996 provides authority for the United States Army Corps of Engineers (USACE) to undertake restoration projects in aquatic ecosystems such as rivers, lakes, and wetlands. The USACE evaluates projects that benefit the environment by restoring, improving, or protecting aquatic habitat for plants, fish and wildlife. The USACE initially conducts a preliminary study to determine if there is a Federal interest in assisting in resolving the problem. A feasibility study is then conducted to define the problem, identify potential solutions, analyze the costs, benefits, and environmental impacts of the alternatives and select a plan. This project is being conducted under the auspices of this program.

The CNMI has promulgated a number of regulations over the past 15 years to protect the environment. The basic environmental rights can be found in the CNMI constitution that states in Article I, Section 9, that each person has the right to a clean and healthful public environment. The Division of Environmental Quality (DEQ) was formed "to develop and administer programs, including, where appropriate, a system of standards, permits, or prohibitions, to prevent or regulate activities concerning the discharge of pollutants to the air, land, water, wetlands, and submerged lands." DEQ has regulations governing earthmoving activities. The purpose of the earthmoving permits is to prevent soil erosion and to minimize pollution of marine, surface or groundwater resources. Although the National Pollutant Discharge Elimination System (NPDES) program has not been delegated to the CNMI, DEQ issues Section 401 Water Quality Certifications to any project that may affect water quality. Section 401 Water Quality Certifications are issued for all projects involving discharges, dredging, or any activity in wetlands. This CNMI permitting process is closely linked to the USACE Section 404 permitting program.

The Clean Water Act (CWA) requires that individual States designate water quality limited segments within their jurisdiction and address water quality concerns within these areas in part through the implementation of Total Maximum Daily Load (TMDL) studies. These TMDL studies attempt to quantify the individual components that contribute suspended and dissolved phase constituents to the nearshore environment. The TMDL studies are a required component of future upgrades to Water Quality Management Plans developed for regulated waters within individual States.

DEQ (1999) has recently completed a Section 305(b) Water Quality Assessment Report for the Commonwealth of the Northern Mariana Islands. This report was written following guidance detailed in Section 305(b) of the CWA and allowed determination of the following issues: (1) whether U.S. waters meet water quality standards, (2) the progress made in maintaining and restoring water quality, and (3) the extent of remaining problems in the CNMI. Onshore, the Safe Drinking Water program began implementing the VOC monitoring requirement, as outlined in the CNMI Drinking Water Regulations in January 2000. Public water systems within the CNMI will be required to do VOC testing in order come into compliance with these regulations. DEQ plans on updating the CNMI's Water Quality Standards at the end of the year 2000.

The Coastal Resources Management (CRM) Program was developed to manage all activities within areas designated as Areas of Particular Concern (APC), including the shoreline to 150 feet inland, lagoon and reefs, wetlands and industrial areas surrounding seaports. The Coastal Resources Management Act is outlined in CNMI Public Law 3-47. This act was established to coordinate island development management and specifies policies and rules that regulate activities that have the potential to affect the island's resources. These resources were broadly defined and included marine water and resources, groundwater, wetlands, watersheds and certain designated APC's. Prior to the initiation of any large development in the CNMI, the developer must obtain a CRM major siting permit. The CRM permitting process provides all of the appropriate government agencies an opportunity to inform the developer the various permitting requirements and general areas of concern for the proposed project. CRM also has an active monitoring and enforcement section.

Soil and Water Conservation Districts were created on Saipan by Public Law 4-44 which outlines methods for conserving, developing and using the soil and water resources on the island to control and to prevent erosion and flooding and to improve agricultural water management.

The CNMI has designated two classes of water (AA and A) for marine uses. The CNMI Water Quality Standards define these classes of water as follows: *"The CNMI has designated two classes of marine waters: A and AA. Class AA represents high-quality waters that are considered to be in a "natural" and "pristine" state. The CNMI Water Quality Standards states that "to the extent practicable, the wilderness character of such areas shall be protected," and does not permit any discharge of pollutants in class AA waters. Class A waters have been designated in two parts of Saipan, and generally represent a slightly lower quality of water in which some discharges may be permitted, for example, the two sewage treatment plant outfalls on Saipan. Nevertheless, Class A waters must support recreational use and the propagation of fish, shellfish, and wildlife, and strict water quality standards have been set for the protection of these uses in Class A marine waters. Additionally, further protection is afforded through the CNMI Anti-Degradation Policy, which is part of the Water Quality Standards and protects existing uses and water quality in any waters, despite their classification."*

Almost all of the coastal marine waters on Saipan are designated as Class AA, including the project site. These waters should remain in their natural pristine state as nearly as possible with an absolute minimum of pollution or alteration of water quality from any human-related source or actions. The uses protected in these waters are the support and propagation of shellfish and other marine life, as well as the conservation of coral reefs and wilderness areas, oceanographic research, and aesthetic enjoyment and compatible recreation inclusive of whole body contact (e.g. swimming and snorkeling) and related activities. The lagoon area within the project site is designated as Class AA waters.

## 2.1 SITE LOCATION

The project site extends from Quartermaster Road to the Fishing Base along the western shoreline of the island of Saipan, CNMI (Figure 1). The project area encompasses the entire inland watershed that contributes groundwater and surface water runoff to this 1.5-mile length of shoreline as well as the adjacent offshore lagoon area out to the fringing coral reef. The general coordinates of the project site extend from 15° 11' to 15° 12' north latitude and 145° 42' 31" to 145° 42' 32" east longitude.

## 2.2 SITE DESCRIPTION

The shoreline in the project area consists of a narrow sand beach. The beach consists mainly of loose limesand with some gravel, shell, and coral rubble, over calcareous gravel and beach rock. These sediments are primarily medium-to course-grained and well sorted. The beach is topped at the high water mark by a strip of grasses, vines, and trees, followed by a concrete pedestrian path further inland. The 2.8-mile long concrete pedestrian walking path that meanders between the narrow sandy shoreline and Beach Road. Picnic facilities, numerous trees, vehicle turnout areas, a memorial to fishermen lost at sea (13 Fishermen Monument), a Japanese tank monument, and concrete defensive bunkers built by the Japanese during the war are also found along this section of shoreline. The northern boundary of the site contains an earthen pier that was built during the Japanese period on the island. A dilapidated barge that was formerly used as a restaurant rests firmly aground just to the south of this earthen pier. The southern boundary of the site is opposite Quartermaster Road. The area to the east of Beach Road contains numerous businesses built on private land, including restaurants, hardware and stationary stores, a car lot and several strip malls.

Beach Road is a two lane undivided, signaled asphalt highway that was improved by the US Military following WWII, but not completely paved along its length until about 1985. Middle Road runs parallel to and about half-mile inland of Beach Road, and was improved to a paved, four-lane undivided and signaled asphalt highway in about 1990. Two paved roads link these two highways, Island Power Road to the North and Quartermaster Road at the Southern boundary of the project area. A number of coral gravel surface roads leading to small commercial and residential buildings are present within the project area. The slope of the land becomes steeper above Middle road and the watershed is broken into a series of irregular hills and valleys containing intermittent streams.

The coastal areas are vegetated with ironwood (*Casuarina equisetifolia*), sea hibiscus (*Hibiscus tiliaceus*) and a number of ornamental trees with an understory dominated by grasses and seaside morning glory (*Ipomoea pescaprae*). The inland portions of the project site are either paved or overgrown by scrub vegetation dominated by tangantangan (*Leucaena leucocephala*), ivy gourd (*Coccinia grandis*), and occasional ironwood and coconut trees.

### 2.2.1 Climate

The climate in Saipan is warm and humid throughout the year and is classified as tropical marine, with an average temperature of between 75 to 80 degrees Fahrenheit (Van der Brug, 1985). Rainfall in the study area is seasonal and averages about 75 to 80 inches/year. The wet season usually extends from July through November, followed by a dry season from December through June. Saipan experienced drought-like conditions during 1998, when the rainfall between January and November totaled roughly 41 inches, or roughly half the annual mean.

The dominant winds in the Northern Marianas are tradewinds, which blow from the east or northeast. These winds are strongest and most constant during the dry season, when wind speeds of 15 to 25 miles per hour are common. During the rainy season, the tradewinds often cease, and on some days the weather may be dominated by westerly moving storm systems that bring heavy showers or steady, at times torrential, rains. These episodic, heavy rainfall events contribute the majority of the sediment and surface water runoff that reaches the nearshore lagoon environment. Some of these heavy rainfall events occur during typhoons.

### 2.2.2 Physiography and Soil

The project site is situated in the western central part of the island of Saipan. The site potentially receives runoff and sediments from the southern half of the West Takpochao watershed, which extends roughly 2 miles inland to the limestone ridge that peaks at 1,540 feet above mean sea level on the summit of Mount Takpochao. The area between the shoreline and Middle road is a slightly to moderately sloping coastal plain composed of unconsolidated limestone derived sediments. The area inland of Middle road possesses the characteristic geomorphology on the island of Saipan with slightly to moderately sloping topographic plateaus separated by seaward-facing scarps of emergent limestone.

The characteristics of the surface soils generally vary in moving inland from the shoreline to upland areas of the watershed (Figure 2). The lowland areas that extend from the shoreline to just inland of Middle road are dominated by soils of the Chinen-Urban Land Map Unit (Young, 1989). These soils are highly porous and account for the lack of natural streambeds or continuous drainage ways across the lowland areas. During the Japanese and German occupations of these islands, much of these lands were in intensive agricultural use. The areas upland of Middle Road in the vicinity of Gualo Rai are covered by soils of the Kagman-Saipan Map Unit while further inland the land area is dominated by the Takpochao-Chinen-Rock Outcrop Map Unit. The Chinen-Urban Land Map unit in the lowlands between Middle road and the Beach Road is the most soil unit most prone to erosion in the area. However, the largest percentage of the sedimentation that occurs along the Beach road drainages appears to come from quarried limestone backfill used for road and lot surfacing, rather than from erosion of the underlying native and disturbed soils.

### 2.2.3 Soil Erosion

Sediment transport to lowland areas occurs naturally in all island systems. In the project area, the amount of sediments being transported to the lagoon environment has increased in conjunction with the spreading urbanization of the lowland areas within the watershed. The increased number of roofs, roads, and other paved areas impervious to rain increases the amount of runoff and tends to channel the runoff between properties. Construction activities and clearing of the natural vegetation tend to disturb the natural soils rendering them more susceptible to sheet and rill erosion. A decline in coverage by natural vegetation due to increased urbanization also limits the ability of the substrate to hold rainfall and makes these remaining lands more subject to runoff and erosion. The resulting increased levels of runoff and sedimentation to the lagoon overloads the ability of the natural seagrass community to cope with these pollutants and can damage coral reefs and associated ecosystems. Damage to coral reef ecosystems can result from direct sedimentation onto coral polyps or from increased nutrient concentrations that may lead to overgrowth by algae species. A shift in reef species towards more nutrient tolerant and less diverse communities will also lead to changes in the fish populations inhabiting the reef. In addition, less diverse communities of coral are more susceptible to damage during natural disasters such as typhoons. The most serious consequence however, is that any perceived decrease in the quality of the coral reef ecosystem is likely to have a negative impact on tourism on Saipan.

The Soil Conservation Service estimated erosion rates for Saipan soils present in the Kagman Watershed on the eastern side of the island. The average erosion rate from the forested upper watershed is estimated to be about three tons per acre per year while areas under construction may exceed rates of 20 tons per acre per year. The developed homestead area in Kagman, which is situated on a relatively flat limestone plateau, yields between two to five tons of soil per acre per year. Erosion rates for the soils present within the project watershed are not available. However, initial observations made during the reconnaissance field visit of eroded gravel roads, obvious sedimentation in storm drain gullies, and occasional lapses in implementation of Best Management Practice (BMP) regulations at construction sites suggest that erosion rates may be high.

### 2.2.4 Regional Geology and Hydrogeology

The island of Saipan is composed of a volcanic core upon which a series of discrete limestone formations have been deposited by coral reefs when these sections of the island were below sea level. Roughly, 90 percent of the surface of the island is currently mantled with limestone, with the remaining areas chiefly comprised of volcanic outcrops and unconsolidated beach or marsh deposits (Figure 3). The aerial distribution of rock type on the island has been created by successive episodes of tectonic uplift resulting from the flexure of the outer edge of the Philippine Plate in response to subduction of the Pacific Plate to the east of Saipan along the Marianas trench (Karig, 1971). The thick fringing limestone units, which are exposed at elevations of up to 1,540 feet above mean sea level on the summit of Mount Tagpocahu, have become sub-aerially exposed as a result of these tectonic processes.

The western half of the island, where the site investigation was conducted, is bordered by a large barrier reef and lagoon. Cloud et al. (1956) show the Garapan coastal plain to be underlain by recently emerged lime sands that overlie competent limestone reef at varying depths. Groundwater in the western coastal portions of Saipan occurs as an unconfined brackish water lens that overlies saltwater. The regional aquifer at the subject site is made up of the coral and coral-derived material of the Marianas Formation and the overlying lime sands. Due to the relatively high permeability of these units, the water levels within this aquifer fluctuate with ocean tides. Historically, limited amounts of generally brackish water have been exploited by wells dug along the coastal plain into this unit. Water quality measurements made on a number of wells located within the project watershed are compiled in Table 2. This data shows that the majority of the wells produce very brackish water with somewhat elevated concentrations of nitrate.

### 2.2.5 Watershed Delineation

The Coastal Resources Management Commission has delineated eleven major watersheds on the island of Saipan. The project site is located within the West Takpochao watershed (Figure 4). This watershed extends along the shoreline from about 500 feet south of Quartermaster Road to the area just north of Charlie Dock at Tanapag Harbor. The watershed extends inland to the ridgeline that runs up to Mount Takpochao and continues on through the Capitol Hill area.

### 2.2.6 Coral Reef and Lagoon Habitat

Amesbury et al (1979) described 24 habitats in Saipan Lagoon of which eleven are present fronting the project site. These habitat types are expressed and expanded upon in the Saipan Lagoon Use Management Plan (Duenas and Swavely, 1995). This document divides the lagoon into several planning areas of which Planning Area 5 ("from the small cove opposite the fisheries complex in Garapan south to San Jose Beach") encompasses the project area. Habitats in the project are delineated in Figure 5 and include the following:

- Inshore Seagrass Beds and Patches
    - Habitat 2. Seagrass (Enhalus) in sand, to 0.3m deep
    - Habitat 3. Seagrass (Halodule) in sand, to 0.6 m deep
- Mid-Lagoon Sandy Areas
    - Habitat 4. Seagrass (Halodule) and algae in sand and dead coral, to 1 m deep
    - Habitat 5. Sand, coral rubble and small live corals with algae (Dictyota, Goodlea, Homothanmion), to 1 m deep
    - Habitat 6. Sand with "Sargassum", to 1 m deep

  - Habitat 7. Sand and coral rubble with Laurencia, to 1.6 m deep
  - Habitat 11. Sand and blue-green algae, to 7 m deep
  - Habitat 14. Dead coral patches in sand with Halimeda and Dictyota, to 2 m deep
  - Habitat 15. Sand with live beds of staghorn corals, to 3 m deep
- Lagoon Barrier Reef Flat
  - Habitat 21. Submerged barrier reef with large live coral
  - Habitat 22. Submerged barrier reef with large live coral and algae (Bryopsis, Halimeda, Avrainvillea) to 4 m deep

The focus of this project is the inshore habitat since it receives the majority of the fresh water pollution and serves as the first line of defense for the valuable coral reef and fisheries resources further offshore. This area is described in greater detail below.

The inshore zone is generally comprised of a sand and sand/silt/rubble substrate covered by thick stands of seagrass and algae with only an occasional coral head or limestone outcropping. Because of the heavy input of fresh water (runoff and groundwater) into this environment, dense beds of the large bladed tall (up to 3 feet) seagrass *Enhalus acoroides* are found in a 10 to 50 meter wide band along the shoreline. Freshwater and entrained nutrients are known to enhance the growth of this sea grass but would have a negative impact on any corals in the area. Intermixed between stands of the *Enhalus* and extended further out into the lagoon, often to the reef, is the very common short sea grass *Halodule uninervis* which may cover 20 to 70% of the benthic substrate in the lagoon outside the *Enhalus* beds and inside the coral reef. Algae species are abundant (more so nearshore) including *Halameda, Padina, Calurpa spp., Laurencia spp., Acanthophora* and *Dictyota* as the most common genera. Of concern, however, are the noted presence of two types of algae, *Enteromorpha*, and *Cladophora* with rapid growth potential that could bloom and become nuisance algae if nutrient levels become significantly elevated. The green, hair-like *Enteromorpha* was noted along the beach in several areas in the upper tidal area and appeared coincident with areas of fresh water infiltration. The pale hair-like algae Cladophora was noted in the inner lagoon area adjacent to the northern edge of the project area.

Corals in the inshore zone are very sparse and are characterized by scattered, small colonies of *Porites lutea* and *Pocillopora damicornis*. Live coral cover is less than one percent overall, but some areas may support colonies of Porites and Pocillopora at densities up to 5%. Invertebrates conspicuous in the inshore zone include the common sea cucumber genuses *Holothuria, Actinopyga*, and *Bohadschia*, the large starfish Linckia *laevigata*, and the clam known locally as "Amsum". Inshore fish resources include rabbitfish (Siganus), mullet (Mugilidae), goatfish (Mullidae), snappers (Lutjanidae), the emperor fish (Lethrinus harak), and silversides (Atherinidae). Juveniles of many species may be found in the sea grass beds and occasional predatory species such as groupers, jacks and barricuda may also be present. This resource is utilized by local fishermen for subsistence and sport. Fish are collected with small eye throw-nets, scoop nets, surround-nets, and spears.

Fishermen interviewed expressed the opinion that inshore fisheries resources were in decline, and information from the Division of Fish and Wildlife (DNR, 1998) would seem to support this contention (Figure 6).

## 2.3 SITE HISTORY

The Mariana Islands were discovered in 1521 by Ferdinand Magellan and were claimed for Spain in 1565 by de Legaspi. By 1568, the Spaniards relocated all Chamorros living on the Northern Mariana Islands (including Saipan) to villages on Guam in order to suppress indigenous resistance to foreign rule. Carolinians from the outer islands of the Truk district were the first Micronesians to repopulate Saipan in 1815 as a result of being displaced from their home islands by a devastating typhoon. In 1899, Spain sold the Mariana Islands to the Germans who developed coconut plantations for copra production using local labor. In 1914, the Mariana Islands were seized by a Japanese naval fleet during the opening days of World War I. The League of Nations placed the islands under Japanese mandate in 1920. The Japanese actively colonized and cultivated the Mariana Islands during their tenure. For instance, roughly 32 percent of the land area on Saipan was planted with sugarcane by the 1930s. By 1937, a total of 42,000 Japanese were living on the Northern Mariana Islands. A narrow-gauge railway was built around much of Saipan in order to transport harvested sugarcane to the cane mill located in Chalan Kanoa. Garapan and the northern half of the project area served as the commercial center on the island during the Japanese tenure. The island was heavily fortified by the Japanese during World War II as a result of the island's strategic location in relation to the Japanese mainland.

During World War II, United States forces invaded Saipan on June 15, 1944, and successfully captured the island on July 9, 1944. The shoreline at the project site was heavily shelled during the invasion and numerous live and dud ordnance were encountered during construction of the beachpath. The military quickly embarked on numerous construction projects throughout Saipan that required improving the existing transportation system on the island. Beach road and the Garapan area infrastructure was upgraded by the Navy shortly after the war.

Saipan underwent tremendous growth in the 1980s with the growth of the island's tourist and garment industries. This is reflected in the tremendous growth in the islands population from roughly 15,000 in 1980 to over 72,000 in the year 2000.

## 2.4 LAND USE IN AREA

The two major thoroughfares on Saipan, Beach and Middle Roads, run through the project area. The majority of urban development in the area is concentrated along these two roads. The community of Gualo Rai extends inland of Middle Road. The remainder of the watershed area inland of Middle Road is predominately covered by forest vegetation. The area between Beach and Middle roads within the study area is currently only heavily developed in the immediate areas adjacent to these two roads. However, it is likely that the entire land area between these two roads will become heavily urbanized within the next decade due to this areas proximity to the island's commercial and governmental centers and the demands of a rapidly increasing population.

The urbanization of the inland watershed area that has occurred over the past twenty years has likely dramatically increased the amount of sediments and storm water runoff reaching the lagoon area. Prior to urban development of the area, the majority of sediment and stormwater runoff was trapped by the natural vegetation present along the coastal plain prior to reaching the lagoon. Increasing future urbanization of this area would likely increase the volume of both sediment and rainfall runoff reaching the lagoon.

## 2.5 POTENTIAL CONTAMINATING ACTIVITIES WITHIN WATERSHED

The areas adjacent to Beach and Middle roads contain numerous commercial, residential and industrial facilities that are all potential sources of pollutants to surface and ground waters which impact the lagoon. Potential contaminating activities (PCAs) present in this area include gas stations, garment factories, automobile dealerships, septic systems associated with various residential and commercial properties, and sediment erosion associated with construction and unpaved road erosion. Additionally, the sewer collection system within the project area along Middle Road is known to overflow, and a major new collection system nearing completion along Beach Road will raise the potential for lagoon contamination from sanitary sewer overflows (SSOs).

## 2.6 SITE INFRASTRUCTURES (STORM DRAINS AND SEWERS)

At present, there are 13 storm drainage outlets within the study area that drain to the Saipan Lagoon (Figure 7). The drains were originally installed during construction of Beach Road in the early 1980s. Headwalls for the drain outlets were constructed when the beach walk (bike path) was built in the mid-1990's. A typical storm drain consists of a grated catch basin on the inland side of Beach Road, followed by 30-inch diameter reinforced concrete pipe(s) (RCP) that run beneath Beach Road and convey the storm water from the catch basin to the lagoon. In general, these storm drains collect stormwater from the immediate vicinity of Beach Road (i.e. runoff from Beach Road and properties adjacent to the road). The size of the drainage outlets vary from outlets with one 30" RCP to outlets with three 30" RCPs. The tributaries (areas) for these drains were not delineated during the site visit.

Middle Road parallels Beach Road about a half-mile inland and is similarly drained by a series of individual storm drains. The design of the drains is similar to that of Beach Road with catch basins on the inland side of the road and outlets on the other side of the road. The contributory flow from the upland areas of Middle Road were not delineated or quantitated during the site visit. The drains along Middle Road discharge to the properties between Beach Road and Middle Road. However, there seems to be no connection between the storm drains on the upper road and those on the lower road. There does not appear to be any drainage easement through this area. Since the topography of the area is relatively flat, runoff tends to pond in the area during heavy rainfall. Depending on the severity of the rainfall event, flooding of the down-slope properties and roads may occur. It appears that only a small fraction of the runoff from properties inland of Middle Road reach the storm drains at Beach Road during normal intensity rainstorms, with the majority of the runoff infiltrating into the highly permeable limestone.

A visual survey of the drainage outlets along Beach Road was conducted. Sediment deposition was observed in the immediate area surrounding the outlets (see site photographs). The deltaic formations around the outlets extended up to 50 feet into the lagoon from these discharge points. The transported sediment consisted of fine sand with some silt and was significantly darker in color than adjacent beach sand.

At present, the homes and businesses within the study area limits are not sewered and use septic systems for disposal of wastewater. No records were available describing the number and location of septic systems in the area. Local regulatory officials suggested that some gray water disposal is discharged directly to the surface without benefit of a septic system or leach field. It is believed that septic system failures probably contribute a significant amount of nutrients to the nearshore waters within the project area.

The Commonwealth Utilities Commission (CUC) is presently constructing a gravity sewer system for the area. Figure 8 shows the general layout of the sewers as shown in the CUC Sewer Master Plan for the area. The main trunk line for the new sewer will run along Beach Road with a number of laterals connecting from the side streets and private properties. Due to topography, lift (pump) stations will be required at certain points in the conveyance system. The new sewer will connect into the existing system in Garapan with the ultimate destination of the wastewater being the Sadok Tasi Wastewater Treatment Plant (WWTP) to the north. PVC pipe will be used for the new sewers.

Sanitary sewer overflows (SSOs) have been reported for the existing wastewater collection system. However, no records have been kept that detail the frequency, location, quantity, cause, and affected area. The only information available is a trouble call log. There have been reports that some overflows have caused wastewater to be discharged into the nearshore marine environment. According to local personnel familiar with the system, the major causes for SSOs have been reported to be:

- Failure of the pumps at the lift stations due to clogging of the impellers.
- Capacity of the collection system exceeded during storm events. During storm events, the collection systems have on occasion received excessive Infiltration and Inflow (I/I) causing them to back up and overflow. I/I in the system can be attributed to a number of factors.

- Large portions of the existing collection systems in the Chalan Kanoa/Kobler Area and the Garapan Area were constructed in the early 70s. The original sewers were constructed using vitrified clay pipe (VCP). The age of the sewer along with the pipe material may give cause for concern for cracks, leaks, and structural damage.
- The sewers are located in areas that have a shallow groundwater table. Some of the sewers are located below the groundwater table lending for a higher possibility of infiltration.
- Localized flooding during storm events may lead to inflow at different points in the collection system (manholes, lift station wet wells, etc.).

## 2.7 SOCIOECONOMIC CONSIDERATIONS

Saipan’s population has increased over four fold between the 1970's to current levels. Much of the population increase occurred in the 1980's as a result of a burgeoning Asian tourist market. Unfortunately, the level of tourism has substantially decreased since the beginning of the Asian crisis in 1997.

In addition to tourism, Saipan’s economy is based heavily upon light industrial (garmet factory) production. As a US protectorate nation, merchandise manufactured in Saipan may be sold with a “Made in the USA” label. This affords a marketing benefit for these products in the United States. Much of the work force in these garment factories are foreign (primarily Chinese) contract workers who retain neither residency or citizenship in Saipan. Land ownership in Saipan is limited to persons of indigenous origin. Therefore land ownership is an extremely important factor in the socio-economic system of the island. Remedial measures that require conversion of private lands to public may prove difficult to implement. In addition, knowledgeable personnel interviewed while on Saipan suggested that whatever remedial measure is recommended should require low maintenance to assure long term success.

A number of scientific studies have been conducted on the island of Saipan over the past three decades. Many of the previous studies involved studying the biological communities and sediment contaminant levels present within the offshore environment. The data generated during these previous studies is summarized in the following sections. The final section in this chapter (Section 3.6) lists the additional environmental, hydrologic and biological studies required to establish baseline conditions existent in the project watershed prior to the initiation of remedial activities.

## 3.1 PREVIOUS ENVIRONMENTAL INVESTIGATIONS

A number of environmental investigations have been conducted on Saipan at formerly used defense sites created by the U.S. military during and shortly after World War II. These sites are currently being investigated by the USACE under the Defense Environmental Restoration Program: Formerly Used Defense Sites (DERP-FUD). No specific DERP-FUD project site has been identified within the project limits.

The Division of Environmental Quality (DEQ) and USEPA Region IX conducted limited sediment sampling from six offshore sites located around the municipal dump to the north of the project area in 1987. The sediment samples collected were analyzed for heavy metals and PCBs. An extensive follow-on sediment sampling investigation was recently completed within Tanapag Lagoon in the vicinity of the Puerto Rico dump (Denton et al., 2000). Surficial sediments were collected from 32 nearshore and 9 offshore stations and analyzed for heavy metals, polychlorinated biphenyls (PCBs) and polycyclic aromatic hydrocarbons (PAHs). All sediment samples were taken to a depth of 15 cm using hand-held aluminum corers. Three sediment cores were collected for separate analysis from within a 3-m diameter circle at each station. The sediment samples collected were analyzed for the following 10 heavy metals (Ag, Cd, Cr, Cu, Hg, Ni, Pb, Sn, Zn), the 20 chlorobiphenyls of greatest environmental importance based on their toxicological properties, and 16 common PAH compounds ranging in size from two to six fused aromatic rings.

Slightly elevated mercury and lead levels were measured in the vicinity of a sewer outfall and near the entrance to Saipan Harbor. Moderate levels of tin contamination (0.1-5.0 μg/g) were observed in sediments collected from nearshore stations. All offshore stations in Tanapag Lagoon were relatively free of PCB contamination with total levels consistently below 1 ng/g. Moderate levels of PCBs were detected in sediments collected from two nearshore stations. This study concluded that PCBs do not pose a major threat to benthic communities in this area at the present time. PAHs were only detected in 33% of all offshore sediment cores compared with 81% from nearshore stations. Total sedimentary PAH concentrations ranged from non-detectable to barely measurable in the majority of offshore samples. Closer to shore, levels were often appreciably higher rising to 2.44 μg/g near the docks and 3.23 μg/g near the Puerto Rico dump.

Sediment sampling has not been conducted in the lagoon portion of the project site. A limited number of sediment samples should be collected and analyzed, at a minimum, for the same list of constituents evaluated during the recent Tanapag Lagoon investigation. The resulting data will be useful for establishing the baseline concentrations of constituents of concern (COC) present within the lagoon prior to the initiation of remedial activities. It will also be useful to compare the COC levels present in sediments from the project area lagoon with levels detected in sediments collected from the more heavily industrialized Tanapag Lagoon.

## 3.2 PREVIOUS PHYSICAL OCEANOGRAPHIC STUDIES

The CNMI Marine Monitoring Team assesses the condition of the coral reefs in the CNMI on a regular basis. This periodic survey of the condition of the coral reefs provides a reliable indicator of changes in marine water quality in the nearshore lagoon environment. The pH of the lagoon is slightly lower than the open ocean due to increased carbon dioxide concentrations from biotic respiratory activity. Water temperatures vary from a low of 22°C to the upper thirties in the shallow swash zone along the beach. Even under conditions of no rain or runoff, salinity of the lagoon water varies generally with distance from the shoreline as a function of groundwater input and depth. It is not unusual for shoreline salinity to be several points lower than the full 35ppt ocean salinity typical over the outer coral reef. Terrigenous inputs to the lagoon waters can cause turbidity in lagoon waters due to suspended sediments (Pring-Ham and Kirby 1989). However, according to current studies within Saipan lagoon, these silt loads are apparently rapidly diluted and carried out to the open ocean by currents within the lagoon (USACE, 1980, Randall, et.al. 1987). These currents are powered primarily by the pumping action of breaking waves across the reef and tidal flux, and secondarily by wind and wave set-up along the beach. Resultant currents transport lagoon waters out to the ocean through several well-defined reef passages. During the vast majority of times when there is no runoff, the lagoon waters are typically of exceptional clarity.

The results from these previous oceanographic studies should be combined to produce an estimate of the probable residence time of water within the lagoon.

## 3.3 PREVIOUS WATER QUALITY STUDIES

The Division of Environmental Quality (DEQ) monitors water quality on a weekly basis at 38 fixed stations located along Saipan's western facing coastal beaches. Six beach sites on the northeast coast of the island and six beach sites on the southeast coast are monitored on a quarterly basis. Eleven sites around Managaha Island are also monitored on a quarterly basis. Three of these monitoring locations (WB 22-Garapan Beach, WB 23-Garapan Drainage and WB 24-Chalan LauLau Beach) are located within the project area. The microbiological and chemical parameters monitored include: temperature, salinity, dissolved oxygen, pH, turbidity, and fecal coliform. DEQ has also just begun to test nutrient levels, including nitrate and reactive phosphate, on a monthly and quarterly basis at a subset of these sites. The quality of water in Tanapag Harbor was also surveyed by Doty (1977) and M&E Pacific (1980). Nearshore values indicated that nitrate levels were higher in low salinity waters probably reflecting land-derived input to the coastal waters.

DEQ also monitors water quality in private and municipal water wells on a biannual and annual basis. The water quality data for nine wells located within the project watershed are compiled in Table 2. The groundwater present within the areas located on the lagoon side of Middle Road is very brackish and contains relatively elevated nitrate concentrations.

Most microbiological violations on Saipan have occurred in areas with heavy stormwater run-off, sewer overflows.and leaking septic systems. Garapan was developed on a low-lying wetland and sewer overflows in this area can create standing pools of contaminated water that act as a continual source of fecal coliform contamination to the lagoon. As a result, the majority of fecal coliform violations tend to occur during the rainy season on Saipan (between July through November). Within the project area, the Garapan Beach monitoring site has had a total of four violations while the Garapan Beach Drainage and Chalan Laulau Beach stations have had three violations. This area also likely has a high density of septic tanks which contributes to nitrate contamination in the nearshore environment.

Water quality measurements of stormwater runoff on Saipan have not been made. However, a study (Zolan, 1981) conducted on commercial and residential areas of Guam may be used as an indicator of which chemical constituents may pose a threat to the lagoon environment in Saipan. This study found that runoff samples collected from commercially developed areas were generally much higher in metals levels than runoff from residential areas. The metals tended to be concentrated in the suspended load of the runoff rather than being present in the form of dissolved metal. Concentrations of mercury, cadmium, and lead in urban runoff occasionally approached or exceeded drinking and surface water quality standards. This study concluded that further analysis of receiving waters, sediments and biota were needed to determine the distribution of metals in Guam's environment.

Stormwater runoff samples need to be collected from the project watershed to evaluate the levels of pollutants entering the lagoon via this pathway. In addition, high frequency water quality monitoring (26 times per year) should be conducted at four sites within the project area that contain a high density of seagrass beds. This monitoring would provide the data required to statistically establish baseline water quality for the dry and wet seasons.

## 3.4 PREVIOUS FLOOD AND RUNOFF STUDIES

A number of the original wetlands present on Saipan were filled during the Japanese era to provide areas suitable for farming. It is estimated that over 60 percent of the wetlands on Saipan were lost during this period (DEQ, 1999). These changes to the natural land cover led to increased rates of sediment and stormwater runoff from the island.

A large portion of the coastal plain from Garapan to Susupe-Chalan Kanoa is currently subject to flooding. The areas to the north (Garapan) and south (Chalan Kanoa) of the project site tend to be the most heavily impacted by flooding. Flooding within the project area appears to largely consist of localized ponding of excess runoff in the areas surrounding Beach and Middle roads.

Flood control studies completed by the USACE for the western shoreline of Saipan include "Draft Detailed Project Report and Environmental Statement Susupe-Chalan Kanoa Flood Control Study" (1979) and "Draft Detailed Project Report and Environmental Statement for the Garapan Flood Control Project" (1984). Because data was not available for the subject areas in these previous reports, the standard unit storm was assumed using precipitation data derived for Guam's Ugum river Study, and depth-duration curves were based upon State of Hawaii data. The primary causes of flood problems in the coastal plain area are the relatively flat topography, the absence of ponding-infiltration areas, and the lack of suitable outlets to convey runoff to the ocean. Initial development of this area for agricultural purposes undoubtedly eliminated the natural wetlands that would store runoff and promote infiltration. The current high density of urban development in this area is not conducive to re-construction of wetland areas.

Three measures to alleviate flooding in the Garapan area were given serious consideration in the USACE studies. Each of these measures involved structural improvements consisting of a diversion channel to convey floodwaters to an outlet channel that would discharge the flow into Saipan Lagoon. The proposed diversion channel was 15 to 20 feet wide at its base and the outlet channel widths varied from 40 to 50 feet. The preferred flood control plan identified by USACE required construction of a 5,720 foot long channel that would discharge into the lagoon near Tanapag Harbor, leaving the lagoon waters fronting Garapan and Puntan Muchot free from flood water input. However, the recommended plan has several inherent problems including:

- The potential for disturbing unknown subsurface historic sites;
- Potential alteration of remaining wetland sites;
- Strong opposition from the National Park Service to construction of one outlet channel through a portion of the American Memorial Park;
- Opposition from the CNMI Department of Natural Resources because the channel traverses a wetland and may endanger birds in the area; and
- Concern about the unknown environmental impact of adding a large flux of flood waters at a single point discharge into Saipan Lagoon

The United States Geological Survey (USGS) maintained a stream gage within the Talufofo Watershed for a number of years (Van der Brug, 1985). Aside from this locality, there are no other perennial streams on Saipan. The Soil Conservation Service has prepared a soil map for the island of Saipan. This document also contains permeability and erosion rates for Saipan soils.

The National Resources Conservation Service (NRCS) conducted an extensive flood and runoff study for the Kagman watershed, on the eastern side of Saipan. Stormwater runoff rates were calculated for this watershed using a Soil Conservation Service computer model that was calibrated to the USGS gage results obtained from the South Fork of Talufofo Stream. Sediment budgets for the area were calculated using the Universal Soil Loss Equation (USLE) and Sediment Delivery Ratios (SDR).

A detailed flood and runoff study has not been conducted for the project area. A study using a similar technical approach utilized by NRCS should be conducted for this area so that peak discharge volumes and sediment loads entering the lagoon environment can be calculated.

## 3.5 PREVIOUS MARINE BIOLOGICAL SURVEYS IN LAGOON AREA

Saipan has had a number of biological surveys conducted by a variety of highly qualified observers during the past half century. Beginning in the 1950's, Schultz and others (Shultz, et.al., 1953, Cloud, 1959) characterized the richness of the tropical coral reef fish assemblage and shoal-water ecology in Saipan. In the 1970's numerous studies were completed, primarily through individuals associated with the University of Guam Marine Laboratory, concerning the abundance of algae (Tsuda & Tobias, 1977; Fitzgerald, 1987), calcareous coraline algae (Gawell, 1974), and reef fishes. In 1977 a study of the harbor area near the proposed mooring site of a power barge brought together a wealth of information regarding the abundance of marine resources present even in an area considered by many to be degraded (Doty & Marsh, 1977). Much of the above works are summarized by Amesbury (Amesbury, et.al., 1979) who defines habitat types and characteristics for Saipan Lagoon. The first general atlas of marine resources of Saipan Lagoon based largely on the habitats defined by Amesbury was completed by Eldridge in 1980. Several other reports, typically requisitioned as a result of specific development proposals, have added significantly to the substantial base of marine biological knowledge of this resource, including a marine survey of the northern Tanapag Reef (Randall et.al., 1987). Much of this information on lagoon habitats and distribution has been digitized and included in the government's GIS database. Given the abundance of background and baseline information, it is fortunate that the CNMI Government and Division of Environmental Quality (DEQ) has established through the CNMI Marine Monitoring Team a program of regular reef monitoring surveys. These surveys will continue to be of great importance for monitoring changes to the reef ecosystem brought about by changes in the water quality of the lagoon.

## 3.6 IDENTIFICATION OF DATA GAPS FOR PROECT AREA

The review of previous biological and environmental studies conducted on Saipan identified a number of additional studies required to adequately establish baseline environmental conditions within the lagoon. These studies should be completed prior to the initiation of remedial measures within the project area so that the effectiveness of these measures can be evaluated in the future. Each of the recommended studies is discussed in greater detail in Section 4.

The following additional studies are required to establish baseline environmental conditions present within the project area:

- Stormwater Quality Investigation
- Analyze Lagoon Sediments for Physical and Chemical Parameters
- Marine Habitat Mapping from Historical and Current Aerial Photographs
- Inshore Lagoon Area Seagrass and Associated Fauna Survey
- Inventory of Potentially Contaminating Activities in Watershed
- Hydrologic Study of Runoff Processes in Watershed
- Groundwater Level Investigation in Watershed
- Lagoon Water Quality Investigation
- Sanitary Sewer Overflow Assessment of Project Area Collection Systems
- Residence Time Study of Lagoon Water

The studies recommended in this section were selected to provide baseline information on the environmental conditions present within the lagoon and contributory watershed as well as the quality and quantity of runoff entering the lagoon. The data generated by these studies will be combined with the existing site data discussed in Section 3 and can be used to refine the design of future remedial measures. A number of the studies recommended below involve collecting baseline environmental data for the measurable aquatic ecosystem unit proposed for monitoring (i.e., seagrass habitat).

## 4.1 STORMWATER QUALITY INVESTIGATION

Storm water quantity and quality should be investigated and correlated with rainfall and up-slope land use. Samples and volume estimates should be collected from drainage outlets number 1, 4 and 13 (Figure 7) along Beach Road, and drainage outlets located along Middle Road. A minimum of two rounds of sampling should be conducted, preferably corresponding to storm events occurring during both the dry and wet seasons. If possible, the stormwater sample should be collected within the first half inch of runoff. This is consistent with the "first flush" concept that holds that the first half inch of runoff from any given event will carry 95% of the pollutants transported as a result of that event. Approximate stream flow rates should be measured at the time the stormwater sample is collected. An attempt will be made to measure the total volume of suspended sediment transported during the two monitored storm events by surveying the height and extent of the deltaic deposits that form around the major storm drains after large rainfall events. The stormwater samples should be analyzed, at a minimum, for suspended sediment load, nutrients, pH, turbidity, fecal coliform bacteria and priority pollutant metals. The exact list of constituents of concern (COC) monitored will be based upon the results of the Potentially Contaminating Activities (PCA) survey (Section 4.5), which will identify the types of chemical pollutants that may exist within the watershed.

This investigation will generate useful information on the sediment and nutrient loads entering the lagoon environment. This data will also be useful for future Total Maximum Daily Load (TMDL) studies required for future updates to the island of Saipan's Water Quality Management Plan.

## 4.2 ANALYZE LAGOON SEDIMENTS FOR PHYSICAL AND CHEMICAL PARAMETERS

Lagoonal sediments need to be investigated since they act as major sinks for many of the more persistent and potentially toxic organic and inorganic chemicals introduced into the aquatic environment (Ingersoll 1995). Sediment chemical data provides useful data for evaluating the environmental quality of the lagoon environment and will provide and invaluable baseline for future studies. Sediment samples should be collected along three transects oriented parallel to the shoreline in the lagoon (Figure 9). A total of six composite samples should be collected along each transect.

The sampling locations will roughly correspond to the locations of the six largest stormwater runoff drainage outlets located along the shoreline within the study area. The samples should be collected to depths of 15 centimeters using hand-held aluminum corers. Three separate sediment samples will be collected from a five-meter circular area at each sampling location and combined to generate a single composite sample for analysis. The sediment samples will be analyzed, at a minimum, for grain size, organic carbon content, metals (Ag, Cd, Cr, Cu, Hg, Ni, Pb, Se, Sn, Zn), the 20 chlorobiphenyls of greatest environmental importance based on their toxicological properties, and 16 common PAH compounds ranging in size from two to six fused aromatic rings. Additional COC's may also be analyzed depending on the results of the PCA survey (Section 4.5). The chemical data generated during this study will be compared to the contaminant levels recently measured in sediments collected from Tanapag lagoon (Denton et al, 2000).

## 4.3 MARINE HABITAT MAPPING FROM HISTORICAL AND CURRENT AERIAL PHOTOGRAPHS

Coral communities, algae beds, and shorelines are not static systems; they naturally change over time in response to their surroundings. There are multiple sources of aerial photographs of the Saipan Reef extending back to World War II. In 1980, Eldridge and Randall used a set of USGS photographs to provide the first base maps of the lagoon communities. Amesbury and others have used these maps and supplemental ground observed information to produce the various habitat maps and descriptions presently in use. More recently the USGS, NOAA, and NASA have completed additional photographs and multi-spectral images from various platforms. These map resources should be compiled and compared to the older aerial maps. Information can be obtained relating to shifts in coral colonies, algae abundance, and shoreline erosion and accretion. This information would be invaluable to resource managers charged with the long-term management of resources for future generations.

## 4.4 INSHORE LAGOON AREA SEAGRASS AND ASSOCIATED FAUNA SURVEY

There is presently an adequate mechanism in place for the monitoring of the coral reef and lagoon habitats in the project area. However, the first ecosystem likely to be impacted by lower water quality will be the inshore seagrass habitats and associated fauna. This information gap needs to be filled as soon as possible and the results compared to previous surveys to document the extent of historical change to this habitat.

Thereafter, a simple monitoring strategy for the segrass habitats must be developed that can be successfully undertaken by the CNMI Marine Monitoring Team on a regular and systematic basis. This seagrass monitoring program will be the primary tool used to measure the effectiveness of any environmental resource remediation strategies implemented as a result of this project, such as implementation of best management practices for sewer line maintenance.

## 4.5 INVENTORY OF POTENTIALLY CONTAMINATING ACTIVITIES IN WATERSHED

Potential contaminating activities (PCAs) that reside within the watershed should be inventoried. Some examples of PCAs on Saipan that should be inventoried include fuel storage facilities such as gas stations, garment factories, septic systems, leach fields, sanitary sewer overflow points, automotive repair facilities, cattle feed lots, intensive agriculture activities, underground and above-ground fuel storage units, and dry cleaning or large-scale laundry operations.

A generic list of PCAs and their associated contaminants should be created. The PCA list will include known sources of contamination, significantly high-risk activities, and other activities that will require a field evaluation during the inventory process. The PCAs will be grouped into categories of Very High, High, Medium, and Low reflecting their relative potential to contaminate the lagoon waters. Factors that will be considered when placing a PCA into a certain category include: 1) the nature of the activity, 2) contaminants associated with the activity, and 3) association with historical incidents of groundwater contamination. A list of chemicals associated with individual PCAs should also be created. This list will be used to associate particular contaminants of concern with each specific type of PCA identified within the watershed.

The PCA inventory will yield an inventory of potentially contaminating sources present within the watershed at the present time. By collecting this baseline information, future changes in chemical loading to the lagoon environment can potentially be related to future changes in land use within the watershed. This information will also be used to finalize the list of chemicals monitored during the stormwater quality (Section 4.1) and sediment analysis (Section 4.2) studies.

## 4.6 HYDROLOGIC STUDY OF RUNOFF PROCESSES IN WATERSHED

A hydrologic analysis for the project watershed is required. This analysis will provide estimates of watershed yield and peak discharges to the shoreline. This hydrologic data is required to properly design storm water quality facilities (e.g. sedimentation basins) so that the sediment retention efficiencies can be obtained.

The first step in the analysis is to delineate and map the various watersheds within the project area. Individual watershed areas will likely need to be sub-divided into smaller subareas of comparatively homogeneous slope, soil and vegetative cover. These areas would then be grouped and erosion rates calculated on the basis of land use, soil, and slope within each subarea. Peak discharges for the project watersheds will be estimated by using an appropriate computer model. Sediment budgets for the areas that contribute to stormwater discharge along the shoreline should be prepared using the Universal Soil Loss Equation (USLE) and site-specific Sediment Delivery Ratios (SDR). The USLE computes average annual erosion rates. The model results will be calibrated using the suspended sediment loads measured during the two rainfall events monitored for the stormwater quality investigation (see Section 4.1).

## 4.7 GROUNDWATER LEVEL INVESTIGATION IN WATERSHED

The direction and gradient of groundwater flow within the watershed should be determined. This data will be used to estimate the discharge rate of groundwater along the shoreline within the project area. Approximately 25 wells are located within the project watershed. The elevations of up to eight of these wells should be surveyed (Figure 10). Synoptic water level measurements should then be made at these wells and at a lagoon monitoring site (the Fishing Base Pier) over a three-day period. Fluctuations in water levels in the coastal wells due to tides will require that pressure transducers be used to accurately determine the average regional water levels over a minimum three-day period. The hydrologic information collected will be useful for optimizing the design of future stormwater re-injection or infiltration systems. The data will also allow a more accurate estimate of the flux of groundwater that enters the nearshore lagoon within the project area.

## 4.8 LAGOON WATER QUALITY INVESTIGATION

In order to achieve better spatial coverage within the project shoreline area, additional sampling is recommended at new shoreline sampling locations. This data will augment the existing data being collected by DEQ at sites WB 22, WB 23 and WB 24 (Figure 11). Sampling should be augmented to include four areas along the length of the project area; three samples should be collected from each area; one at the shoreline, one beyond the seagrass beds at the surface, and one beyond the seagrass beds near the bottom. Information on tide, wind direction, swell height, and current speed and direction should also be acquired. Samples should be taken at early morning every other week for one year and on a daily basis following at least two storms coincident with the storm water sampling project. This data will allow for the computation of a log-normal statistical baseline for the dry season, wet season, and include variance for storm runoff. In addition a salinity/temperature probe should be used during dry weather and low tide to map salinity temperature profiles along the project shoreline over a period of one tidal cycle. This data will allow a more accurate calculation of residence time within the lagoon and help locate groundwater input sites along the shoreline.

## 4.9 SANITARY SEWER OVERFLOW ASSESSMENT OF PROJECT AREA COLLECTION SYSTEMS

It is suspected that a significant amount of the nutrient and bacteriological contamination along the shoreline arises from overflows and leakage from the sewer system. Although the sewer system within the project area is currently being installed and is not expected to have overflow problems, a sanitary sewer overflow (SSO) study of the collection systems in Garapan and Chalan Kanoa should be conducted. The major concern being backups in the older collection systems in Garapan and Chalan Kanoa can lead to backups and SSOs within the new sewers of the project area.

At present, there are no official records kept on SSOs that document the frequency, location, quantity spilled, cause, and affected area. In addition, no records are kept on the frequency of sewer line maintenance and pump station maintenance. This information is important because it helps to identify the problem areas in the collection system, the different types of problems, and the severity of the problems. As a first step, information/data of this type should be collected for all SSOs and maintenance activities and stored in a historical database.

After a reasonable amount of data is collected (approximately one to two years), problem areas can be identified and prioritized. Depending on the nature of the problem identified, a number of different types of studies may be conducted for a particular problem area. Some of the different types of studies that may be conducted include the following:

- Closed circuit television inspection of the sewer lines. This type of inspection is useful in identifying the structural condition of the pipe (i.e. cracks and broken pipes), infiltration points, and problem sources (i.e. grease, roots, and structural damage).
- Infiltration and inflow (I/I) study. This type of study is used if excessive I/I is suspected. It is useful in identifying the approximate location and quantity of I/I sources. It may be helpful in identifying areas that require CCTV inspection.
- Capacity analysis of the collection system. This type of study helps to identify areas in the collection system (i.e. pump station and trunk lines) that need to upgraded because the existing capacity is exceeded due to increased flow rates from collection system expansion or increased wastewater generation.

The results from these studies will allow the government to focus future expenditures of limited infrastructure maintenance funds on those sections of the sewer system that are creating the most environmental damage.

## 4.10 RESIDENCE TIME STUDY OF LAGOON WATER

At least two studies of current speeds and patterns within the lagoon have been conducted. The original data from these studies needs to be obtained and integrated with bathymetric charts to calculate the residence time of water at various points within the lagoon. These results need to be combined with storm water inflow calculations to determine the probable concentrations and residence time of pollutants within the lagoon. This number is necessary to determine the total maximum daily load of pollutants that can be allowed to enter the lagoon through point and nonpoint sources without damaging the reef ecosystem. This calculation is also useful for the design (sizing) of storm water retention basins.

## 4.11 RANKING OF PROPOSED ADDITIONAL INVESTIGATIONS

The studies recommended in this section are listed in Table 3 according to three categories: relative importance of study for addressing existing data gaps, the relative cost of the study, and the estimated duration of the study. While all of the recommended studies are required to provide missing baseline data prior to the initiation of remedial activities, some of the studies are deemed more critical than others. Cost is also a consideration since only a limited budget exists for the second phase of this study.

The estimated cost of these studies has been classified into three categories: Low, Medium, and High. Low cost studies are estimated to cost less than $20,000, medium cost studies between $20,000 and $60,000, while high cost studies greater than $60,000 to complete. The relative duration required to complete the recommended studies is also estimated in this table. Short duration studies are estimated to require less than one month to complete. Medium duration studies are estimated to require between one and four months to complete while long duration studies would take between four to twelve months.

Meetings were held in Saipan in early March 2001 with representatives of the U.S. Army Corps of Engineers, Environet, CNMI Department of Environmental Quality and CNMI Department of Public Works. Several decisions arose out of these meetings regarding which studies that would be conducted during the Phase II portion of this project. It was decided that three of the proposed studies, Groundwater Level Investigation in Watershed (Section 4.7), Sanitary Sewer Overflow Analysis (Section 4.9), and Residence Time Study of Lagoon Water (Section 4.10), while important, were not critical to the completion of this project. In addition, DEQ offered to assist the Corps and their Contractors in collecting samples and data for some of the remaining studies. In particular, DEQ has agreed to assist with sample collection and monitoring for those tasks that require working in the lagoon. DEQ will assist the Corps contractor with collecting samples for the Stormwater Quality Investigation (Section 4.1) and the Lagoon Sediment Analysis (Section 4.2). DEQ will also conduct the nearshore lagoon sea grass and fauna surveys (Section 4.4) and will provide runoff observations for the Hydrologic Study of Runoff Processes in Watershed study (Section 4.6).

One of the primary causes of nearshore marine water quality degradation or contamination is storm water runoff carried to the shoreline through natural or man-made drainage structures or via overland flow. Other contributing factors include inadequate infrastructure (e.g., sewage overflows), and accidental spills or leaks of contaminants from industrial facilities located near the shoreline. An environmental restoration program must address each of these potential sources to be successful. Once remedial measures are implemented, the resultant improvements in water quality will increase the nearshore fish population (by improving their habitat) and reduce the frequency of beach closures to public recreational uses.

Several alternatives are discussed below that, if implemented, may improve the water quality and aquatic habitat present in the nearshore lagoon environment in the project area. The alternatives under preliminary consideration include regulatory considerations, improved watershed management, and undertaking infrastructure improvements to reduce the amount of sediments and contaminants that discharge into the ocean. These alternative were tentatively identified by EI based on the limited environmental data currently available and may be changed or modified as more data becomes available. Regulatory considerations are briefly reviewed because they form the basic legal framework under which the studies proposed in Section 4 and tentative restoration alternatives presented in Sections 5.2 and 5.3 should be completed. The U.S. Army Corps of Engineers cannot assist the Saipan government in funding activities related to regulatory compliance. Implementation of regulatory measures and development of public education programs and a watershed management plan are the local governments responsibility.

An important task that must be completed prior to implementing any restoration project is to collect sufficient data to establish existing environmental conditions. This data will help determine appropriate restoration measures and establish a baseline for monitoring the progress of future environmental restoration work. Section 4 provides a discussion of proposed studies that will address the deficiencies in the existing environmental data available for the western shoreline of Saipan.

## 5.1 REGULATORY CONSIDERATIONS

There are a number of federal regulations and programs that address, either directly or indirectly, nearshore water quality issues. Implementation of these regulations will require additional personnel and resources, and a strong commitment from the CNMI government to enforce the regulations. The CNMI government has enacted some regulations, such as the DEQ Earthmoving and Erosion Control Permit, that will potentially improve nearshore water quality. Compliance with the permit requirements is monitored by DEQ.

The primary water quality regulations are promulgated under the Clean Water Act (CWA), which required States and territories, including the CNMI, to promulgate water quality standards. Section 319 was added to the Clean Water Act in 1987 and established the national Non-Point Source program. Congress has provided funding under Section 319 to States and tribes for the control of non-point source pollution since 1989. The Non-Point Source program is locally focused and state administered.

The National Pollutant Discharge Elimination System (NPDES) Program under the CWA also requires certain industrial activities, including publicly owned treatment works (POTW), to obtain discharge permits. NPDES also provides nationwide General Permits, which provide permit coverage for certain industrial activities that do not require individual permits, provided the activity complies with the conditions of the General Permits.

On December 8, 1999, EPA published Phase II NPDES permitting requirements for small municipal separate storm systems (MS4) (those serving less than 100,000 persons) and construction sites that disturb one to five acres. The rule allows for the exclusion of certain sources from the national program based on a demonstration of the lack of impact on water quality, as well as the inclusion of others based on a higher likelihood of localized adverse impact on water quality. The regulations also exclude from the NPDES program storm water discharges from industrial facilities that have ''no exposure'' of industrial activities or materials to storm water. It appears that Saipan is not currently subject to this regulation. However, as population on the island rises and the urban population density increases, the Phase II NPDES permitting requirements may become applicable in the near future.

Other regulations, while not addressing water quality specifically, that may have an impact on nearshore water quality include those promulgated under the Resource Conservation and Recovery Act (RCRA), Toxic Substance Control Act (TSCA), and the Oil Pollution Prevention Act (OPA). RCRA regulations govern the management of hazardous waste and underground storage tanks; TSCA regulates the use and disposal of PCB containing materials; and OPA requires the preparation of spill prevention, control, and countermeasure (SPCC) plans and spill response plans. Compliance with these regulations would reduce the amount of contaminants released into the environment, thereby reducing the amount of contaminants carried to the ocean in storm water runoff.

It should be noted that if federal funding is to be used to conduct water quality restoration projects, the National Environmental Policy Act (NEPA) requires that an Environmental Assessment (EA) for the entire project area on the western side of Saipan be performed. Several of the alternatives outlined in the following section may have a significant impact on the environment. Therefore, more comprehensive Environmental Impact Statements may need to be prepared prior to implementation of some of the remedial alternatives recommended below.

Specific regulatory measures that should be considered to address the problems associated with sediment accumulation and entrained pollutant loads in storm water runoff include:

- Revise existing construction permit requirements so that storm water retention capacity standards are current and appropriate for conditions on Saipan.

- Establish storm water drainage standards for new construction and for upgrades of existing infrastructure.
- Review and enforce existing construction Best Management Plans to reduce runoff and sediment loads from development sites.
- The future drainage master plan update for the island should emphasize construction standards that minimize future sediment discharge to the nearshore lagoon environment.
- Review and update existing erosion and sediment control management guidelines, rules and regulations.
- Explore land use control measures such as limiting the size and nature (i.e., commercial, residential, recreational) of future developments between Beach Road and Middle Road.
- Establish a review process for future developments to ensure that storm water runoff concerns are considered and addressed.

## 5.2 INFRASTRUCTURE IMPROVEMENTS

The following infrastructure improvements should be considered to reduce the volume of sediments and improve the quality of stormwater currently entering the lagoon.

- Construct storm infiltration structures to reduce the amount of runoff that reaches the lagoon. Examples of infiltration structures include injection wells and perforated piping buried under roadways, infiltration trenches and basins. Infiltration facilities rely on the percolation of storm water runoff through surface soils. Pollutants are captured by soil particles as the filtered water percolates down into groundwater. Use of infiltration facilities is dependent on suitable soils and groundwater protection issues. One possible way of establishing an infiltration basin is to construct a multipurpose recreational facility (football, baseball, and soccer fields) between Beach and Middle Roads. The project area is suitable for this type of system due to the high permeability of the coastal sediments. In addition, a properly located infiltration gallery may provide a partial hydraulic barrier to saltwater intrusion for inland, potable well sources (e.g. Gualo Rai wells). An infiltration system patterned after the Guam San Vitores Road project, where a large underground infiltration gallery is placed directly beneath a significant length of either Beach or Middle road, is another possible alternative.
- Construct/install storm water filters such as vegetation filters or physical filters. Examples of vegetation filters include tall grass covered drainage swales and vegetation covered marshes (wetlands). Examples of physical filters include grates, screens, and rock and sand filters designed to trap particles of various sizes that are entrained in storm water.

- Construct small settling ponds up-slope of Beach Road on each major storm drain outlet to reduce the amount of sediment transported to the shoreline. These basins could double as small parks, playgrounds, or parking lots.
- Construct one or two major storm water retention and infiltration basins between Beach Road and Middle Road. Investigate the possibility of these basins doubling in function as soccer, rugby, baseball or other recreational sporting fields and associated facilities.
- Construct diversionary structures to keep clean rainfall away from contaminant sources. Examples include diverting rainfall runoff from areas of land disturbance at construction sites.
- Continue with present plans to update, improve, and extend existing sewer system. Establish deadlines to require connection for all waste water systems and abandonment of septic tank and leach field systems located within the project area. Leaks from the existing sewer lines are the suspected primary source of high nitrate levels and fecal coliform that are periodically detected in the lagoon waters. The sewer line study in Section 4.11 provides a discussion of additional information that will be required to implement this alternative.
- Devise engineering controls to minimize failures in pumps at lift stations and improve maintenance of lift stations.
- Road improvements should take into account methods to minimize sediment transport. Design curbs to channel flow to infiltration areas and pave existing unpaved roads that are prone to erosion in the coastal zone.

Future infrastructure improvements need to be coordinated with the design requirements developed in the ongoing USACE Saipan Drainage Master Plan and take into consideration projected population growth and urban development on the island. Infrastructure improvements that will likely have an impact on nearshore water quality during construction may require a Section 401 Water Quality Certification (WQC) Form. Section 401 refers to that section in the Clean Water Act, which is regulated by DEQ. A WQC is issued when there is a corresponding federal permit for an activity that may result in water quality degradation. All construction projects on Saipan require a DEQ Earthmoving and Erosion Control Permit which requires "24 hour storage of 25-year, 24-hour storm; or 75% sediment removal rate" for both during-construction stormwater systems and post-construction stormwater systems.

## 5.3 WATERSHED MANAGEMENT

The rapid rise in population on Saipan over the past two decades has led to increasing urbanization of the island. Urbanization increases overland runoff into the ocean because building and roadway construction decreases open space and permeable land area. Urbanization also increases the amount of pollutants released into the environment from a concentration of people and potential sources, and consequently increases the contaminants that are carried to the lagoon in runoff and via groundwater.

Watershed management involves a combination of regulatory enforcement, infrastructure improvement, and urban planning to reduce the introduction of pollutants to a land area, and to minimize the amount of storm water runoff, which carries the pollutants to the lagoon. The preliminary remedial measures under consideration involve the preparation of a watershed management plan. Components of the plan may include:

- Identify major source areas of sediments entering the lagoon.
- Evaluate the effectiveness of initiating reforestation of currently denuded portions of the watershed to minimize soil erosion. Special consideration should be given to native tree, shrub, and grass species (this may have the added benefit of reestablishing threatened or endangered species).
- Educate the public to reduce unnecessary application of fertilizers, pesticides, and improper disposal of household chemicals.
- Insure better enforcement of existing environmental regulations (see Section 1.4)
- Discuss the possibility of instigating land use control measures such as limiting the size and nature (i.e., commercial, residential, recreational) of future developments, especially in the area between Beach and Middle roads.
- Discuss the need to adopt zoning laws that maximize permeable areas and open spaces within areas undergoing urban development.
- Discuss the need for establishing drainage easements between Middle Road and Beach Road prior to the area becoming even more urbanized.
- Implement recommended infrastructure improvement projects (see Section 5.2).

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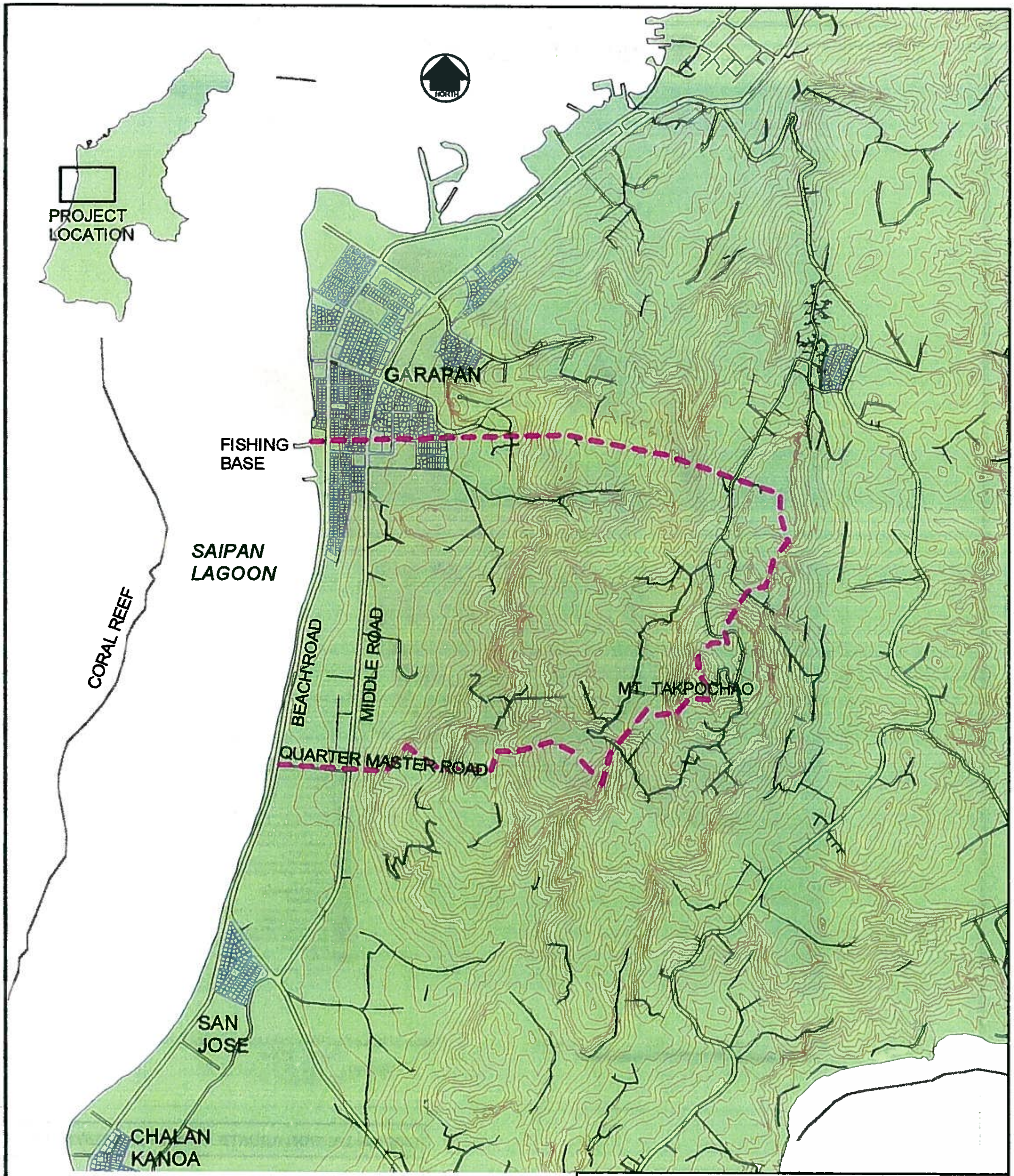


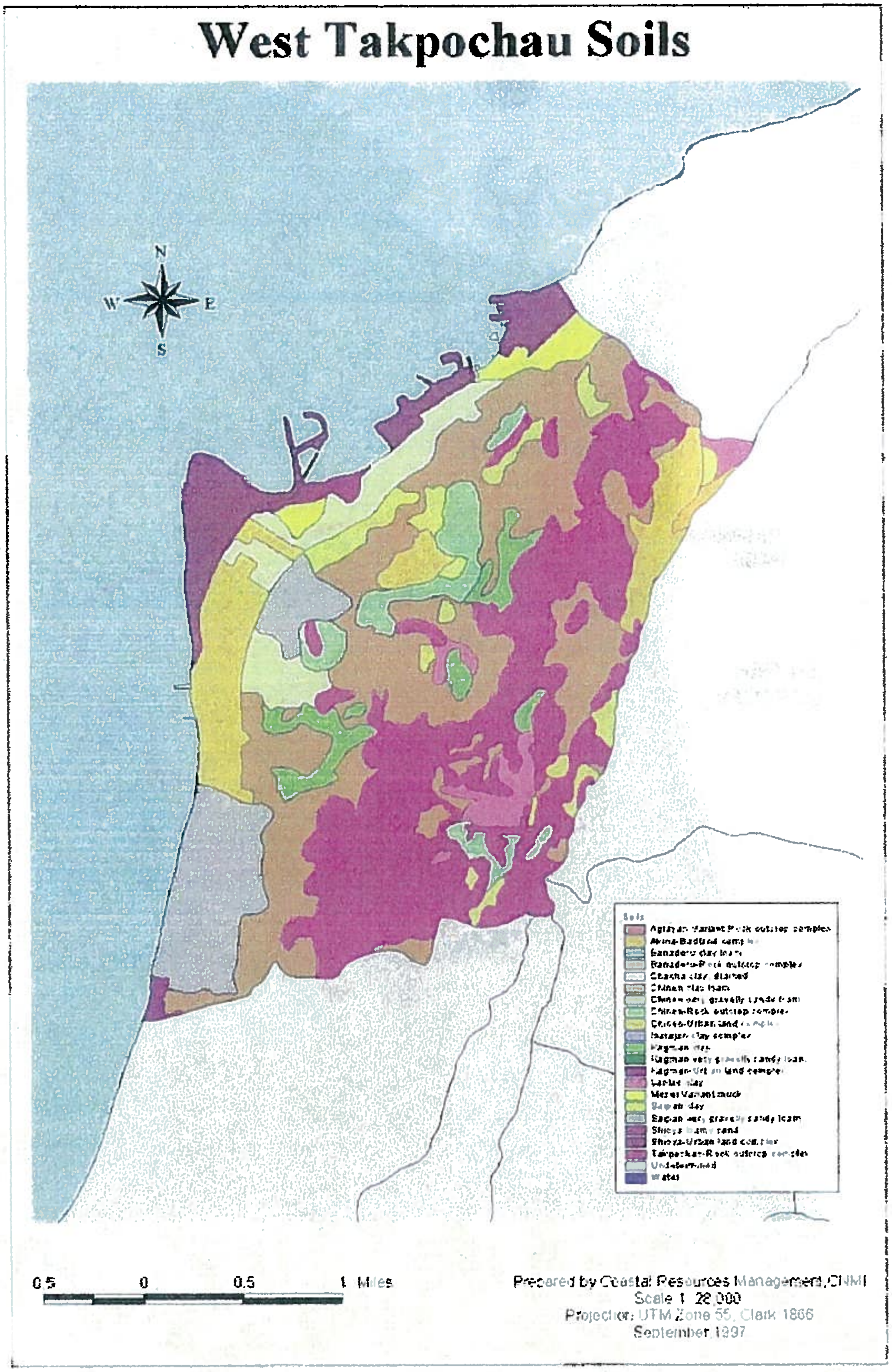
SAIPAN LAGOON AQUATIC ECOSYSTEM RESTORATION

## GENERAL SITE LOCATION MAP

USACE

FIGURE
1

ENVIRONET



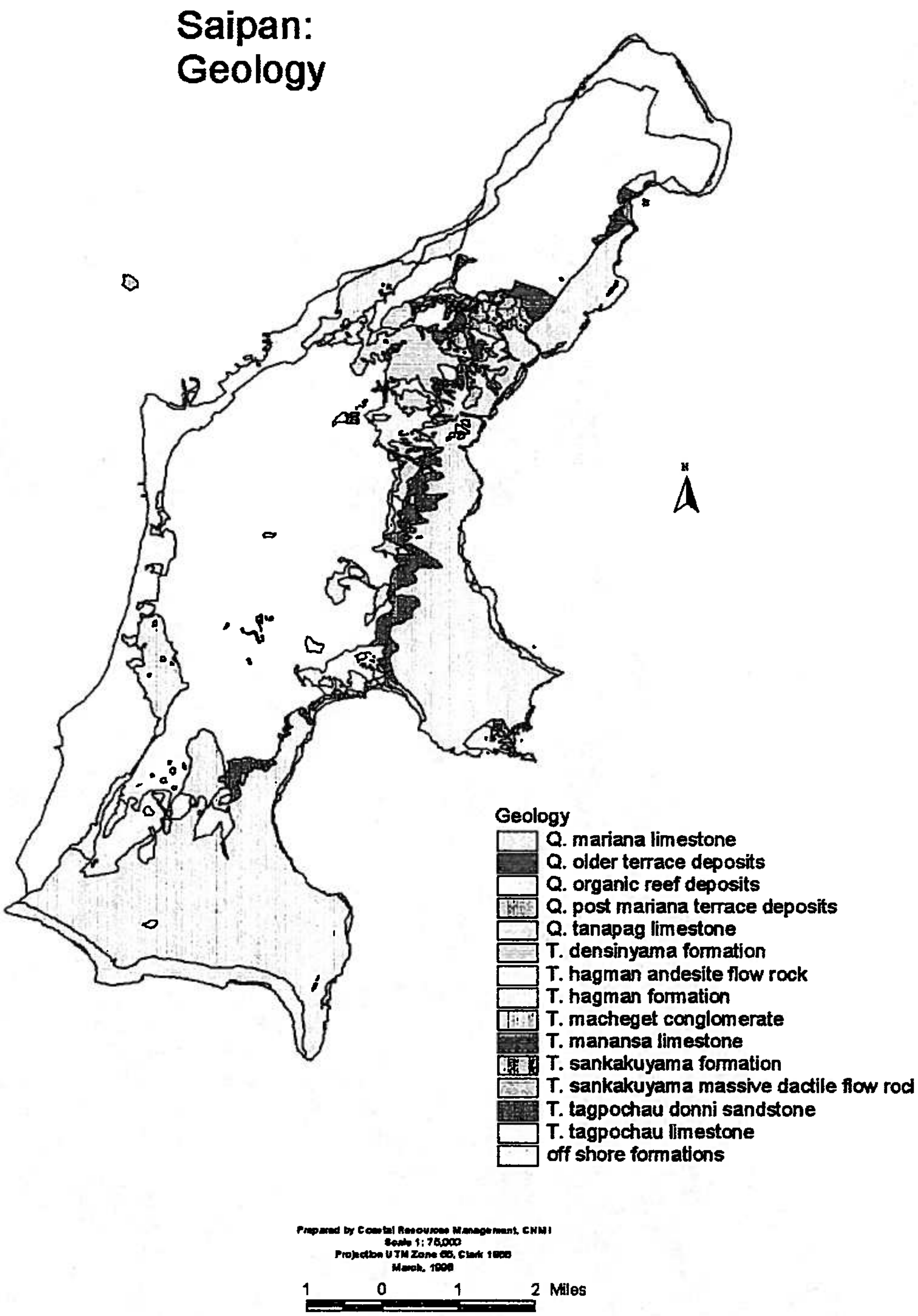
SAIPAN LAGOON AQUATIC ECOSYSTEM RESTORATION

## SOIL TYPES WITHIN WATERSHED

USACE

ENVIRONET

FIGURE 2

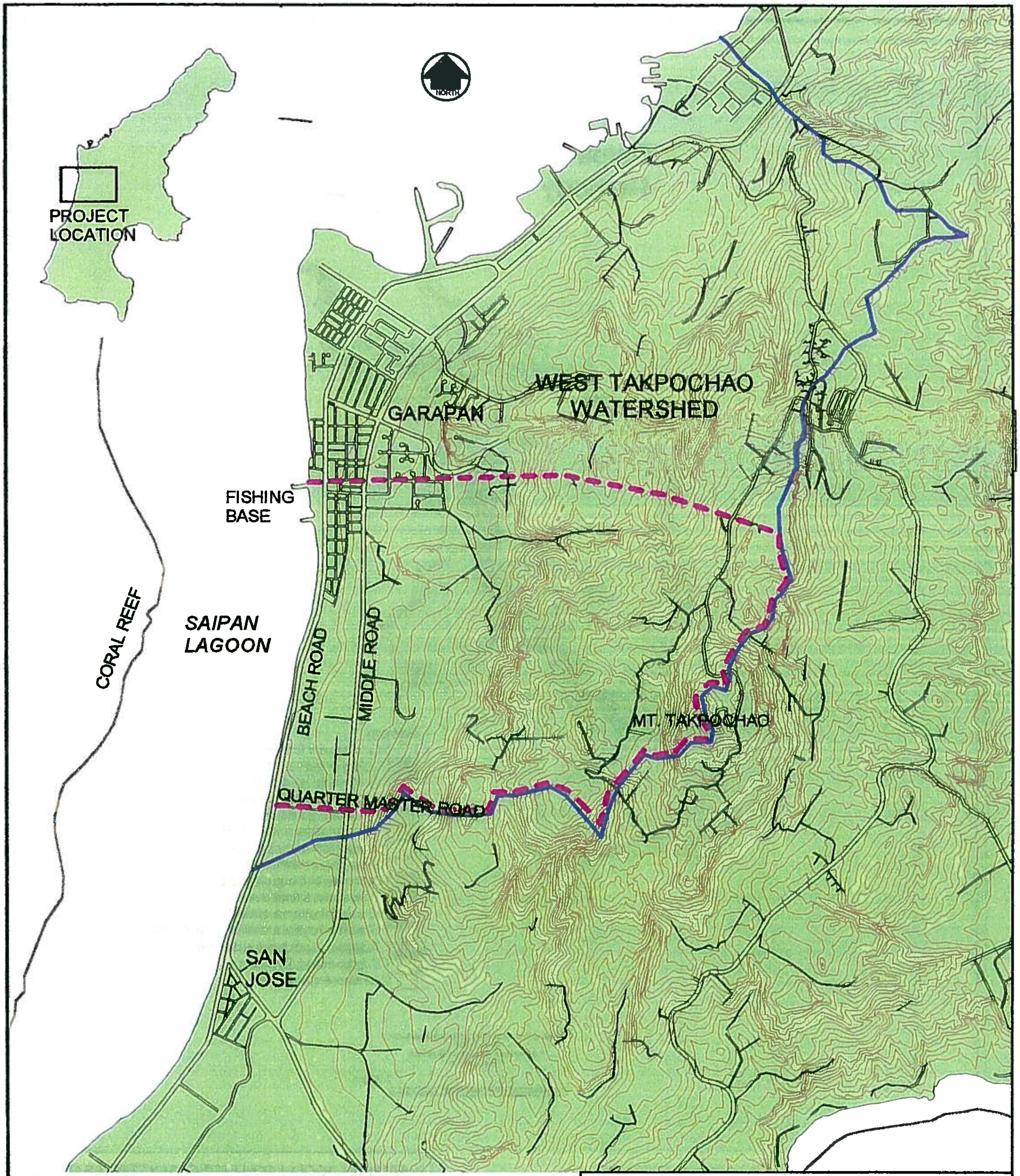


Prepared by Coastal Resources Management, CNMI
Scale 1: 75,000
Projection UTM Zone 55, Clark 1866
March, 1998

SAIPAN LAGOON AQUATIC ECOSYSTEM RESTORATION

GEOLOGIC MAP OF SAIPAN

| USACE | | FIGURE |
|---|---|---|
| ENVIRONET | | 3 |



╍╍ STUDY AREA LIMITS

— WATERSHED BOUNDARY

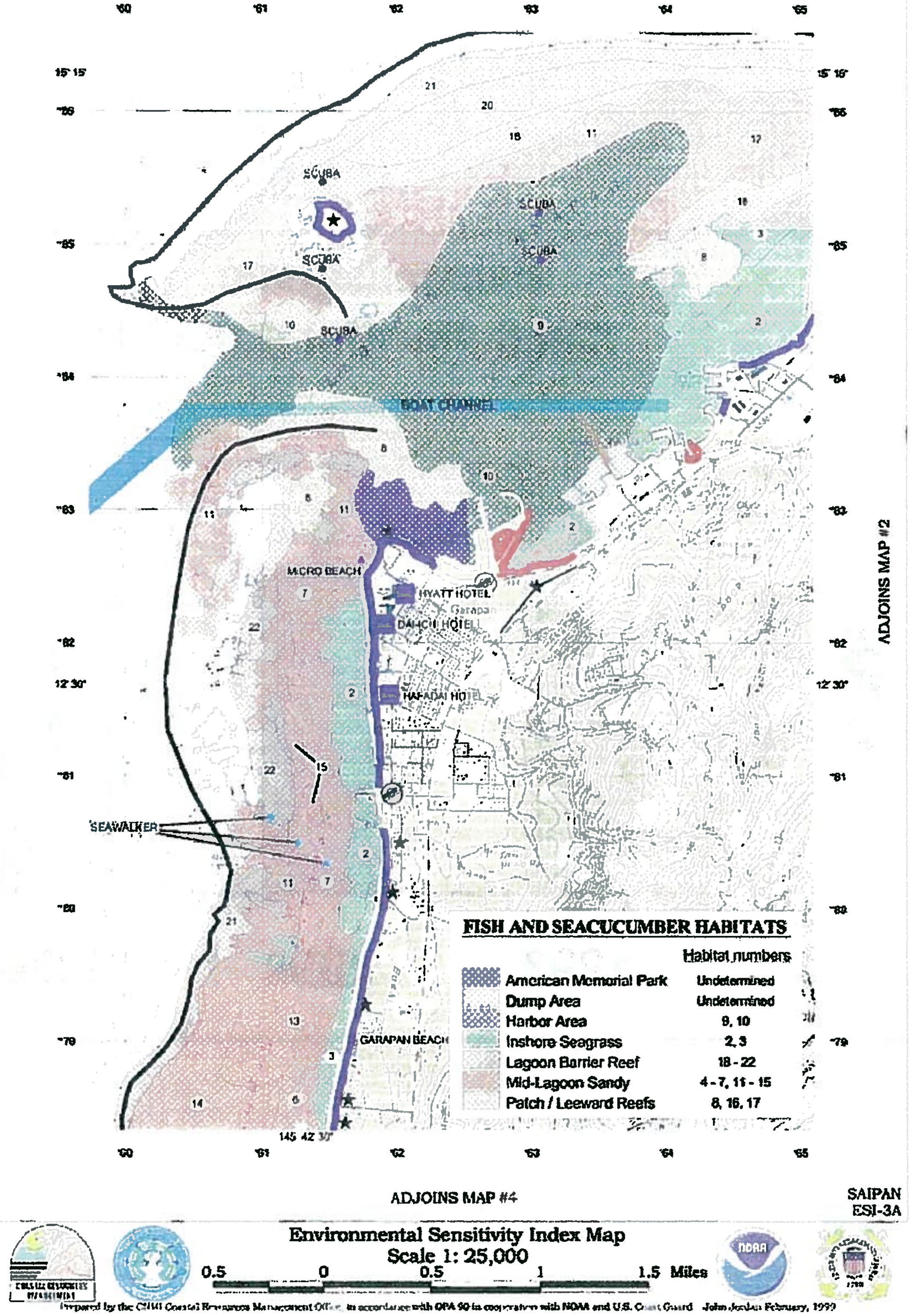
SAIPAN LAGOON AQUATIC ECOSYSTEM RESTORATION

## WATERSHED BOUNDARY MAP

USACE

FIGURE 4

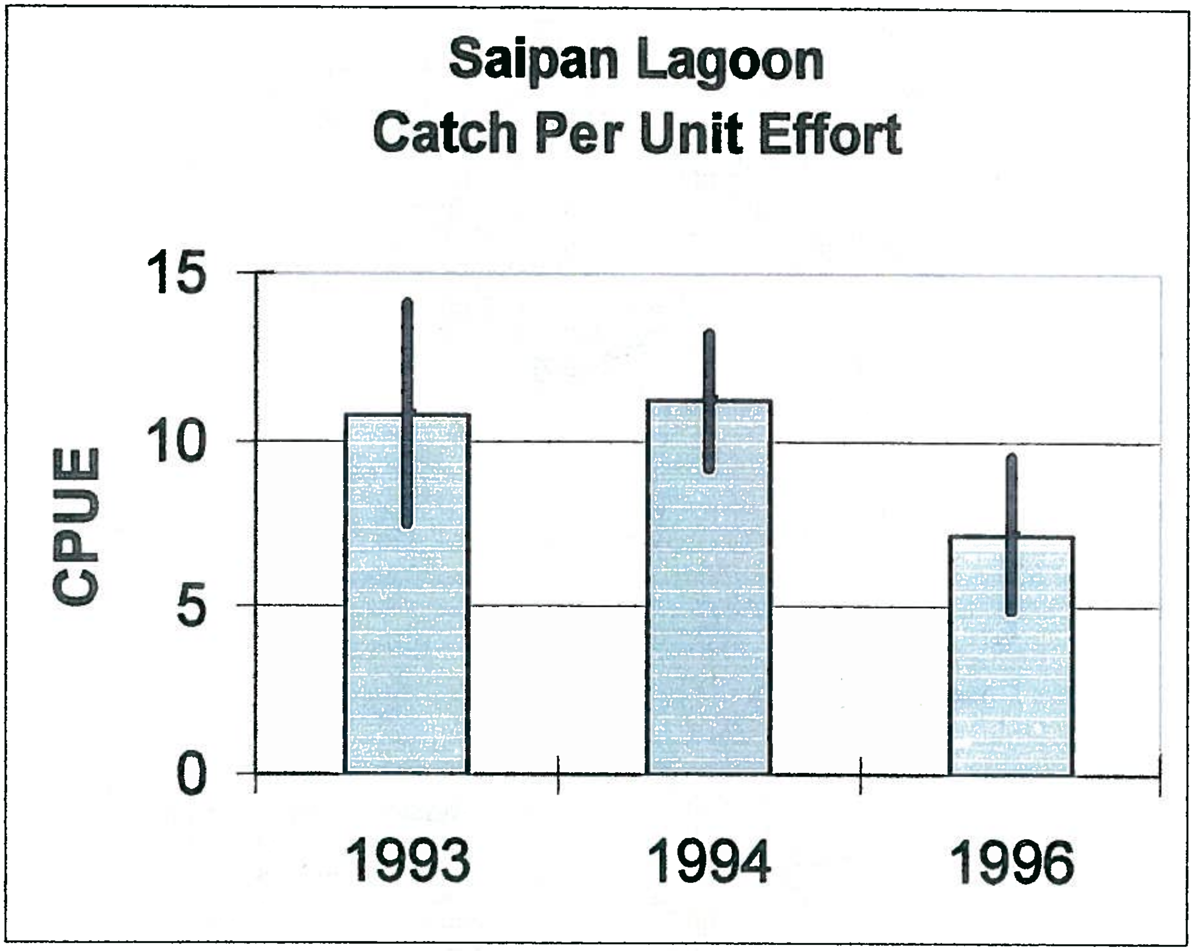
ENVIRONET



SAIPAN LAGOON AQUATIC ECOSYSTEM RESTORATION

# MARINE HABITATS IN LAGOON

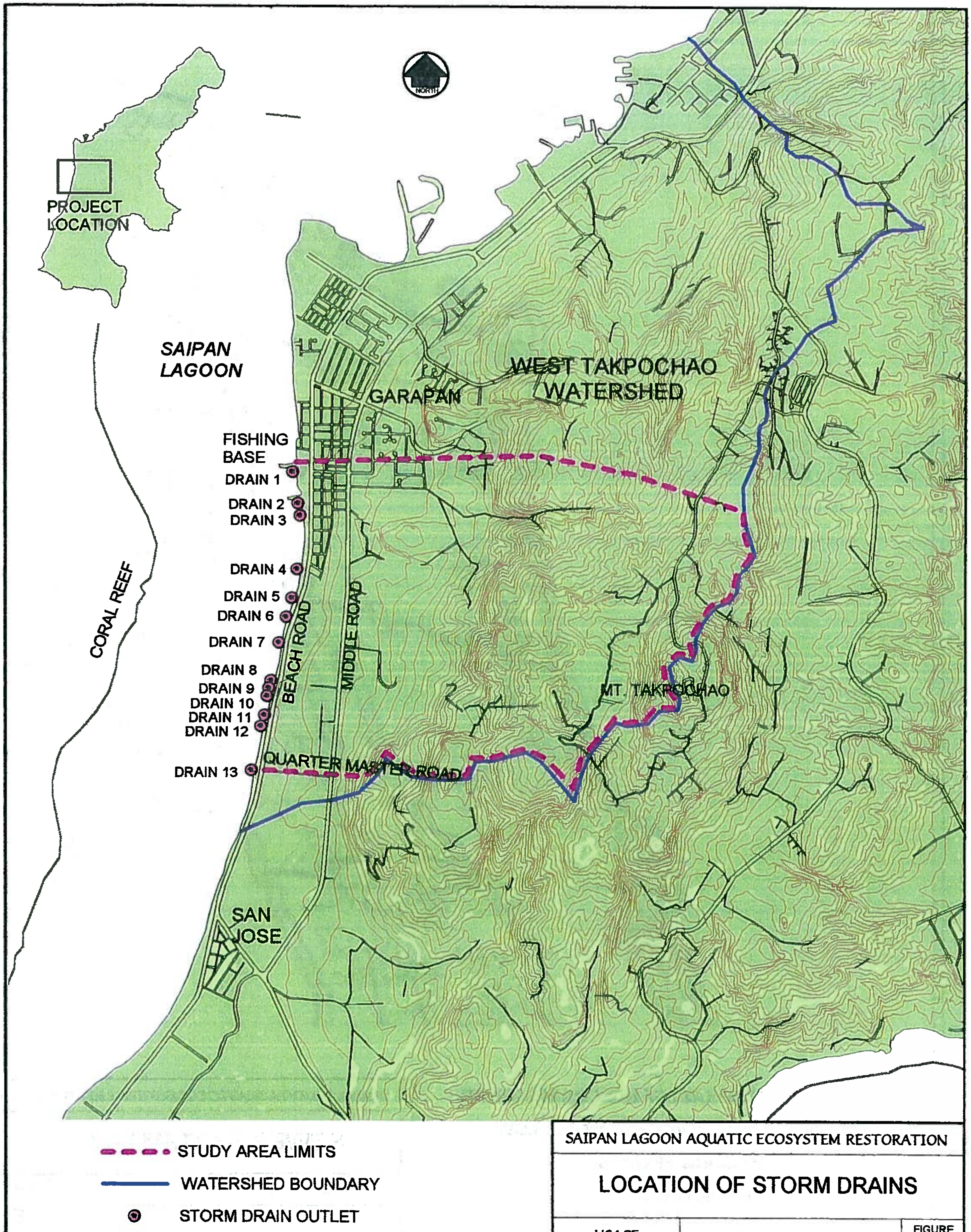
| USACE | | FIGURE |
|---|---|---|
| ENVIRONET | | 5 |



SAIPAN LAGOON AQUATIC ECOSYSTEM RESTORATION

MEASURED DECLINE IN FISH TAKE FROM SAIPAN LAGOON

| USACE | | FIGURE |
|---|---|---|
| ENVIRONET | | 6 |



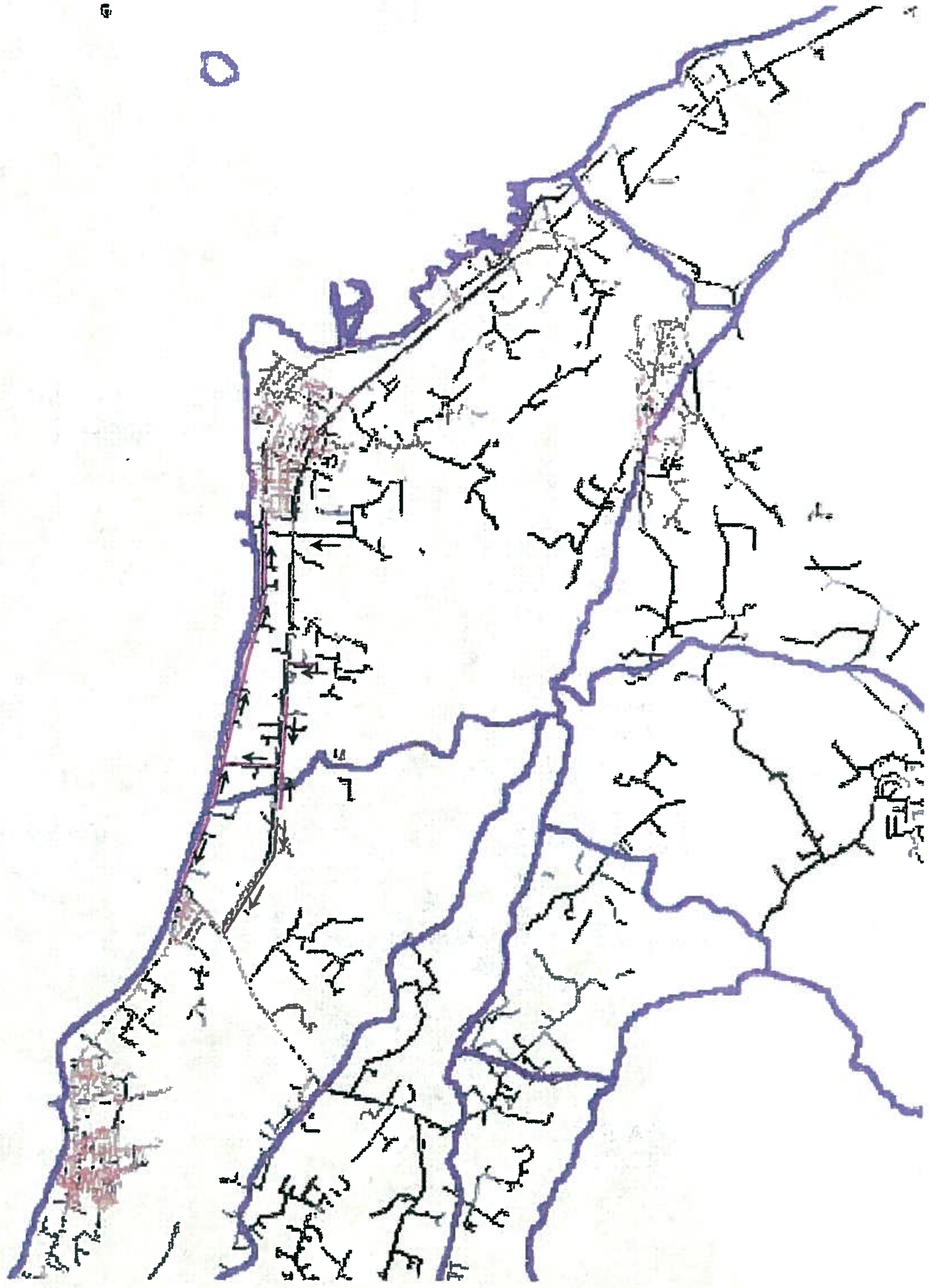
SAIPAN LAGOON AQUATIC ECOSYSTEM RESTORATION

## LOCATION OF STORM DRAINS

USACE

ENVIRONET

FIGURE 7



— LOCATION OF NEW TRUNK SEWERS

→ DIRECTION OF SEWAGE FLOW

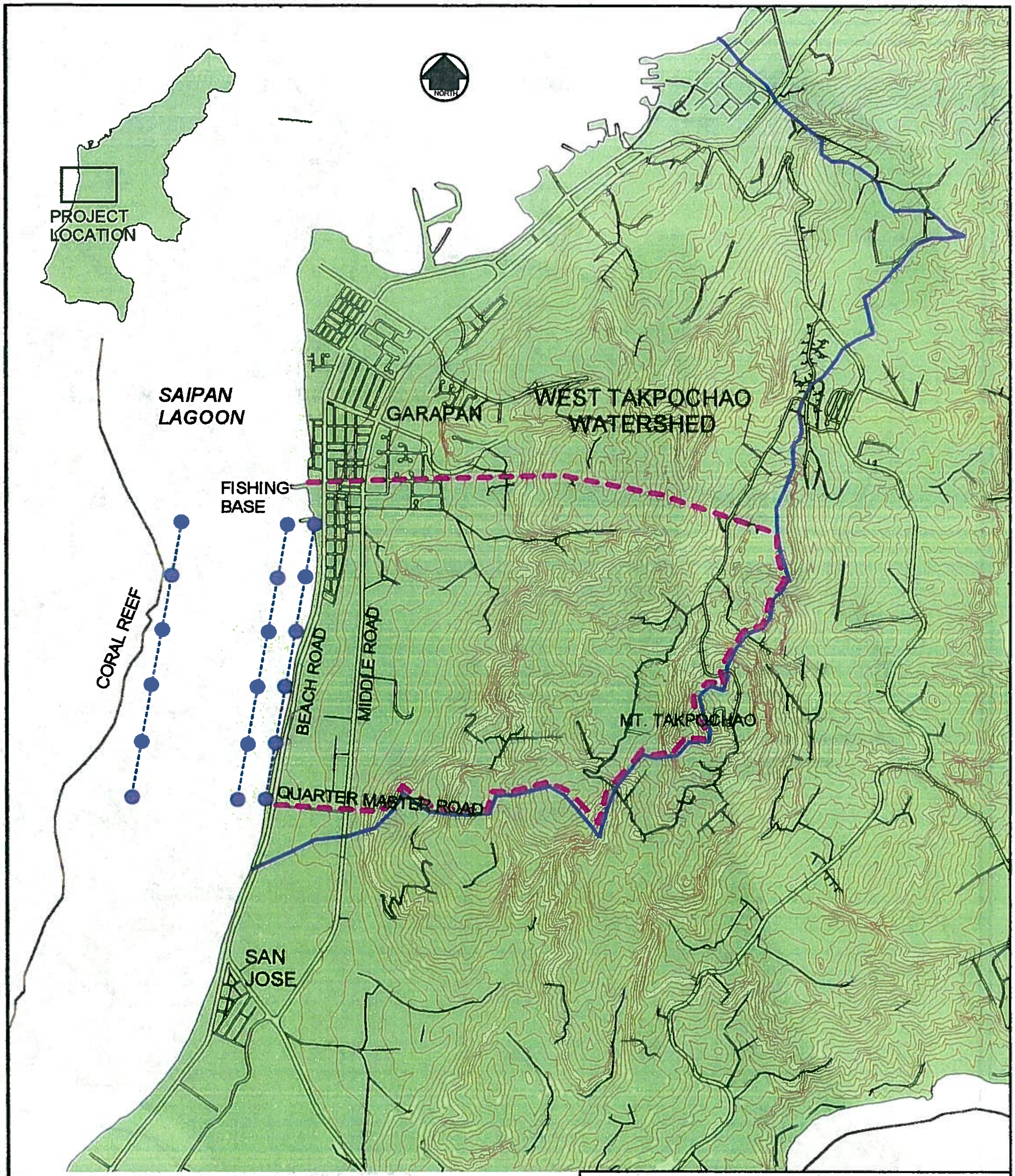
— EXISTING SEWERS

— POWER LINES

SAIPAN LAGOON AQUATIC ECOSYSTEM RESTORATION

## SEWER SYSTEM LAYOUT

| USACE | | FIGURE |
|---|---|---|
| ENVIRONET | | 8 |



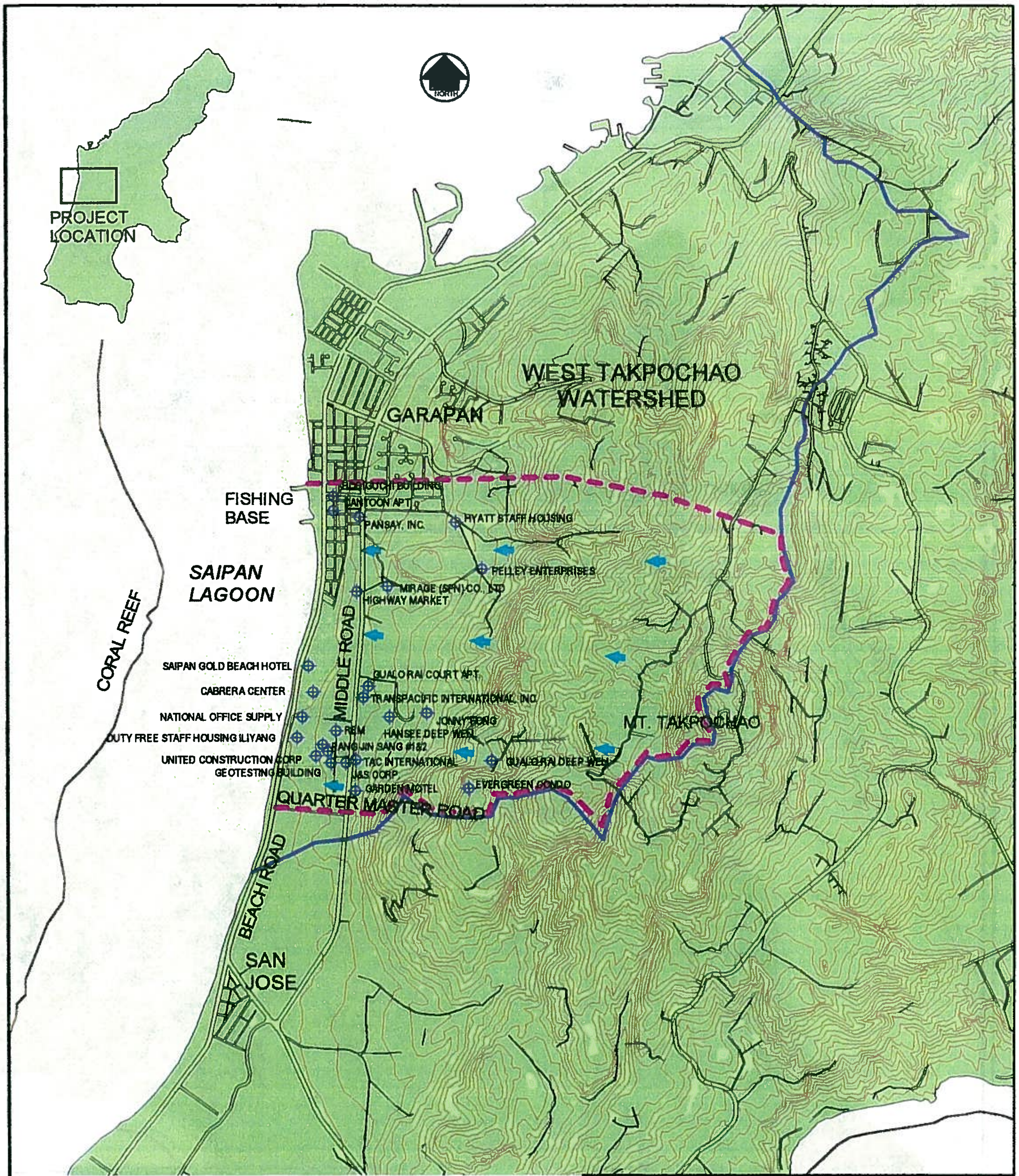
SAIPAN LAGOON AQUATIC ECOSYSTEM RESTORATION

## PROPOSED OFFSHORE SEDIMENT SAMPLING SITES

USACE

ENVIRONET

FIGURE
9



— WATERSHED BOUNDARY

⊕ WELL

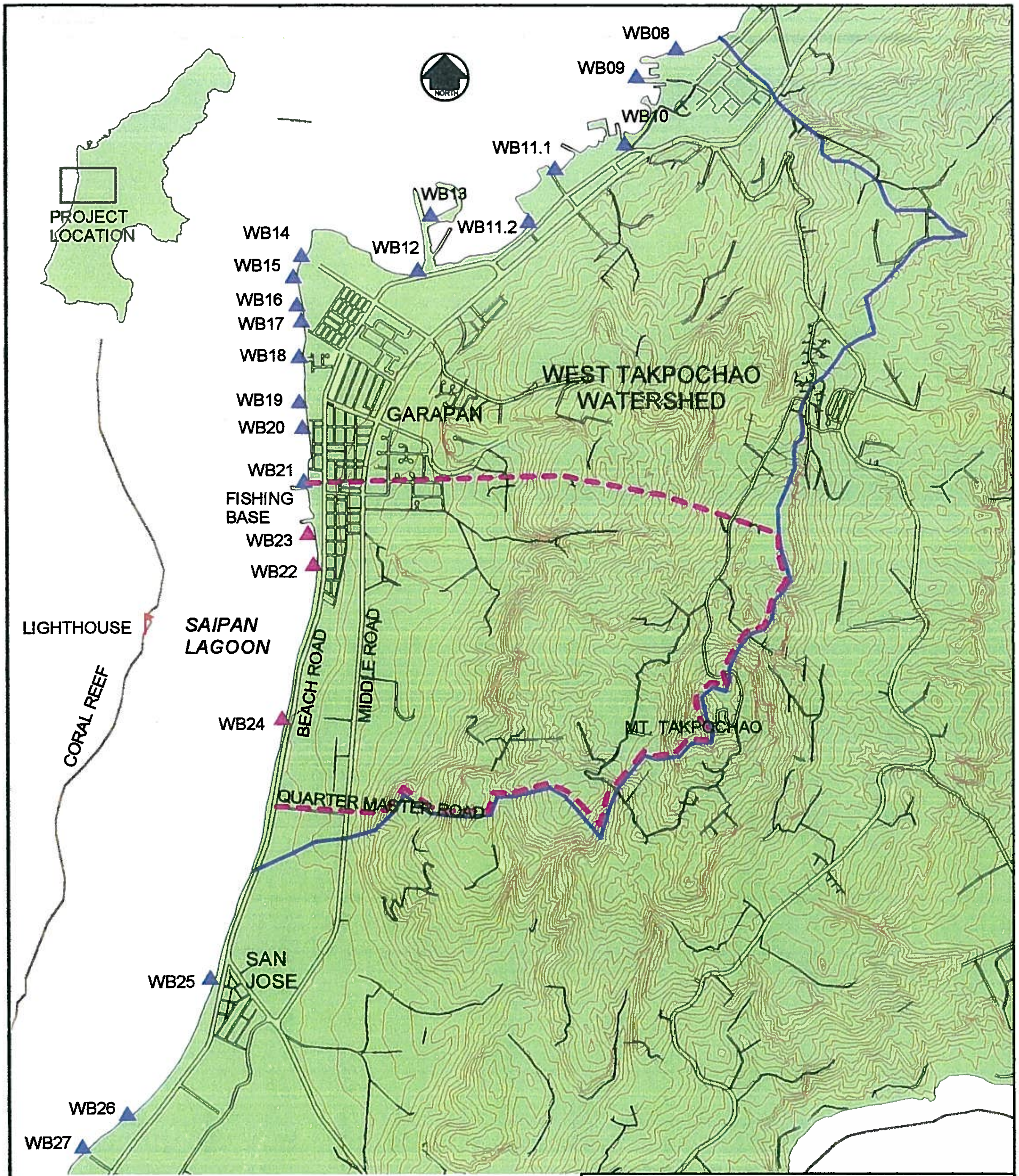
- - - STUDY AREA LIMITS

← GROUNDWATER FLOW DIRECTION

SAIPAN LAGOON AQUATIC ECOSYSTEM RESTORATION

## WELL LOCATIONS

| USACE | | FIGURE<br>10 |
|---|---|---|
| ENVIRONET | | |



— WATERSHED BOUNDARY

▲ WATER QUALITY MONITORING SITE

▲ WATER QUALTIY MONITORING SITE LOCATED WITHIN STUDY AREA

⚑ BIOCRITERIA MONITORING SITE

- - - STUDY AREA LIMITS

SAIPAN LAGOON AQUATIC ECOSYSTEM RESTORATION

## DEQ WATER QUALITY MONITORING LOCATIONS

| | | |
|---|---|---|
| USACE | | FIGURE<br>11 |
| ENVIRONET | | |

# TABLE 1
## LIST OF KNOWLEDGEABLE PEOPLE INTERVIEWED

| NAME | | AGENCY AND TITLE | PHONE | E-MAIL | NOTES | FAX |
|---|---|---|---|---|---|---|
| Dan | Nakamura | USACE, Project Manager | | | | |
| Milton | Yoshimoto | USACE, Civil Works | | | | |
| Lincoln | Gayagas | USACE, Civil Works | 438 8862 | | UASCE on-site mgr | |
| Helen | Stedebean | USACE | | | Aerial Coastal Monitoring | |
| Peter | Barlas | CRM, Acting Director | | | Co-Sponser | |
| Jack | Salas | CRM, Chief Enforcement | 234 6623 | | | |
| Doug | Mauro | CRM | | | GIS / CAD | |
| John | Jordan | CRM | | | | |
| Ed | Babauta | CUC, Wastewater | 235 6933 | | | |
| Lorainne | Babauta | CUC, Wastewater | | | | |
| Andy | Smith, P.E. | DPW, Tech Services Dir | 322 9436 | | Co-Sponser | 322-3547 |
| Brian | Bearden | DEQ | 664 8510 | brian.bearden@saipan.com | | |
| Clarrissa | Tanaka | DEQ, Chemist | 664 8520 | clarissa.tanaka@saipan.com | Water Quality Data | |
| Joe | Kaipat | DEQ | 664 8509 | | Groundwater monitoring | |
| Peter | Houge | DEQ, Marine Fishery | 664 8504 | | | |
| Jeff | Schorr | Dept of the Interior | | | | |
| Richard | Seman | DFW, Director | 664 6000 | | | |
| Kathryn | Miller | DFW, Permitting | 664 8505 | | Resource planner, fisheries | |
| Mike | Trianni | DFW, Fisheries | | mstdfw@itecnmi.com | Sea Cucumbers / survey info | |
| Kate | Moots | DFW, Fisheries officer | | katemoots@Saipan.com | | |
| Floyd | Masga | DFW, Fisheries Statistician | | | | |
| Arnold | Palaciol | DLNR | 322 9830 | | (Palacious) - ex-aquaculture | |
| Kathy | Yuknavage | Health Services, Sanitation Dept. | 664 4877 | kathyy@gtepacifica.net | | |
| John | Tagabuel | Health Services, Sanitation Dept. | | beh2@gtepacifica.net | | |
| Susan | Burr | HI DOH | | | Data shoreline survey? | |
| Ken | Kramer | NRCS | 233 3415 | | | |
| Tim | Brasuell | NRCS | 233-3415 | | | |
| Bill | Moran | NRCS | | | | |
| Vince | Castro | DLNR | 288-3757 / 58 | dpl@gtepacifica.net | GIS Atlas | 288-3755 |
| Robert | Carruth | USGS | 322 2060 | | | |
| Bruce | Hill | USGS | 322 2060 | bahill@saipan.com | | |
| Vicky | Viligomez | | | | Gov's Special Projects Office | |
| Tony | Peligrino | | | | Citizen - Pizza owner / boat operator | |
| Deno | Jones | Congressman | 664 8863 | | | |
| Tom | Pangalenan | Congressman | 664 8888 | | | |
| Hines | Hopschnider | Congressman | 664 6969 | | | |
| Steve | Spengler | Environet | 843 2319 | mspengler@lava.net | | 843-2035 |
| Ryan | Yamauchi | Environet | 843 2319 | ryamauch@lava.net | | 843-2035 |
| Bob | Bourke | Oceanit | 531-3017 | rbourke@oceanit.com | | 531-3177 |

# TABLE 2
# WATER QUALITY MEASURED IN WELLS LOCATED WITHIN PROJECT WATERSHED

| **Well Name** | **Analysis Date** | **Chloride (mg/L)** | **TDS (mg/L)** | **Conductivity (umhos/cm)** | **Hardness** | **pH** | **$NO_3$ (mg/L)** |
|---|---|---|---|---|---|---|---|
| United Construction | Oct-99 | 6498 | 9000 | 15340 | 2480 | 6.7 | 2.7 |
| Garden Motel | Apr-98 | 700 | 2130 | 2950 | 550 | 7.2 | 3.7 |
| Pang Jin Sang Sa | Mar-98 | 1899 | 4929 | 6650 | 1030 | 6.8 | 4.9 |
| T. America | Jul-00 | 2599 | 5200 | 8780 | 1300 | 6.8 | - |
| Geotesting | Aug-98 | 1799 | 5397 | 5770 | 1020 | 7.1 | 11 |
| REM International | Jul-00 | 7998 | 13350 | 2100 | 3200 | 7.1 | - |
| DFS Iliyang | Jul-00 | 8497 | 16350 | 24200 | 3200 | 7 | - |
| Cantoon Apartments | Aug-97 | 4760 | 8980 | 15570 | 2690 | 7 | 4.1 |
| Horiguchi Building | Jul-00 | 6398 | 11950 | 19470 | 2440 | 7.5 | - |

# TABLE 3
# ESTIMATED IMPORTANCE, COST AND DURATION OF RECOMMENDED STUDIES

| RECOMMENEDED STUDY | RELATIVE IMPORTANCE OF STUDY | RELATIVE COST OF STUDY [*1] | ESTIMATED DURATION OF STUDY [*2] |
|---|---|---|---|
| Stormwater Quality Investigation | HIGH | HIGH | LONG |
| Analyze Lagoon Sediments for Physical and Chemical Parameters | HIGH | HIGH | MEDIUM |
| Marine Habitat Mapping from Historical and Current Aerial Photographs | HIGH | LOW | SHORT |
| Inshore Lagoon Area Sea Grass and Associated Fauna Survey | HIGH | HIGH | MEDIUM |
| Inventory of Potentially Contaminating Activities in Watershed | MEDIUM | LOW | SHORT |
| Hydrologic Study of Runoff Processes in Watershed | HIGH | HIGH | LONG |
| Groundwater Level Investigation in Watershed | MEDIUM | MEDIUM | MEDIUM |
| Lagoon Water Quality Investigation | MEDIUM | MEDIUM / HIGH[*3] | LONG |
| Sanitary Sewer Overflow Analysis for Project Area Collection Systems | HIGH | HIGH | LONG |
| Residence Time Study of Lagoon Water | MEDIUM | LOW | SHORT |

[*1] Relative Cost Designations Based on the Following Ranges: Low = <\$20,000, Medium = >\$20,000 and <\$60,000, High = >\$60,000

[*2] Estimated Duration of Study Based on the Following Ranges: Short = < 1 month, Medium = > 1 month and < 4 months, Long > 4 months.

[*3] Cost of Study is Dependent on the Extent to which Personnel from the Department of Envioronmental Quality will be Involved in the Sampling and Analysis

Document: Draft Phase 1, Saipan Lagoon, Aquatic Ecosystem Restoration Project
Reviewer: Mr. Peter J. Barlas
Title: Coastal Resources Management Office
Date: January 19, 2001

| Comment Number | Comment | Response to Comment |
|---|---|---|
| 1 | In general, the report is very well written and accurately describes existing conditions, the regulatory framework, previous environmental investigations, existing baseline data and restoration alternatives. However, I am concerned that several of the studies recommended to determine missing baseline data are highly technical, costly and may not be necessary to effectuate the restoration alternatives. As I agree it would be useful information, we may need to narrow the scope of the baseline data collection to more specific parameters. If we focus too many resources in this area it may bog down the study and effect our ability to move to the restoration phase. | Collection of some baseline data is required to allow the effectiveness of implemented remedial technologies to be evaluated quantitatively.<br>Saipan DEQ personnel have tentatively agreed to assist collecting much of the baseline data required for the Phase 2 study. This will allow a larger percentage of the project budget to be allocated toward the proposed restoration work. |
| 2 | My draft did not included Table 3 and this may address this concern. | Reviewer had a preliminary fax copy of the draft report which did not include all of the tables and figures. |
| 3 | Lastly, I encourage the study to focus on the infrastructure improvements as reliance on stronger regulations and enforcement are less likely to be effective alternatives in the CNMI. | Comment noted. |

Document: Draft Phase 1, Saipan Lagoon, Aquatic Ecosystem Restoration Project
Reviewer: Mr. Antonio I. Deleon Guerrero
Title: Director, Commonwealth of the Northern Mariana Islands, Division of Environmental Quality
Date: March 21, 2001

| Comment Number | Comment | Response to Comment |
|---|---|---|
| 1 | An Executive Summary should be provided at the beginning of this document, no more than 2 pages in length, which briefly states the findings on the suspected causes of lagoon degradation, and the recommendations for regulatory changes, infrastructure improvements, watershed management, and additional studies necessary to refine these recommendations. | We will add an executive summary to the report |
| 2 | Section 1.4 (Page 4, 3rd paragraph) – This paragraph describes the definitions of Class A and AA waters in the CNMI, but there are some inconsistencies with the actual regulations that define these classifications. We suggest the following description for Class A and AA marine waters to be more consistent with the wording in our Water Quality Standards:<br>*The CNMI has designated two classes of marine waters; A and AA. Class AA represents high-quality waters that are considered to be in a "natural" and "pristine" state. The CNMI Water Quality Standards states that "to the extent practicable, the wilderness character of such areas shall be protected", and does not permit any discharge of pollutants in class AA waters. Class A waters have been designated in two parts of Saipan, and generally represent a slightly lower quality of water in which some discharges may be permitted, for example, the two sewage treatment plant outfalls on Saipan. Nevertheless, Class A waters must support recreational use and the propagation of fish, shellfish, and wildlife, and strict water quality standards have been set for the protection of these uses in Class A marine waters Additionally, further protection is afforded through the CNMI Anti-Degradation Policy, which is part of the Water Quality Standards and protects existing uses and water quality in any waters, despite their classification.* | We will replace the paragraph with the exact wording taken out of the Water Quality Standards. |
| 3 | Section 2.2 (Page 5, 3rd para.) Beach Road is a <u>two</u>-lane, undivided highway. | We will revise the text. |
| 4 | Section 2.2.2 (Page 6, 3rd para.) Add the following underlined word: "The site potentially receives runoff and sediments <u>from</u> the entire West Takpochao watershed…" | We will revise the text. |

Document: Draft Phase 1, Saipan Lagoon, Aquatic Ecosystem Restoration Project
Reviewer: Mr. Antonio I. Deleon Guerrero
Title: Director, Commonwealth of the Northern Mariana Islands, Division of Environmental Quality
Date: March 21, 2001

| Comment Number | Comment | Response to Comment |
|---|---|---|
| 5 | Section 2.2.2 (Page 6, 3rd para.) The end of this paragraph states "The Chinen-Urban Land Map unit in the lowlands between Middle Road and the Beach Road likely contributes the majority of sediments to the lagoon environment due to the disturbed nature of this soil unit." DEQ has observed that a large percentage of the sedimentation along the beach road drainages appears to come from quarried limestone backfill used for road and lot surfacing, and not so much from the underlying soils. | Agree. We will revise the text to state that the Chinen-Urban Land Map unit contributes the majority of the sediment originating from erosion of the surface soils present in the area during heavy rainfall events. We will also add the observation about stockpiled backfill material providing a lot of the transported sediment. |
| 6 | Section 2.2.3 (Page 7, 1st para.) "Damage to coral reef ecosystems can…" Consider adding that toxic pollutants adsorbed to soil particles can also contribute to damage from sedimentation. | Agreed. |
|  | "A shift in reef species toward more nutrient tolerant and less diverse communities…" Consider adding that coral reefs with less diverse communities are also more susceptible to damage from natural disasters. | Agreed. |
|  | "the apparent lack of adherence to Best Management Practices (BMPs) regulations at construction sites…" DEQ administers the CNMI's Earthmoving and Erosion Control Permit program, which requires that all new construction have an erosion control plan based on BMPs. While there may be occasional problems with implementation and inspection, and we do not question that the Corps' consultants may have observed this, we respectfully request that this sentence be re-worded to reflect that there are procedures and requirements in place, that DEQ performs occasional site inspections for compliance, and therefore not a total "lack of adherence…" | We will revise the text to reflect the ongoing efforts of DEQ to mitigate erosion problems associated with construction on the island. |
| 7 | Section 2.2.6 (page 9, 2nd para.) "algae species are abundant (more so nearshore) including…" Add the following common algae species : "Calurpa spp., Laurencia spp., and Acanthophora." | Agreed. |

Document: Draft Phase 1, Saipan Lagoon, Aquatic Ecosystem Restoration Project
Reviewer: Mr. Antonio I. Deleon Guerrero
Title: Director, Commonwealth of the Northern Mariana Islands, Division of Environmental Quality
Date: March 21, 2001

| Comment Number | Comment | Response to Comment |
|---|---|---|
| 8 | Section 2.5 (Page 11, 3rd para.) Another potentially contaminating activity we suggest adding is sanitary sewer overflows, perhaps by adding the following sentence: "Additionally, the sewer collection system within the project area along Middle Road is known to overflow, and a major new collection system nearing completion along Beach Road will raise the potential for lagoon contamination from sanitary sewer overflows (SSOs)." | We agree. The text will be revised accordingly. |
| 9 | Section 2.6 (Page 12, 5th para.) "According to local personnel familiar with the system, the two main causes for SSOs…" More than two points are listed below this sentence. | We will revise the text. |
| 10 | Section 2.7 (Page 13, last para.) "Land ownership in Saipan is limited to citizens…" Land ownership in the CNMI is limited to persons of indigenous origin only, not all U.S. citizens. | Agreed. We will revise the text. |
| 11 | Section 3.4 (Page 17) – Also might want to clarify that the previous Garapan Flood Control Project did not include the project area, and probably could not based on topography. | Agreed. We will add this to the text. |
| 12 | Section 3.5 (page 18, 2nd para.) "it is fortunate that the Government of Saipan…" this sentence should be changed to read as follows: "It is fortunate that the CNMI Government and Division of Environmental Quality (DEQ) has established through the CNMI Marine Monitoring Team a program of regular reef monitoring surveys."<br>(3rd para.) "An important biological indicator that is currently not monitored by DEQ…." Actually, DEQ has begun a nearshore monitoring program, but this was not started until late 2000. | Agreed.<br>We will revise the text. |
| 13 | Section 4.3 (Page 21, 2nd para.) Delete "with" in first sentence: "…they naturally change ~~with~~ over time…" | Agreed. |
| 14 | Section 4.4 (Page 21, last para.) Change reference to "Division of Aquatic Resources Marine Monitoring Team" to "CNMI Marine Monitoring Team". | Agreed. We will revise the text. |
| 15 | Section 4.5 (Page 22, 2nd para.) Should sanitary sewer overflow points (lowest manholes, pump stations) also be listed in the PCA inventory? | Yes. We will add this to the PCA inventory list. |

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| Comment Number | Comment | Response to Comment |
|---|---|---|
| 16 | Section 4.7 (Page 23) We recommend using the Fishing Base Pier as the lagoon water level monitoring site since it is within the study area, rather than the Sugar Dock Pier, which is several miles south of the project area, and in a different lagoon environment, and may give different water levels. | The reason we suggested using Sugar Dock Pier was because a surveyed monitoring point already existed at this location.<br>We will change the proposed monitoring location to the Fishing Base Pier in the revised text. |
| 17 | Section 5.1 (Page 27, 2nd para.) Is the information regarding Phase II NPDES permitting correct? DEQ is under the impression that MS4s for municipalities with populations greater than 10,000 are now regulated, which would probably include Saipan. This should be verified. | ????? |
| 18 | Section 5.1 (Page 27, last para.) "Specific Regulatory measures…" Existing construction permit requirements do include stormwater retention capacity – but this could probably be revised to be more current and appropriate for Saipan. The DEQ Earthmoving and Erosion Control Permits require "24 hour storage of 25-year, 24-hour storm; or 75% sediment removal rate" for both during-construction erosion control BMPs, and post-construction stormwater systems. DEQ agrees fully with the recommendations listed here, however we want this document to make it clear that there is already a program in place that requires these things for all new development, but may be in need of revision. These recommendations should be slightly revised to reflect this, and to make sure some credit is given to DEQ for attempting implementation. | We will revise the text to include a discussion of the regulatory programs already in place on Saipan. We will refine our draft recommendations in light of these existing programs. |
| 19 | Section 5.2 (Page 28) DEQ would like to see listed a recommendation for a BMP type that can be installed within the existing Beach Road easement, like Guam's San Vitores Road project, which placed a large underground infiltration gallery beneath a significant length of the road in this heavily developed coastal strip. | Agreed. |
| 20 | Section 5.2 (Page 29, 2nd para.) CUC has already added level sensors and bar screens at all lift stations, but maintenance (cleaning) of the bar screens is sometimes a problem. Consider also recommending improving maintenance of lift stations. | Agreed. |

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| Comment Number | Comment | Response to Comment |
|---|---|---|
| 21 | Section 5.2 (Page 29, 4th para.) Infrastructure projects may require a Section 401 WQC, but not necessarily. A WQC is only issued when there is a corresponding federal permit for an activity that may result in water quality degradation. All construction projects, however, will require a DEQ Earthmoving and Erosion Control Permit, which contains the stormwater quality requirements mentioned above. | We will revise the text to reflect the reviewers comments. |
| 22 | Finally, based on our discussions with your office, the Corps, and their contractor, the following additional studies are recommended as the minimum required to complete Phase II of this study:<br>1. **Stormwater Quality Investigation**<br>primary responsibility: Corps<br>assistance: DEQ may assist with some sample taking<br>2. **Analyze Lagoon Sediments for Physical and Chemical Parameters**<br>primary responsibility: Corps<br>assistance: DEQ will perform sample taking<br>3. **Marine Habitat Mapping from Historical and Current Aerial Photographs**<br>primary responsibility: Corps<br>4. **Inshore Lagoon Area Sea Grass and Associated Fauna Survey**<br>primary responsibility: DEQ<br>5. **Inventory of Potentially Contaminating Activities in Watershed**<br>primary responsibility: Corps<br>6. **Hydrologic Study of Runoff Processes in Watershed**<br>primary responsibility: Corps<br>assistance: DEQ will provide field runoff observations | Agreed. We will revise the text to reflect these arrangements that were negotiated after submittal of the draft report. |

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Reviewer: Mr. Antonio I. Deleon Guerrero
Title: Director, Commonwealth of the Northern Mariana Islands, Division of Environmental Quality
Date: March 21, 2001

| Comment Number | Comment | Response to Comment |
|---|---|---|
| 23 | The remaining studies, while important, are not critical (in DEQ's opinion) to completing Phase II:<br>1. Sanitary Sewer Overflow Analysis for Project Area Collection Systems<br>2. Groundwater Level Investigation in Watershed<br>3. Lagoon Water Quality Investigation<br>4. Residence Time Study of Lagoon Water | Agreed. We will revise the text to reflect the decisions that arose out of Saipan officials review of the draft document. |

Document: Draft Phase 1, Saipan Lagoon, Aquatic Ecosystem Restoration Project
Reviewer: Stan Good
Title: Department of Public Works
Date: March 20, 2001

| Comment Number | Comment | Response to Comment |
|---|---|---|
| 1 | Section 2, Part 2.2.2: The study area is the western coastal area of Saipan from Garapan to roughly Chalan Kanoa. The report states the project area receives runoff from the entire west Takpochao watershed which extends roughly 3.5 miles inland. This is a gross overstatement. Mt. Takpochao is only about 2 miles inland from the western coast and the island is barely 3.5 miles wide in this location. There are certainly localized drainage channels which find their way to the sea, but their run in not over a mile. Also, in this same section it is mentioned the soils are uniformly varying from the coast to the uplands. From our experience there are pockets of eroded sediments, clayey areas and karst throughout the area from the coastal area to the uplands. While general soil profiles can describe an area, within the area the soils can vary widely. | We will revise the text to specifically talk about the watershed area that contributes runoff to only the project area, which extends from Quartermaster Road to the Fishing Base. We will also add a comment about the small scale heterogeneity in soil types present throughout the watershed. |
| 2 | 2.2.3: Soil Erosion: In my opinion significant soil erosion is from unpaved secondary road, unprotected building sites, and recently cleared or burned areas. | Agreed. |
| 3 | 2.4: In contrast to their statement I would consider the eastern side of Beach Road to be densely developed, not characterized by "a few houses present along the few dirt and paved roads that cross between the two main roads" referring to the area between Beach Road and Middle Road. | The comment in the text was meant to refer to the overall area located between Beach and Middle road which is one of the less developed areas along the western coastal plain of Saipan. |
| 4 | 2.5: This section states the variety of development in the area and contradicts the area previously mentioned as sparsely developed. | We will make the text consistent regarding the density of development in the area. |
| 5 | 2.6: This section is in contrast to Section 2.2.2 and states that the tributaries for the storm drains "were not delineated during the site visit". Why not, it is not so hard to walk up a drainage channel? The section also states that drainage from "upland areas of Middle Road were not delineated or quantitated during the site visit". And in addition, "there seems to be no connection between storm drains on the upper road and those on the lower road". This is simply not true. The report says ponding prevails after a heavy rainfall and only a small fraction of the Middle Road runoff reaches Beach Road. Obviously, they have never experienced a heavy rainfall and seen the raging rivers crossing Middle Road on their way to the beach areas. | The purpose of the reconnaissance field visit was to simply identify the relevant issues that require additional study.<br>Based on our limited observation of runoff after heavy rainfall within the project area, significant amounts of runoff are generated in the vicinity of Middle road, which ultimately flows towards the downhill, ocean side of the road. However, much of this runoff appears to infiltrate within the developed and undeveloped land areas located between Middle road and Beach road prior to reaching the lagoon. |

Document: Draft Phase 1, Saipan Lagoon, Aquatic Ecosystem Restoration Project
Reviewer: Stan Good
Title: Department of Public Works
Date: March 20, 2001

| Comment Number | Comment | Response to Comment |
|---|---|---|
| 14 | 5.2: Good ideas! But where is the septic system mitigation? | Will add a discussion of septic system mitigation to the text. |
| 15 | In the table of important and knowledgeable people contacted John Gourley was not mentioned. They shows photos from his work on the cover of their report and did not refer to him at all. | We did not meet Mr. Gourley during our reconnaissance visit to the island. We will make a point of talking with him during the Phase 2 portion of the project. |

Document: Draft Phase 1, Saipan Lagoon, Aquatic Ecosystem Restoration Project
Reviewer: Miscellaneous
Date: January 2001

| Comment Number | Comment | Response to Comment |
|---|---|---|
| 1 | Some discussion or depiction of overall study schedule, construction schedule, or management implementation timelines is appropriate. | The details of the future project schedule are outside the control of the contractor. We will include a the projected end date for the project in the report. |
| 2 | Maps with the project area delineated would focus attention on the impacted areas (i.e. soils, land use, etc). May be difficult with the scale of the figures provided. | We will revise Figure 1 in the draft report to include an outline of the project area. |
| 3 | Photos (where available) would give the reader better understanding of the written descriptions. | We will include some photos of the project area in the appendix of the final report. |
| 4 | For the preliminary alternatives-provide priority for implementation, a rough order of magnitude estimate, and an example sketch, photo or figure where appropriate. | Estimated cost information for the preliminary alternatives is provided in Table 3 of the draft report. |
| 5 | The new sewer along Beach Road may be a force main rather than gravity line as described in the report. | We will revise the text. |
| 6 | Is there any multispectral imagery available? | We have been unable to locate any. |
| 7 | The population estimate for the year 2000 does not look correct. | We will check the value listed in the draft report. |
| 8 | It is a bit difficult for me to believe that U.S. Government Aide is related to the increase of island population during the 1980's….Is there a citation you can use? | We will remove this statement in the final report. |
| 9 | I don't understand the relevance of discussing all the toxicity data from the Puerto Rico dump. The contaminants of the 50-year open dump is not at all related to the storm water drains of south Garapan. | The sediment data collected from offshore the Puerto Rico dump will be compared with levels detected in sediments collected from within the project area lagoon. |
| 10 | Word of caution: The 60% loss of wetlands quoted by the DEQ is an unsubstantiated statement which was also included in the previous years (1998) 305(b) report. I have no idea where they obtained the estimate…. | We will add the 1998 reference to the text in addition to the DEQ, 1999 reference cited. |
| 11 | You may wish to discuss the distribution of flood plains as described by FEMA in their FIRM maps (Community Panel #750001 0011B) which were published in 1991. | We will attempt to find copies of these maps for the project area and describe the portions of the project area that are prone to flooding. |
| 12 | I believe the stormwater drainage system presently under discussion is covered somehow by a USEPA 402 general permit. I know the DEQ issued a Section 401 WQC for the stormwater drains in 1997(?). I used to have a copy of the DEQ Section 401 WQC but was not able to find it to FAX to you. I believe Mike Lee or Pat Young (USEPA) may be able to obtain a copy for you. | I will e-mail Pat Young to see if she has a copy of this document. |

# *Appendix C*
# *Baseline Monitoring Studies*

## *C.1*
# *Stormwater Quality Investigation*

# APPENDIX C.1

# STORMWATER QUALITY INVESTIGATION

Stormwater runoff samples were collected from storm drains 4, 6, 11, and 13 located along the shoreline within the study area, Drain 14 located south of the study area, and the Dai Ichi Hotel and Hafa Adai Hotel located north of the study area (Figure C.1). These particular storm drains or drainage areas were chosen for several reasons:

- Drains 4, 6, and 11 typically have a high volume of runoff during rain events, and even flow during small rain events, providing consistent sediment transport to the lagoon. They are also spatially located to provide comprehensive coverage of the study area.
- Drain 13 was chosen because it is located at the intersection of Quartermaster Road and Beach Road. This location provides lateral coverage of the study area and allows for runoff variance between Middle and Quartermaster Roads. This location was only sampled once.
- Drain 14 is located south of the study area in the vicinity of Lake Susupe and its associated wetlands. This location was sampled twice in an effort to determine if the presence of a natural wetland (Lake Susupe) would reduce the sediment/nutrient load transported by stormwater discharge.
- The Dai Ichi Hotel and the Hafa Adai Hotel are located north of the study area. These two locations were each sampled twice to establish potential sediment/nutrient load adjacent to the study area.

Table C.1 provides stormwater discharge volume measurements collected in 2002 from the selected drain locations.

**Table C.1: Discrete Stormwater Discharge Volumes**

| Date | Drain 4 (gpm) | Drain 6 (gpm) | Drain 11 (gpm) | Drain 13 (gpm) | Drain 14 (gpm) |
|---|---|---|---|---|---|
| 2/13/02 | NS | 3 | 30 | NS | 30 |
| 5/9/02 | NS | 1200-1500 | 200 | 10 | NS |
| 7/1/02 | 106 | 40 | 15 | NS | NS |
| 7/29/02 | 5 | 20 | 20 | NS | NS |
| 8/12/02 | 428 | 1000 | 150 | 12 | NS |
| 9/20/02 | 60 | 1200 | NS | 600 | NS |

NS = not sampled
gpm = gallons per minute

Flow volumes at each drain vary greatly due to several factors. During small rain events, the amount of rainfall within the watershed determines how much rain affects each drain. For example, it may have rained harder at the northern end of the study area than at the southern end, resulting in more flow at northern drains. Also, the topography of the contributory areas for each drain differs, affecting both the time of concentration and the volume of flow to each drain.

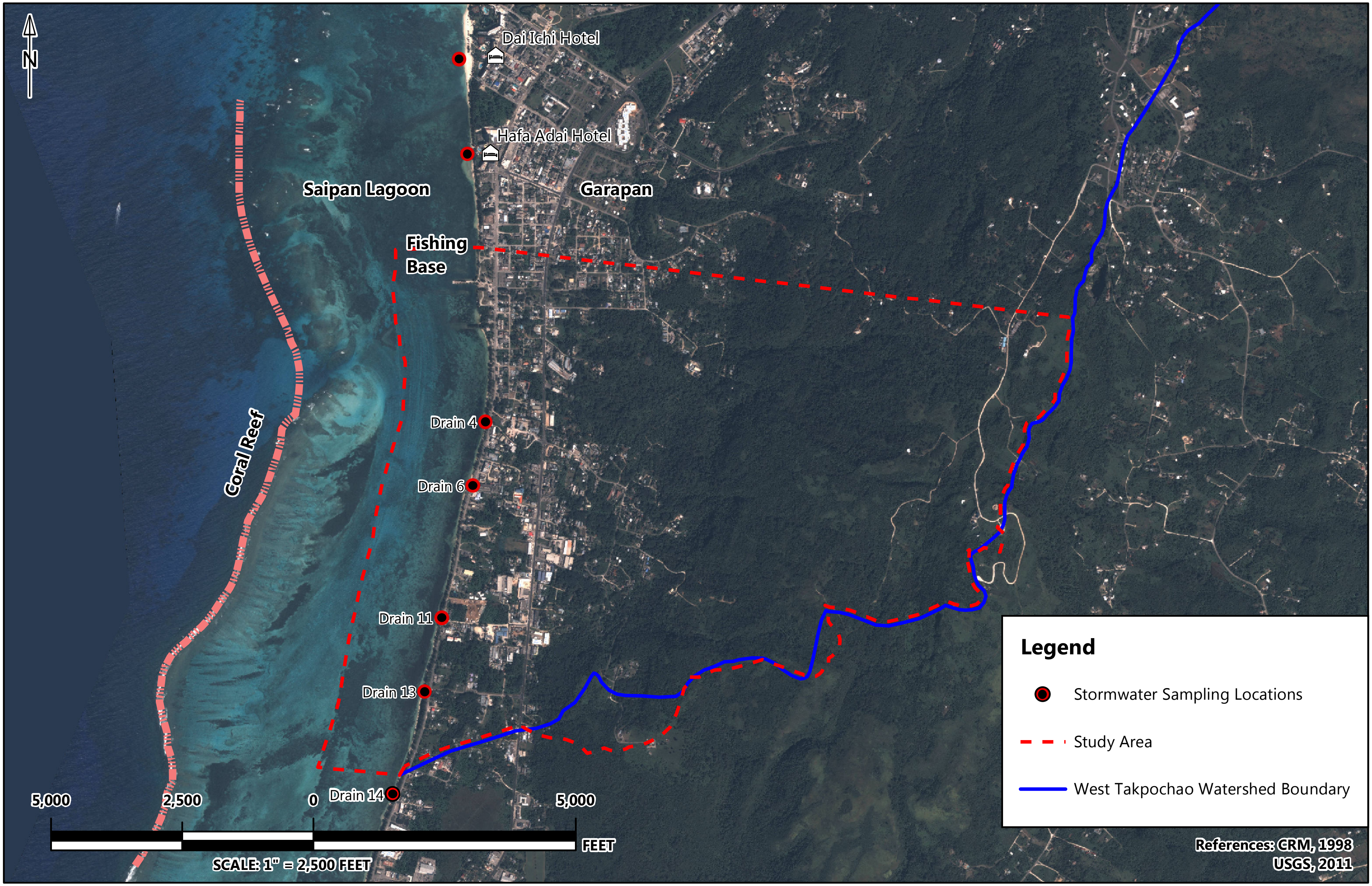
Typically, the initial surface runoff water is the most heavily contaminated during a rain event simply because it transports contaminants that may be present on the ground surface down-slope. An effort was made to collect the runoff samples during the initial flush of the rain events listed above in order to try to capture the most contaminant–laden runoff water. The runoff samples were shipped to Sequoia Analytical Laboratories in Petaluma, California to be analyzed for priority pollutant metals. The complete laboratory analytical reports from these analyses are included at the end of this report. Results are presented in Table C.2.

The runoff sample results were compared against the United States Environmental Protection Agency (EPA) national recommended water quality standards for priority pollutants (EPA, 2009), both chronic and acute toxicity values for the freshwater aquatic life criteria:

- Runoff samples from Drain 4 consistently exceeded the standards for cadmium, copper, lead, and zinc. Selenium was detected at a concentration exceeding the chronic toxicity standard in one of the four samples collected from Drain 4.
- Runoff samples from Drain 6 consistently exceeded the standards for copper. In addition, cadmium and lead were detected at concentrations exceeding the standards in five of seven samples collected from Drain 6. Zinc was detected once at a concentration exceeding the acute toxicity criteria at Drain 6.
- Runoff samples from Drain 11 consistently exceeded the standards for copper. In addition, cadmium and lead were detected at concentrations exceeding the standards in five of six samples collected from Drain 11. Zinc was detected three times at a concentration exceeding the acute toxicity criteria at Drain 11. Nickel was detected once at a concentration exceeding the chronic toxicity criteria at Drain 11.

None of the metals were detected at concentrations exceeding the standards in the single sample collected at Drain 13.

- Zinc was detected at a concentration exceeding the acute toxicity criteria in both samples collected at Drain 14. Copper was detected once at a concentration exceeding the acute toxicity criteria at Drain 14. Cadmium was detected once at a concentration exceeding the chronic toxicity criteria at Drain 14.
- Cadmium and selenium were detected at concentrations exceeding the chronic toxicity criteria in both of the samples collected at the Dai Ichi Hotel. Copper and zinc were detected at concentrations exceeding the acute toxicity criteria in one of the two samples collected at the Dai Ichi Hotel.
- Cadmium and copper were detected at concentrations exceeding the standards in both of the samples collected at the Hafa Adai Hotel. Lead was detected once at a concentration exceeding the chronic toxicity standard at the Hafa Adai Hotel.



| Environet, Inc. | PROJECT NO.: 1057<br>DATE: SEPTEMBER 20, 2012<br>DRAWN BY: CB<br>REVIEWED BY: MA | ECOSYSTEM RESTORATION REPORT<br>SAIPAN LAGOON AQUATIC ECOSYSTEM RESTORATION STUDY<br>STORMWATER SAMPLING LOCATIONS<br>SAIPAN, CNMI | FIGURE<br>C.1 |
|---|---|---|---|

**Table C.2: Stormwater Runoff Metals Analytical Summary, 2002**

| Sample Location | Date Collected | Units | Antimony | Arsenic | Barium | Beryllium | Cadmium | Chromium | Copper | Lead | Mercury | Nickel | Selenium | Silver | Thallium | Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **EPA National Recommended Water Quality Criteria[1]** | **Acute Toxicity** | µg/L | NL | 340 | NL | NL | 2 | 570 | $13^{2}$ | 65 | 1.4 | 470 | NL | 3.2 | NL | 120 |
|  | **Chronic Toxicity** | µg/L | NL | 150 | NL | NL | 0.25 | 74 | $9^{2}$ | 2.5 | 0.77 | 52 | 5 | NL | NL | 120 |
| Drain 4 | 7/29/2002 | µg/L | 3.3J | 9.6 | 34 | 4U | 2.5 | 44 | 43 | 18 | 0.062J | 29 | 2.6J | 0.21J | 2U | 230 |
|  | 8/12/2002 | µg/L | 2.3J | 12 | 60 | 4U | 1.1 | 41 | 49 | 9.3 | 0.017J | 40 | 4.3J | 1U | 2U | 160 |
|  | 10/7/2002 | µg/L | 2.2J | 5U | 27 | 4U | 2.1 | 17 | 33 | 15 | 0.048 | 15 | 2.4J | 1U | 2U | 170 |
|  | 12/4/2002 | µg/L | 3.3J | 11 | 74 | 4U | 5.2 | 40 | 57 | 36 | 0.15J | 51 | 6.1 | 1U | 0.44J | 290 |
| Drain 6 | 2/13/2002 | µg/L | 60U | 100U | NA | 0.35J | 10U | 2.4J | 15 | 75U | 0.2U | 30U | 100U | 7U | 100U | 48 |
|  | 5/9/2002 | µg/L | 60U | 100U | NA | 0.13J | 10U | 14 | 18 | 15J | 0.2U | 11J | 100U | 7U | 100U | 66 |
|  | 7/29/2002 | µg/L | 1.1J | 3.9J | 11 | 4U | 0.39J | 10 | 11 | 2.4J | 0.013J | 4.9J | 5U | 0.2J | 0.23J | 75 |
|  | 8/12/2002 | µg/L | 1.5J | 3.8J | 23 | 4U | 0.83 | 13 | 23 | 8.6 | 0.039J | 8.2J | 2.2J | 0.17J | 2U | 130 |
|  | 8/12/2002 | µg/L | 1.4J | 2.9J | 12 | 4U | 0.83 | 20 | 16 | 3.2 | 0.01J | 5.3J | 5U | 1U | 2U | 110 |
|  | 10/7/2002 | µg/L | 1.2J | 5U | 17 | 4U | 1.3 | 2.7J | 18 | 8.9 | 0.017J | 6.4J | 3.6J | 1U | 2U | 100 |
|  | 12/4/2002 | µg/L | 1.2J | 5U | 14 | 4U | 1.2 | 2J | 11 | 4 | 0.015J | 4.5J | 5U | 1U | 2U | 64 |
| Drain 11 | 2/13/2002 | µg/L | 60U | 100U | NA | 0.45J | 3.7J | 26 | 95 | 53J | 0.008J | 14J | 100U | 7U | 100U | 250 |
|  | 5/9/2002 | µg/L | 60U | 100U | NA | 1U | 10U | 6.9J | 24 | 23J | 0.2U | 30U | 100U | 7U | 100U | 59 |
|  | 7/29/2002 | µg/L | 1.2J | 2J | 11 | 4U | 0.53 | 21 | 12 | 1.7J | 0.2U | 7.6J | 1.5J | 0.2J | 2U | 100 |
|  | 8/12/2002 | µg/L | 5.8 | 12 | 42 | 4U | 1.6 | 41 | 94 | 44 | 0.026J | 120 | 4.4J | 1U | 2U | 240 |
|  | 8/12/2002 | µg/L | 6 | 11 | 34 | 4U | 1.8 | 47 | 87 | 58 | 0.041J | 35 | 1.9J | 1U | 2U | 330 |
|  | 10/7/2002 | µg/L | 4.6J | 5U | 26 | 4U | 2.2 | 28 | 71 | 40 | 0.026J | 14 | 5U | 1U | 2U | 160 |
| Drain 13 | 5/9/2002 | µg/L | 60U | 100U | NA | 1U | 10U | 10U | 4.4J | 75U | 0.2U | 30U | 100U | 7U | 100U | 42 |
| Drain 14 | 2/13/2002 | µg/L | 60U | 100U | NA | 0.35J | 10U | 6.3J | 19 | 75U | 0.013J | 30U | 100U | 7U | 100U | 120 |
|  | 8/12/2002 | µg/L | 1.2J | 5U | 8J | 4U | 0.48J | 15 | 6.2J | 1.1J | 0.2U | 7.6J | 5U | 1U | 2U | 140 |
| Dai Ichi Hotel | 8/12/2002 | µg/L | 1.8J | 11 | 8.4J | 4U | 0.48J | 17 | 8.9J | 3U | 0.015J | 11 | 14 | 1U | 2U | 150 |
|  | 12/4/2002 | µg/L | 0.93J | 110 | 14 | 4U | 0.67 | 10U | 22 | 0.95J | 0.02J | 31 | 130 | 1U | 2U | 82 |
| Hafa Adai Hotel | 7/29/2002 | µg/L | 1.3J | 2.6J | 12 | 4U | 0.54 | 19 | 13 | 5.9 | 0.013J | 7J | 5U | 1U | 2U | 94 |
|  | 12/4/2002 | µg/L | 0.85J | 91 | 11 | 4U | 1.1 | 10U | 14 | 0.69J | 0.2U | 27 | 5U | 1U | 2U | 69 |

Notes:

[1] EPA national recommended water quality criteria for priority pollutants, freshwater aquatic life criteria (EPA, 2009).

[2] Based on the CNMI water quality criteria for priority toxic pollutants, freshwater aquatic life criteria (DEQ, 2002).

- "U" indicates that the analyte was not detected at or above the reporting limit.
- "J" indicates estimated value.

NA = not analyzed
NL = not listed
µg/L = micrograms per liter
🟥 meets or exceeds the EPA water quality standard for acute and chronic toxicity standards
🟨 meets or exceeds the EPA water quality standard for chronic toxicity standards

Some of the metals were detected at a higher concentration during times when the measured stormwater discharge was higher. This may be an indication that metals that are deposited on the ground surface from anthropogenic sources such as motor vehicles and industrial activities are washed into the lagoon via stormwater runoff during large rainfall events. However, runoff sample exceedances occurred during both the dry and wet season, and the result is not consistent enough to conclude that more metals are carried into the lagoon during larger rainfall events. It may be safer to conclude that the amount of metals that are carried into the lagoon via stormwater runoff depends on the source of contamination (from pervious or impervious surfaces) and the relative timing of the rain event. Stormwater runoffs during early season rains or after a dry period usually contain the highest pollutant concentration due to the amount of time that has allowed pollutants to be deposited and accumulate on impervious surfaces. Pollutants from pervious surfaces on the other hand may be found at a constant rate regardless of the timing of the rain event. Additional data may be required to determine the source of metal pollutants that are washed into the lagoon via stormwater runoff (no additional stormwater data has been collected since 2002). Since this study proposes a solution that will capture contaminated stormwater regardless of the source of metal pollutants, additional study is considered outside the scope of this study.

## REFERENCES

EPA, 2009. *National Recommended Water Quality Criteria*. Office of Water, Office of Science and Technology. <http://water.epa.gov/scitech/swguidance/standards/current/index.cfm>

DEQ, 2002. CNMI Water Quality Standards. Promulgated in accordance with the *Commonwealth Environmental Protection Act, (CEPA),* 1982, 2 CMC §§3101 to 3134, Public Law 3-23; the *Commonwealth Environmental Amendments Act,* 1999, Public Law 11-103; and the *Commonwealth Groundwater Management and Protection Act*, 1988, 2 CMC §§3311 to 3333, Public Law 6-12, of the Commonwealth of the Northern Mariana Islands, and under the provisions of the Clean Water Act, P.L. 92-500 (33 U.S.C. 1251 et. seq.).

July 12 , 2002

Matt Neal
Environet, Inc.
2850 Paa Street, Suite 212
Honolulu, HI 96819
RE: Saipan AES / P202349

Enclosed are the results of analyses for samples received by the laboratory on 02/20/02. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Angelee Cari
Project Manager

CA ELAP Certificate Number 2374

**ANALYTICAL REPORT FOR SAMPLES**

| Sample ID | Laboratory ID | Matrix | Date Sampled | Date Received |
|---|---|---|---|---|
| F01009SW11-0.0 | P202349-01 | Water | 02/13/02 20:15 | 02/20/02 09:35 |
| F01009SW06-0.0 | P202349-02 | Water | 02/13/02 20:25 | 02/20/02 09:35 |
| F01009SW14-0.0 | P202349-03 | Water | 02/13/02 20:30 | 02/20/02 09:35 |

# Total Metals by EPA 6000/7000 Series Methods
## Sequoia Analytical - Petaluma

**F01009SW11-0.0 (P202349-01) Water Sampled: 02/13/02 20:15 Received: 02/20/02 09:35**

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Mercury** | **0.0080** | 0.0070 | 0.20 | ug/l | 1 | 2020481 | 03/01/02 | 03/04/02 | EPA 7470A | J |
| Antimony | ND | 16 | 60 | " | " | 2020487 | 03/04/02 | 03/05/02 | EPA 6010B | |
| Arsenic | ND | 22 | 100 | " | " | " | " | " | " | |
| **Beryllium** | **0.45** | 0.11 | 1.0 | " | " | " | " | " | " | J |
| **Cadmium** | **3.7** | 3.6 | 10 | " | " | " | " | " | " | J |
| **Chromium** | **26** | 2.2 | 10 | " | " | " | " | " | " | |
| **Copper** | **95** | 2.2 | 10 | " | " | " | " | " | " | |
| **Lead** | **53** | 13 | 75 | " | " | " | " | " | " | J |
| **Nickel** | **14** | 11 | 30 | " | " | " | " | " | " | J |
| Selenium | ND | 39 | 100 | " | " | " | " | " | " | |
| Silver | ND | 1.5 | 7.0 | " | " | " | " | " | " | |
| Thallium | ND | 21 | 100 | " | " | " | " | " | " | |
| **Zinc** | **250** | 12 | 20 | " | " | " | " | " | " | |

**F01009SW06-0.0 (P202349-02) Water Sampled: 02/13/02 20:25 Received: 02/20/02 09:35**

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| Mercury | ND | 0.0070 | 0.20 | ug/l | 1 | 2020481 | 03/01/02 | 03/04/02 | EPA 7470A | |
| Antimony | ND | 16 | 60 | " | " | 2020487 | 03/04/02 | 03/05/02 | EPA 6010B | |
| Arsenic | ND | 22 | 100 | " | " | " | " | " | " | |
| **Beryllium** | **0.35** | 0.11 | 1.0 | " | " | " | " | " | " | J |
| Cadmium | ND | 3.6 | 10 | " | " | " | " | " | " | |
| **Chromium** | **2.4** | 2.2 | 10 | " | " | " | " | " | " | J |
| **Copper** | **15** | 2.2 | 10 | " | " | " | " | " | " | |
| Lead | ND | 13 | 75 | " | " | " | " | " | " | |
| Nickel | ND | 11 | 30 | " | " | " | " | " | " | |
| Selenium | ND | 39 | 100 | " | " | " | " | " | " | |
| Silver | ND | 1.5 | 7.0 | " | " | " | " | " | " | |
| Thallium | ND | 21 | 100 | " | " | " | " | " | " | |
| **Zinc** | **48** | 12 | 20 | " | " | " | " | " | " | |

## Total Metals by EPA 6000/7000 Series Methods
## Sequoia Analytical - Petaluma

**F01009SW14-0.0 (P202349-03) Water Sampled: 02/13/02 20:30 Received: 02/20/02 09:35**

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Mercury** | **0.013** | 0.0070 | 0.20 | ug/l | 1 | 2020481 | 03/01/02 | 03/04/02 | EPA 7470A | J |
| Antimony | ND | 16 | 60 | " | " | 2020487 | 03/04/02 | 03/05/02 | EPA 6010B | |
| Arsenic | ND | 22 | 100 | " | " | " | " | " | " | |
| **Beryllium** | **0.35** | 0.11 | 1.0 | " | " | " | " | " | " | J |
| Cadmium | ND | 3.6 | 10 | " | " | " | " | " | " | |
| **Chromium** | **6.3** | 2.2 | 10 | " | " | " | " | " | " | J |
| **Copper** | **19** | 2.2 | 10 | " | " | " | " | " | " | |
| Lead | ND | 13 | 75 | " | " | " | " | " | " | |
| Nickel | ND | 11 | 30 | " | " | " | " | " | " | |
| Selenium | ND | 39 | 100 | " | " | " | " | " | " | |
| Silver | ND | 1.5 | 7.0 | " | " | " | " | " | " | |
| Thallium | ND | 21 | 100 | " | " | " | " | " | " | |
| **Zinc** | **120** | 12 | 20 | " | " | " | " | " | " | |

# Total Metals by EPA 6000/7000 Series Methods - Quality Control
## Sequoia Analytical - Petaluma

| Analyte | Result | MDL | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 2020481 - EPA 7470A** | | | | | | | | | | | |
| **Blank (2020481-BLK1)** | | | | | Prepared: 03/01/02 Analyzed: 03/04/02 | | | | | | |
| Mercury | ND | 0.0070 | 0.20 | ug/l | | | | | | | |
| **Laboratory Control Sample (2020481-BS1)** | | | | | Prepared: 03/01/02 Analyzed: 03/04/02 | | | | | | |
| Mercury | 1.57 | 0.0070 | 0.20 | ug/l | 1.60 | | 98 | 80-120 | | | |
| **Matrix Spike (2020481-MS1)** | | **Source: P202320-02** | | | Prepared: 03/01/02 Analyzed: 03/04/02 | | | | | | |
| Mercury | 1.39 | 0.0070 | 0.20 | ug/l | 1.60 | 0.013 | 86 | 75-125 | | | |
| **Matrix Spike (2020481-MS2)** | | **Source: P202354-01** | | | Prepared: 03/01/02 Analyzed: 03/04/02 | | | | | | |
| Mercury | 1.44 | 0.0070 | 0.20 | ug/l | 1.60 | ND | 90 | 75-125 | | | |
| **Matrix Spike Dup (2020481-MSD1)** | | **Source: P202320-02** | | | Prepared: 03/01/02 Analyzed: 03/04/02 | | | | | | |
| Mercury | 1.43 | 0.0070 | 0.20 | ug/l | 1.60 | 0.013 | 89 | 75-125 | 3 | 20 | |
| **Matrix Spike Dup (2020481-MSD2)** | | **Source: P202354-01** | | | Prepared: 03/01/02 Analyzed: 03/04/02 | | | | | | |
| Mercury | 1.42 | 0.0070 | 0.20 | ug/l | 1.60 | ND | 89 | 75-125 | 1 | 20 | |
| **Batch 2020487 - EPA 3010A** | | | | | | | | | | | |
| **Blank (2020487-BLK1)** | | | | | Prepared: 03/04/02 Analyzed: 03/05/02 | | | | | | |
| Antimony | ND | 16 | 60 | ug/l | | | | | | | |
| Arsenic | ND | 22 | 100 | " | | | | | | | |
| Beryllium | 0.172 | 0.11 | 1.0 | " | | | | | | | J |
| Cadmium | ND | 3.6 | 10 | " | | | | | | | |
| Chromium | ND | 2.2 | 10 | " | | | | | | | |
| Copper | ND | 2.2 | 10 | " | | | | | | | |
| Lead | ND | 13 | 75 | " | | | | | | | |
| Nickel | ND | 11 | 30 | " | | | | | | | |
| Selenium | ND | 39 | 100 | " | | | | | | | |
| Silver | ND | 1.5 | 7.0 | " | | | | | | | |
| Thallium | ND | 21 | 100 | " | | | | | | | |
| Zinc | ND | 12 | 20 | " | | | | | | | |

# Total Metals by EPA 6000/7000 Series Methods - Quality Control

## Sequoia Analytical - Petaluma

### Batch 2020487 - EPA 3010A

**Laboratory Control Sample (2020487-BS1)** Prepared: 03/04/02 Analyzed: 03/05/02

| Analyte | Result | MDL | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Antimony | 515 | 16 | 60 | ug/l | 500 | | 103 | 80-120 | | | |
| Arsenic | 501 | 22 | 100 | " | 500 | | 100 | 80-120 | | | |
| Beryllium | 52.9 | 0.11 | 1.0 | " | 50.0 | | 106 | 80-120 | | | |
| Cadmium | 50.8 | 3.6 | 10 | " | 50.0 | | 102 | 80-120 | | | |
| Chromium | 533 | 2.2 | 10 | " | 500 | | 107 | 80-120 | | | |
| Copper | 519 | 2.2 | 10 | " | 500 | | 104 | 80-120 | | | |
| Lead | 521 | 13 | 75 | " | 500 | | 104 | 80-120 | | | |
| Nickel | 522 | 11 | 30 | " | 500 | | 104 | 80-120 | | | |
| Selenium | 501 | 39 | 100 | " | 500 | | 100 | 80-120 | | | |
| Silver | 45.7 | 1.5 | 7.0 | " | 50.0 | | 91 | 80-120 | | | |
| Thallium | 525 | 21 | 100 | " | 500 | | 105 | 80-120 | | | |
| Zinc | 512 | 12 | 20 | " | 500 | | 102 | 80-120 | | | |

**Matrix Spike (2020487-MS1)** Source: P202319-01 Prepared: 03/04/02 Analyzed: 03/05/02

| Analyte | Result | MDL | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Antimony | 293 | 16 | 60 | ug/l | 500 | 22 | 54 | 75-125 | | | QM-07 |
| Arsenic | 566 | 22 | 100 | " | 500 | 42 | 105 | 75-125 | | | |
| Beryllium | 55.2 | 0.11 | 1.0 | " | 50.0 | 2.9 | 105 | 75-125 | | | |
| Cadmium | 54.3 | 3.6 | 10 | " | 50.0 | ND | 109 | 75-125 | | | |
| Chromium | 652 | 2.2 | 10 | " | 500 | 130 | 104 | 75-125 | | | |
| Copper | 661 | 2.2 | 10 | " | 500 | 150 | 102 | 75-125 | | | |
| Lead | 538 | 13 | 75 | " | 500 | 44 | 99 | 75-125 | | | |
| Nickel | 705 | 11 | 30 | " | 500 | 170 | 107 | 75-125 | | | |
| Selenium | 468 | 39 | 100 | " | 500 | ND | 94 | 75-125 | | | |
| Silver | 45.7 | 1.5 | 7.0 | " | 50.0 | ND | 91 | 75-125 | | | |
| Thallium | 545 | 21 | 100 | " | 500 | 24 | 104 | 75-125 | | | |
| Zinc | 776 | 12 | 20 | " | 500 | 270 | 101 | 75-125 | | | |

**Matrix Spike Dup (2020487-MSD1)** Source: P202319-01 Prepared: 03/04/02 Analyzed: 03/05/02

| Analyte | Result | MDL | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Antimony | 297 | 16 | 60 | ug/l | 500 | 22 | 55 | 75-125 | 1 | 20 | QM-07 |
| Arsenic | 572 | 22 | 100 | " | 500 | 42 | 106 | 75-125 | 1 | 20 | |
| Beryllium | 55.7 | 0.11 | 1.0 | " | 50.0 | 2.9 | 106 | 75-125 | 0.9 | 20 | |
| Cadmium | 55.5 | 3.6 | 10 | " | 50.0 | ND | 111 | 75-125 | 2 | 20 | |
| Chromium | 657 | 2.2 | 10 | " | 500 | 130 | 105 | 75-125 | 0.8 | 20 | |
| Copper | 664 | 2.2 | 10 | " | 500 | 150 | 103 | 75-125 | 0.5 | 20 | |
| Lead | 567 | 13 | 75 | " | 500 | 44 | 105 | 75-125 | 5 | 20 | |
| Nickel | 708 | 11 | 30 | " | 500 | 170 | 108 | 75-125 | 0.4 | 20 | |
| Selenium | 522 | 39 | 100 | " | 500 | ND | 104 | 75-125 | 11 | 20 | |

# Total Metals by EPA 6000/7000 Series Methods - Quality Control

## Sequoia Analytical - Petaluma

| Analyte | Result | MDL | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 2020487 - EPA 3010A** | | | | | | | | | | | |
| **Matrix Spike Dup (2020487-MSD1)** | | **Source: P202319-01** | | | Prepared: 03/04/02 | Analyzed: 03/05/02 | | | | | |
| Silver | 45.7 | 1.5 | 7.0 | ug/l | 50.0 | ND | 91 | 75-125 | 0 | 20 | |
| Thallium | 525 | 21 | 100 | " | 500 | 24 | 100 | 75-125 | 4 | 20 | |
| Zinc | 780 | 12 | 20 | " | 500 | 270 | 102 | 75-125 | 0.5 | 20 | |

## Notes and Definitions

| | |
|---|---|
| J | Estimated value. |
| QM-07 | The spike recovery was outside control limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery. |
| DET | Analyte DETECTED |
| ND | Analyte NOT DETECTED at or above the reporting limit |
| NR | Not Reported |
| dry | Sample results reported on a dry weight basis |
| RPD | Relative Percent Difference |

# Oceanic Analytical Laboratory, Inc.

99-193 Aiea Heights Drive, Suite 121 Aiea, Hawaii 96701-3900
Telephone: (808)486-LABS (5227) Fax: (808)486-2456 E-mail: Info@oceanic-labs.com

LABORATORY USE ONLY
LAB JOB NO ____
LOCATION ____
CONTAINERS ____

## Chain of Custody / Analysis Request Form

Report To: Matt Neal
Company Name: Enviromet Inc
Address: 2850 Paa St #212
City: Honolulu State: HI ZIP: 96819
Phone: 808 833-2225 Fax: 808 832-2234
Sampler: MJN # of Samples in Shipment: 3

**Project Identification**
Job Name: Saipan AES
Job Number: F01009
P.O. Number:
Date of Sample Shipment: 2-14-02
Date Results Needed: std TAT

**Indicate Analysis Requested**

| Item No. | Client Sample I.D. | COMP | GRAB | Water | Soil | Wastewater | Drinking water | Sludge | Liquid | Solid | Oil | Other | Preservation Method | Sampling Date | Sampling Time | Number of Containers | Metals Priority pollutant (13) | Laboratory No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | F01009SW11-0.0 | | X | | | | | | | | | | HNO3 | 2-13-02 | 2015 | 1 | | P2023-9-01 |
| 2 | F01009SW06-0.0 | | \| | | | | | | | | | | \| | \| | 2025 | 1 | | 2 |
| 3 | F01009SW14-0.0 | | \| | | | | | | | | | \| | \| | 2030 | 1 | | 3 |
| 4 | | | | | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | |

COOLER CUSTODY SEALS INTACT ☐
NOT INTACT ☐
COOLER TEMPERATURE 26 °C

| Released by (Print/Signature) | Date / Time Released | Delivery Method | Received by (Print/Signature) | Company / Agency Affiliation | Date / Time Received | Condition Noted |
|---|---|---|---|---|---|---|
| Matt Neal / | 2-14/02 1030 | \| | Stevenson / | SEQ | 2/20/02 935 | |
| | / | | | | / | |
| | / | | | | / | |

Comments:

Please Check Box
☐ Dispose by Lab
☐ Return to Client
☐ Archive

White – Oceanic Analytical Yellow – Oceanic Analytical Pink – Client

Page 1 of 1

July 12 , 2002

Matt Neal
Environet, Inc.
2850 Paa Street, Suite 212
Honolulu, HI 96819
RE: Saipan AES / P205412

Enclosed are the results of analyses for samples received by the laboratory on 05/20/02. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Angelee Cari
Project Manager

CA ELAP Certificate Number 2374

| | | |
|---|---|---|
| Environet, Inc.<br>2850 Paa Street, Suite 212<br>Honolulu HI, 96819 | Project: Saipan AES<br>Project Number: [none]<br>Project Manager: Matt Neal | P205412<br>**Reported:**<br>07/12/02 13:05 |

**ANALYTICAL REPORT FOR SAMPLES**

| Sample ID | Laboratory ID | Matrix | Date Sampled | Date Received |
|---|---|---|---|---|
| F01009SW06-0.0 | P205412-01 | Water | 05/09/02 06:10 | 05/20/02 10:55 |
| F01009SW11-0.0 | P205412-02 | Water | 05/09/02 06:17 | 05/20/02 10:55 |
| F01009SW13-0.0 | P205412-03 | Water | 05/09/02 06:21 | 05/20/02 10:55 |

## Total Metals by EPA 6000/7000 Series Methods
## Sequoia Analytical - Petaluma

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **F01009SW06-0.0 (P205412-01) Water** | **Sampled: 05/09/02 06:10** | | **Received: 05/20/02 10:55** | | | | | | | |
| Mercury | ND | 0.0070 | 0.20 | ug/l | 1 | 2050565 | 05/30/02 | 05/30/02 | EPA 7470A | |
| Antimony | ND | 16 | 60 | " | " | 2050606 | 05/29/02 | 06/03/02 | EPA 6010B | |
| Arsenic | ND | 22 | 100 | " | " | " | " | " | " | |
| **Beryllium** | **0.13** | 0.11 | 1.0 | " | " | " | " | " | " | J |
| Cadmium | ND | 3.6 | 10 | " | " | " | " | " | " | |
| **Chromium** | **14** | 2.2 | 10 | " | " | " | " | " | " | |
| **Copper** | **18** | 2.2 | 10 | " | " | " | " | " | " | |
| **Lead** | **15** | 13 | 75 | " | " | " | " | " | " | J |
| **Nickel** | **11** | 11 | 30 | " | " | " | " | " | " | J |
| Selenium | ND | 39 | 100 | " | " | " | " | " | " | |
| Silver | ND | 1.5 | 7.0 | " | " | " | " | " | " | |
| Thallium | ND | 21 | 100 | " | " | " | " | " | " | |
| **Zinc** | **66** | 12 | 20 | " | " | " | " | " | " | |
| **F01009SW11-0.0 (P205412-02) Water** | **Sampled: 05/09/02 06:17** | | **Received: 05/20/02 10:55** | | | | | | | |
| Mercury | ND | 0.0070 | 0.20 | ug/l | 1 | 2050565 | 05/30/02 | 05/30/02 | EPA 7470A | |
| Antimony | ND | 16 | 60 | " | " | 2050606 | 05/29/02 | 06/03/02 | EPA 6010B | |
| Arsenic | ND | 22 | 100 | " | " | " | " | " | " | |
| Beryllium | ND | 0.11 | 1.0 | " | " | " | " | " | " | |
| Cadmium | ND | 3.6 | 10 | " | " | " | " | " | " | |
| **Chromium** | **6.9** | 2.2 | 10 | " | " | " | " | " | " | J |
| **Copper** | **24** | 2.2 | 10 | " | " | " | " | " | " | |
| **Lead** | **23** | 13 | 75 | " | " | " | " | " | " | J |
| Nickel | ND | 11 | 30 | " | " | " | " | " | " | |
| Selenium | ND | 39 | 100 | " | " | " | " | " | " | |
| Silver | ND | 1.5 | 7.0 | " | " | " | " | " | " | |
| Thallium | ND | 21 | 100 | " | " | " | " | " | " | |
| **Zinc** | **59** | 12 | 20 | " | " | " | " | " | " | |

## Total Metals by EPA 6000/7000 Series Methods
## Sequoia Analytical - Petaluma

**F01009SW13-0.0 (P205412-03) Water   Sampled: 05/09/02 06:21   Received: 05/20/02 10:55**

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| Mercury | ND | 0.0070 | 0.20 | ug/l | 1 | 2050565 | 05/30/02 | 05/30/02 | EPA 7470A | |
| Antimony | ND | 16 | 60 | " | " | 2050606 | 05/29/02 | 06/03/02 | EPA 6010B | |
| Arsenic | ND | 22 | 100 | " | " | " | " | " | " | |
| Beryllium | ND | 0.11 | 1.0 | " | " | " | " | " | " | |
| Cadmium | ND | 3.6 | 10 | " | " | " | " | " | " | |
| Chromium | ND | 2.2 | 10 | " | " | " | " | " | " | |
| **Copper** | **4.4** | 2.2 | 10 | " | " | " | " | " | " | J |
| Lead | ND | 13 | 75 | " | " | " | " | " | " | |
| Nickel | ND | 11 | 30 | " | " | " | " | " | " | |
| Selenium | ND | 39 | 100 | " | " | " | " | " | " | |
| Silver | ND | 1.5 | 7.0 | " | " | " | " | " | " | |
| Thallium | ND | 21 | 100 | " | " | " | " | " | " | |
| **Zinc** | **42** | 12 | 20 | " | " | " | " | " | " | |

# Total Metals by EPA 6000/7000 Series Methods - Quality Control

## Sequoia Analytical - Petaluma

| Analyte | Result | MDL | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 2050565 - EPA 7470A** | | | | | | | | | | | |
| **Blank (2050565-BLK1)** | | | | | Prepared & Analyzed: 05/30/02 | | | | | | |
| Mercury | ND | 0.0070 | 0.20 | ug/l | | | | | | | |
| **Laboratory Control Sample (2050565-BS1)** | | | | | Prepared & Analyzed: 05/30/02 | | | | | | |
| Mercury | 1.52 | 0.0070 | 0.20 | ug/l | 1.60 | | 95 | 80-120 | | | |
| **Matrix Spike (2050565-MS1)** | | **Source: P205412-01** | | | Prepared & Analyzed: 05/30/02 | | | | | | |
| Mercury | 1.56 | 0.0070 | 0.20 | ug/l | 1.60 | ND | 97 | 75-125 | | | |
| **Matrix Spike Dup (2050565-MSD1)** | | **Source: P205412-01** | | | Prepared & Analyzed: 05/30/02 | | | | | | |
| Mercury | 1.58 | 0.0070 | 0.20 | ug/l | 1.60 | ND | 99 | 75-125 | 1 | 20 | |
| **Batch 2050606 - EPA 3010A** | | | | | | | | | | | |
| **Blank (2050606-BLK1)** | | | | | Prepared: 05/29/02 Analyzed: 06/03/02 | | | | | | |
| Antimony | ND | 16 | 60 | ug/l | | | | | | | |
| Arsenic | ND | 22 | 100 | " | | | | | | | |
| Beryllium | ND | 0.11 | 1.0 | " | | | | | | | |
| Cadmium | ND | 3.6 | 10 | " | | | | | | | |
| Chromium | ND | 2.2 | 10 | " | | | | | | | |
| Copper | ND | 2.2 | 10 | " | | | | | | | |
| Lead | 23.4 | 13 | 75 | " | | | | | | | J |
| Nickel | ND | 11 | 30 | " | | | | | | | |
| Selenium | ND | 39 | 100 | " | | | | | | | |
| Silver | ND | 1.5 | 7.0 | " | | | | | | | |
| Thallium | ND | 21 | 100 | " | | | | | | | |
| Zinc | ND | 12 | 20 | " | | | | | | | |

# Total Metals by EPA 6000/7000 Series Methods - Quality Control

## Sequoia Analytical - Petaluma

### Batch 2050606 - EPA 3010A

**Laboratory Control Sample (2050606-BS1)** Prepared: 05/29/02 Analyzed: 06/03/02

| Analyte | Result | MDL | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Antimony | 489 | 16 | 60 | ug/l | 500 | | 98 | 80-120 | | | |
| Arsenic | 473 | 22 | 100 | " | 500 | | 95 | 80-120 | | | |
| Beryllium | 47.3 | 0.11 | 1.0 | " | 50.0 | | 95 | 80-120 | | | |
| Cadmium | 48.4 | 3.6 | 10 | " | 50.0 | | 97 | 80-120 | | | |
| Chromium | 482 | 2.2 | 10 | " | 500 | | 96 | 80-120 | | | |
| Copper | 473 | 2.2 | 10 | " | 500 | | 95 | 80-120 | | | |
| Lead | 482 | 13 | 75 | " | 500 | | 96 | 80-120 | | | |
| Nickel | 489 | 11 | 30 | " | 500 | | 98 | 80-120 | | | |
| Selenium | 493 | 39 | 100 | " | 500 | | 99 | 80-120 | | | |
| Silver | 47.2 | 1.5 | 7.0 | " | 50.0 | | 94 | 80-120 | | | |
| Thallium | 496 | 21 | 100 | " | 500 | | 99 | 80-120 | | | |
| Zinc | 466 | 12 | 20 | " | 500 | | 93 | 80-120 | | | |

**Matrix Spike (2050606-MS1)** Source: P205414-14 Prepared: 05/29/02 Analyzed: 06/03/02

| Analyte | Result | MDL | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Antimony | 483 | 16 | 60 | ug/l | 500 | ND | 97 | 75-125 | | | |
| Arsenic | 479 | 22 | 100 | " | 500 | ND | 96 | 75-125 | | | |
| Beryllium | 47.1 | 0.11 | 1.0 | " | 50.0 | ND | 94 | 75-125 | | | |
| Cadmium | 47.0 | 3.6 | 10 | " | 50.0 | ND | 94 | 75-125 | | | |
| Chromium | 480 | 2.2 | 10 | " | 500 | ND | 96 | 75-125 | | | |
| Copper | 473 | 2.2 | 10 | " | 500 | ND | 95 | 75-125 | | | |
| Lead | 482 | 13 | 75 | " | 500 | ND | 96 | 75-125 | | | |
| Nickel | 490 | 11 | 30 | " | 500 | ND | 98 | 75-125 | | | |
| Selenium | 451 | 39 | 100 | " | 500 | ND | 90 | 75-125 | | | |
| Silver | 47.2 | 1.5 | 7.0 | " | 50.0 | ND | 94 | 75-125 | | | |
| Thallium | 487 | 21 | 100 | " | 500 | ND | 97 | 75-125 | | | |
| Zinc | 471 | 12 | 20 | " | 500 | ND | 94 | 75-125 | | | |

**Matrix Spike Dup (2050606-MSD1)** Source: P205414-14 Prepared: 05/29/02 Analyzed: 06/03/02

| Analyte | Result | MDL | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Antimony | 488 | 16 | 60 | ug/l | 500 | ND | 98 | 75-125 | 1 | 20 | |
| Arsenic | 489 | 22 | 100 | " | 500 | ND | 98 | 75-125 | 2 | 20 | |
| Beryllium | 47.4 | 0.11 | 1.0 | " | 50.0 | ND | 95 | 75-125 | 0.6 | 20 | |
| Cadmium | 48.3 | 3.6 | 10 | " | 50.0 | ND | 97 | 75-125 | 3 | 20 | |
| Chromium | 486 | 2.2 | 10 | " | 500 | ND | 97 | 75-125 | 1 | 20 | |
| Copper | 472 | 2.2 | 10 | " | 500 | ND | 94 | 75-125 | 0.2 | 20 | |
| Lead | 485 | 13 | 75 | " | 500 | ND | 97 | 75-125 | 0.6 | 20 | |
| Nickel | 492 | 11 | 30 | " | 500 | ND | 98 | 75-125 | 0.4 | 20 | |
| Selenium | 484 | 39 | 100 | " | 500 | ND | 97 | 75-125 | 7 | 20 | |

## Total Metals by EPA 6000/7000 Series Methods - Quality Control
## Sequoia Analytical - Petaluma

| Analyte | Result | MDL | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 2050606 - EPA 3010A** | | | | | | | | | | | |
| **Matrix Spike Dup (2050606-MSD1)** | | **Source: P205414-14** | | | Prepared: 05/29/02 | Analyzed: 06/03/02 | | | | | |
| Silver | 47.3 | 1.5 | 7.0 | ug/l | 50.0 | ND | 95 | 75-125 | 0.2 | 20 | |
| Thallium | 500 | 21 | 100 | " | 500 | ND | 100 | 75-125 | 3 | 20 | |
| Zinc | 474 | 12 | 20 | " | 500 | ND | 95 | 75-125 | 0.6 | 20 | |

## Notes and Definitions

| | |
|---|---|
| J | Estimated value. |
| DET | Analyte DETECTED |
| ND | Analyte NOT DETECTED at or above the reporting limit |
| NR | Not Reported |
| dry | Sample results reported on a dry weight basis |
| RPD | Relative Percent Difference |

# Environet

2850 Paa Street, Suite 212, Honolulu, HI 96819
Ph: (808) 833-225 Fax: (808) 833-2231

Project Name/Number: Saipan AER F01009

Sampler(s) Signature:

| Sample Identification Number | Date | Time | Prio. 13 Pollutant Metals | Analyses Required | No. of Containers |
|---|---|---|---|---|---|
| F01009SW06-0.0 | 5-9-02 | 0610 | X | P205412-01 | 1 |
| F01009SW11-0.0 | ↓ | 0617 | X | ↓ -02 | 1 |
| F01009SW13-0.0 | ↓ | 0621 | X | -03 | 1 |

~~COOLER CUSTODY SEALS INTACT~~ ☐

NOT INTACT ☐

COOLER TEMPERATURE 1.8 °C

Total No. of Containers 3

Special Instructions:

|  | Date | Time |  | Date | Time |
|---|---|---|---|---|---|
| Relinquished by: | 5-17-02 | 1300 | Received by: Sam Remata | 5/17/02 | 1350 |
| Relinquished by: Sam Remata | 5/20/02 | 1005 | Received by: | 5/20/02 | 1055 |
| Relinquished by: |  |  | Received by Laboratory: |  |  |

September 11 , 2002

Matt Neal
Environet, Inc.
2850 Paa Street, Suite 212
Honolulu, HI 96819
RE: Saipan AES / P208284

Enclosed are the results of analyses for samples received by the laboratory on 08/16/02. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Angelee Cari
Project Manager

CA ELAP Certificate Number 2374

## ANALYTICAL REPORT FOR SAMPLES

| Sample ID | Laboratory ID | Matrix | Date Sampled | Date Received |
|---|---|---|---|---|
| F01009SW06 | P208284-01 | Water | 08/12/02 08:12 | 08/16/02 10:40 |
| F01009SW11 | P208284-02 | Water | 08/12/02 08:16 | 08/16/02 10:40 |
| F01009SW14 | P208284-03 | Water | 08/12/02 08:21 | 08/16/02 10:40 |
| F01009SW Dai Ich | P208284-04 | Water | 08/12/02 12:00 | 08/16/02 10:40 |
| Drain 4 | P208284-05 | Water | 08/12/02 08:18 | 08/16/02 10:40 |
| Drain 6 | P208284-06 | Water | 08/12/02 08:35 | 08/16/02 10:40 |
| Drain 11 | P208284-07 | Water | 08/12/02 08:46 | 08/16/02 10:40 |
| Drain 4 | P208284-08 | Water | 07/29/02 20:12 | 08/16/02 10:40 |
| Drain 6 | P208284-09 | Water | 07/29/02 20:23 | 08/16/02 10:40 |
| Drain 11 | P208284-10 | Water | 07/29/02 20:39 | 08/16/02 10:40 |
| HAFA ADAI HOTEL | P208284-11 | Water | 07/29/02 20:50 | 08/16/02 10:40 |

# Total Metals by EPA 6000/7000 Series Methods
## Sequoia Analytical - Petaluma

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **F01009SW06 (P208284-01) Water** | **Sampled: 08/12/02 08:12** | | **Received: 08/16/02 10:40** | | | | | | | |
| **Barium** | **23** | 0.50 | 10 | ug/l | 1 | 2080592 | 08/30/02 | 09/05/02 | EPA 6020 | |
| **Mercury** | **0.039** | 0.0070 | 0.20 | " | " | 2080449 | 08/30/02 | 08/30/02 | EPA 7470A | J |
| **Antimony** | **1.5** | 0.55 | 5.0 | " | " | 2080592 | 08/30/02 | 09/05/02 | EPA 6020 | J |
| **Arsenic** | **3.8** | 1.3 | 5.0 | " | " | " | " | " | " | J |
| Beryllium | ND | 0.89 | 4.0 | " | " | " | " | " | " | |
| **Cadmium** | **0.83** | 0.13 | 0.50 | " | " | " | " | " | " | |
| **Chromium** | **13** | 0.65 | 10 | " | " | " | " | " | " | |
| **Copper** | **23** | 0.48 | 10 | " | " | " | " | " | " | |
| **Lead** | **8.6** | 0.21 | 3.0 | " | " | " | " | " | " | |
| **Nickel** | **8.2** | 0.48 | 10 | " | " | " | " | " | " | J |
| **Selenium** | **2.2** | 1.4 | 5.0 | " | " | " | " | " | " | J |
| **Silver** | **0.17** | 0.12 | 1.0 | " | " | " | " | " | " | J |
| Thallium | ND | 0.23 | 2.0 | " | " | " | " | " | " | |
| **Zinc** | **130** | 2.8 | 30 | " | " | " | " | " | " | |
| **F01009SW11 (P208284-02) Water** | **Sampled: 08/12/02 08:16** | | **Received: 08/16/02 10:40** | | | | | | | |
| **Barium** | **42** | 0.50 | 10 | ug/l | 1 | 2080592 | 08/30/02 | 09/05/02 | EPA 6020 | |
| **Mercury** | **0.026** | 0.0070 | 0.20 | " | " | 2080449 | 08/30/02 | 08/30/02 | EPA 7470A | J |
| **Antimony** | **5.8** | 0.55 | 5.0 | " | " | 2080592 | 08/30/02 | 09/05/02 | EPA 6020 | |
| **Arsenic** | **12** | 1.3 | 5.0 | " | " | " | " | " | " | |
| Beryllium | ND | 0.89 | 4.0 | " | " | " | " | " | " | |
| **Cadmium** | **1.6** | 0.13 | 0.50 | " | " | " | " | " | " | |
| **Chromium** | **41** | 0.65 | 10 | " | " | " | " | " | " | |
| **Copper** | **94** | 0.48 | 10 | " | " | " | " | " | " | |
| **Lead** | **44** | 0.21 | 3.0 | " | " | " | " | " | " | |
| **Nickel** | **120** | 0.48 | 10 | " | " | " | " | " | " | |
| **Selenium** | **4.4** | 1.4 | 5.0 | " | " | " | " | " | " | J |
| Silver | ND | 0.12 | 1.0 | " | " | " | " | " | " | |
| Thallium | ND | 0.23 | 2.0 | " | " | " | " | " | " | |
| **Zinc** | **240** | 2.8 | 30 | " | " | " | " | " | " | |

| | | |
|---|---|---|
| Environet, Inc. | Project: Saipan AES | P208284 |
| 2850 Paa Street, Suite 212 | Project Number: [none] | **Reported:** |
| Honolulu HI, 96819 | Project Manager: Matt Neal | 09/11/02 17:37 |

# Total Metals by EPA 6000/7000 Series Methods
## Sequoia Analytical - Petaluma

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **F01009SW14 (P208284-03) Water Sampled: 08/12/02 08:21 Received: 08/16/02 10:40** | | | | | | | | | | |
| **Barium** | **8.0** | 0.50 | 10 | ug/l | 1 | 2080592 | 08/30/02 | 09/05/02 | EPA 6020 | J |
| Mercury | ND | 0.0070 | 0.20 | " | " | 2080449 | 08/30/02 | 08/30/02 | EPA 7470A | |
| **Antimony** | **1.2** | 0.55 | 5.0 | " | " | 2080592 | 08/30/02 | 09/05/02 | EPA 6020 | J |
| Arsenic | ND | 1.3 | 5.0 | " | " | " | " | " | " | |
| Beryllium | ND | 0.89 | 4.0 | " | " | " | " | " | " | |
| **Cadmium** | **0.48** | 0.13 | 0.50 | " | " | " | " | " | " | J |
| **Chromium** | **15** | 0.65 | 10 | " | " | " | " | " | " | |
| **Copper** | **6.2** | 0.48 | 10 | " | " | " | " | " | " | J |
| **Lead** | **1.1** | 0.21 | 3.0 | " | " | " | " | " | " | J |
| **Nickel** | **7.6** | 0.48 | 10 | " | " | " | " | " | " | J |
| Selenium | ND | 1.4 | 5.0 | " | " | " | " | " | " | |
| Silver | ND | 0.12 | 1.0 | " | " | " | " | " | " | |
| Thallium | ND | 0.23 | 2.0 | " | " | " | " | " | " | |
| **Zinc** | **140** | 2.8 | 30 | " | " | " | " | " | " | |
| **F01009SW Dai Ich (P208284-04) Water Sampled: 08/12/02 12:00 Received: 08/16/02 10:40** | | | | | | | | | | |
| **Barium** | **8.4** | 0.50 | 10 | ug/l | 1 | 2080592 | 08/30/02 | 09/05/02 | EPA 6020 | J |
| **Mercury** | **0.015** | 0.0070 | 0.20 | " | " | 2080449 | 08/30/02 | 08/30/02 | EPA 7470A | J |
| **Antimony** | **1.8** | 0.55 | 5.0 | " | " | 2080592 | 08/30/02 | 09/05/02 | EPA 6020 | J |
| **Arsenic** | **11** | 1.3 | 5.0 | " | " | " | " | " | " | |
| Beryllium | ND | 0.89 | 4.0 | " | " | " | " | " | " | |
| **Cadmium** | **0.48** | 0.13 | 0.50 | " | " | " | " | " | " | J |
| **Chromium** | **17** | 0.65 | 10 | " | " | " | " | " | " | |
| **Copper** | **8.9** | 0.48 | 10 | " | " | " | " | " | " | J |
| Lead | ND | 0.21 | 3.0 | " | " | " | " | " | " | |
| **Nickel** | **11** | 0.48 | 10 | " | " | " | " | " | " | |
| **Selenium** | **14** | 1.4 | 5.0 | " | " | " | " | " | " | |
| Silver | ND | 0.12 | 1.0 | " | " | " | " | " | " | |
| Thallium | ND | 0.23 | 2.0 | " | " | " | " | " | " | |
| **Zinc** | **150** | 2.8 | 30 | " | " | " | " | " | " | |

## Total Metals by EPA 6000/7000 Series Methods
## Sequoia Analytical - Petaluma

**Drain 4 (P208284-05) Water Sampled: 08/12/02 08:18 Received: 08/16/02 10:40**

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Barium** | **60** | 0.50 | 10 | ug/l | 1 | 2080592 | 08/30/02 | 09/05/02 | EPA 6020 | |
| **Mercury** | **0.017** | 0.0070 | 0.20 | " | " | 2080449 | 08/30/02 | 08/30/02 | EPA 7470A | J |
| **Antimony** | **2.3** | 0.55 | 5.0 | " | " | 2080592 | 08/30/02 | 09/05/02 | EPA 6020 | J |
| **Arsenic** | **12** | 1.3 | 5.0 | " | " | " | " | " | " | |
| Beryllium | ND | 0.89 | 4.0 | " | " | " | " | " | " | |
| **Cadmium** | **1.1** | 0.13 | 0.50 | " | " | " | " | " | " | |
| **Chromium** | **41** | 0.65 | 10 | " | " | " | " | " | " | |
| **Copper** | **49** | 0.48 | 10 | " | " | " | " | " | " | |
| **Lead** | **9.3** | 0.21 | 3.0 | " | " | " | " | " | " | |
| **Nickel** | **40** | 0.48 | 10 | " | " | " | " | " | " | |
| **Selenium** | **4.3** | 1.4 | 5.0 | " | " | " | " | " | " | J |
| Silver | ND | 0.12 | 1.0 | " | " | " | " | " | " | |
| Thallium | ND | 0.23 | 2.0 | " | " | " | " | " | " | |
| **Zinc** | **160** | 2.8 | 30 | " | " | " | " | " | " | |

**Drain 6 (P208284-06) Water Sampled: 08/12/02 08:35 Received: 08/16/02 10:40**

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Barium** | **12** | 0.50 | 10 | ug/l | 1 | 2080592 | 08/30/02 | 09/05/02 | EPA 6020 | |
| **Mercury** | **0.010** | 0.0070 | 0.20 | " | " | 2080449 | 08/30/02 | 08/30/02 | EPA 7470A | J |
| **Antimony** | **1.4** | 0.55 | 5.0 | " | " | 2080592 | 08/30/02 | 09/05/02 | EPA 6020 | J |
| **Arsenic** | **2.9** | 1.3 | 5.0 | " | " | " | " | " | " | J |
| Beryllium | ND | 0.89 | 4.0 | " | " | " | " | " | " | |
| **Cadmium** | **0.83** | 0.13 | 0.50 | " | " | " | " | " | " | |
| **Chromium** | **20** | 0.65 | 10 | " | " | " | " | " | " | |
| **Copper** | **16** | 0.48 | 10 | " | " | " | " | " | " | |
| **Lead** | **3.2** | 0.21 | 3.0 | " | " | " | " | " | " | |
| **Nickel** | **5.3** | 0.48 | 10 | " | " | " | " | " | " | J |
| Selenium | ND | 1.4 | 5.0 | " | " | " | " | " | " | |
| Silver | ND | 0.12 | 1.0 | " | " | " | " | " | " | |
| Thallium | ND | 0.23 | 2.0 | " | " | " | " | " | " | |
| **Zinc** | **110** | 2.8 | 30 | " | " | " | " | " | " | |

## Total Metals by EPA 6000/7000 Series Methods
## Sequoia Analytical - Petaluma

**Drain 11 (P208284-07) Water Sampled: 08/12/02 08:46 Received: 08/16/02 10:40**

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Barium** | **34** | 0.50 | 10 | ug/l | 1 | 2080592 | 08/30/02 | 09/05/02 | EPA 6020 | |
| **Mercury** | **0.041** | 0.0070 | 0.20 | " | " | 2080449 | 08/30/02 | 08/30/02 | EPA 7470A | J |
| **Antimony** | **6.0** | 0.55 | 5.0 | " | " | 2080592 | 08/30/02 | 09/05/02 | EPA 6020 | |
| **Arsenic** | **11** | 1.3 | 5.0 | " | " | " | " | " | " | |
| Beryllium | ND | 0.89 | 4.0 | " | " | " | " | " | " | |
| **Cadmium** | **1.8** | 0.13 | 0.50 | " | " | " | " | " | " | |
| **Chromium** | **47** | 0.65 | 10 | " | " | " | " | " | " | |
| **Copper** | **87** | 0.48 | 10 | " | " | " | " | " | " | |
| **Lead** | **58** | 0.21 | 3.0 | " | " | " | " | " | " | |
| **Nickel** | **35** | 0.48 | 10 | " | " | " | " | " | " | |
| **Selenium** | **1.9** | 1.4 | 5.0 | " | " | " | " | " | " | J |
| Silver | ND | 0.12 | 1.0 | " | " | " | " | " | " | |
| Thallium | ND | 0.23 | 2.0 | " | " | " | " | " | " | |
| **Zinc** | **330** | 2.8 | 30 | " | " | " | " | " | " | |

**Drain 4 (P208284-08) Water Sampled: 07/29/02 20:12 Received: 08/16/02 10:40**

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Barium** | **34** | 0.50 | 10 | ug/l | 1 | 2080592 | 08/30/02 | 09/05/02 | EPA 6020 | |
| **Mercury** | **0.062** | 0.0070 | 0.20 | " | " | 2080449 | 08/30/02 | 08/30/02 | EPA 7470A | J, HT-04 |
| **Antimony** | **3.3** | 0.55 | 5.0 | " | " | 2080592 | 08/30/02 | 09/05/02 | EPA 6020 | J |
| **Arsenic** | **9.6** | 1.3 | 5.0 | " | " | " | " | " | " | |
| Beryllium | ND | 0.89 | 4.0 | " | " | " | " | " | " | |
| **Cadmium** | **2.5** | 0.13 | 0.50 | " | " | " | " | " | " | |
| **Chromium** | **44** | 0.65 | 10 | " | " | " | " | " | " | |
| **Copper** | **43** | 0.48 | 10 | " | " | " | " | " | " | |
| **Lead** | **18** | 0.21 | 3.0 | " | " | " | " | " | " | |
| **Nickel** | **29** | 0.48 | 10 | " | " | " | " | " | " | |
| **Selenium** | **2.6** | 1.4 | 5.0 | " | " | " | " | " | " | J |
| **Silver** | **0.21** | 0.12 | 1.0 | " | " | " | " | " | " | J |
| Thallium | ND | 0.23 | 2.0 | " | " | " | " | " | " | |
| **Zinc** | **230** | 2.8 | 30 | " | " | " | " | " | " | |

## Total Metals by EPA 6000/7000 Series Methods
## Sequoia Analytical - Petaluma

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Drain 6 (P208284-09) Water** | **Sampled: 07/29/02 20:23** | | **Received: 08/16/02 10:40** | | | | | | | |
| **Barium** | **11** | 0.50 | 10 | ug/l | 1 | 2080592 | 08/30/02 | 09/10/02 | EPA 6020 | |
| **Mercury** | **0.013** | 0.0070 | 0.20 | " | " | 2080449 | 08/30/02 | 08/30/02 | EPA 7470A | J, HT-04 |
| **Antimony** | **1.1** | 0.55 | 5.0 | " | " | 2080592 | 08/30/02 | 09/10/02 | EPA 6020 | J |
| **Arsenic** | **3.9** | 1.3 | 5.0 | " | " | " | " | " | " | J |
| Beryllium | ND | 0.89 | 4.0 | " | " | " | " | " | " | |
| **Cadmium** | **0.39** | 0.13 | 0.50 | " | " | " | " | " | " | J |
| **Chromium** | **10** | 0.65 | 10 | " | " | " | " | " | " | |
| **Copper** | **11** | 0.48 | 10 | " | " | " | " | " | " | |
| **Lead** | **2.4** | 0.21 | 3.0 | " | " | " | " | " | " | J |
| **Nickel** | **4.9** | 0.48 | 10 | " | " | " | " | " | " | J |
| Selenium | ND | 1.4 | 5.0 | " | " | " | " | " | " | |
| **Silver** | **0.20** | 0.12 | 1.0 | " | " | " | " | " | " | J |
| **Thallium** | **0.23** | 0.23 | 2.0 | " | " | " | " | " | " | J |
| **Zinc** | **75** | 2.8 | 20 | " | " | " | " | " | " | |
| **Drain 11 (P208284-10) Water** | **Sampled: 07/29/02 20:39** | | **Received: 08/16/02 10:40** | | | | | | | |
| **Barium** | **11** | 0.50 | 10 | ug/l | 1 | 2080592 | 08/30/02 | 09/05/02 | EPA 6020 | |
| Mercury | ND | 0.0070 | 0.20 | " | " | 2080449 | 08/30/02 | 08/30/02 | EPA 7470A | HT-04 |
| **Antimony** | **1.2** | 0.55 | 5.0 | " | " | 2080592 | 08/30/02 | 09/05/02 | EPA 6020 | J |
| **Arsenic** | **2.0** | 1.3 | 5.0 | " | " | " | " | " | " | J |
| Beryllium | ND | 0.89 | 4.0 | " | " | " | " | " | " | |
| **Cadmium** | **0.53** | 0.13 | 0.50 | " | " | " | " | " | " | |
| **Chromium** | **21** | 0.65 | 10 | " | " | " | " | " | " | |
| **Copper** | **12** | 0.48 | 10 | " | " | " | " | " | " | |
| **Lead** | **1.7** | 0.21 | 3.0 | " | " | " | " | " | " | J |
| **Nickel** | **7.6** | 0.48 | 10 | " | " | " | " | " | " | J |
| **Selenium** | **1.5** | 1.4 | 5.0 | " | " | " | " | " | " | J |
| **Silver** | **0.20** | 0.12 | 1.0 | " | " | " | " | " | " | J |
| Thallium | ND | 0.23 | 2.0 | " | " | " | " | " | " | |
| **Zinc** | **100** | 2.8 | 30 | " | " | " | " | " | " | |

Environet, Inc.
2850 Paa Street, Suite 212
Honolulu HI, 96819

Project: Saipan AES
Project Number: [none]
Project Manager: Matt Neal

P208284
**Reported:**
09/11/02 17:37

## Total Metals by EPA 6000/7000 Series Methods
## Sequoia Analytical - Petaluma

**HAFA ADAI HOTEL (P208284-11) Water Sampled: 07/29/02 20:50 Received: 08/16/02 10:40**

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Barium** | **12** | 0.50 | 10 | ug/l | 1 | 2080592 | 08/30/02 | 09/05/02 | EPA 6020 | |
| **Mercury** | **0.013** | 0.0070 | 0.20 | " | " | 2080449 | 08/30/02 | 08/30/02 | EPA 7470A | J, HT-04 |
| **Antimony** | **1.3** | 0.55 | 5.0 | " | " | 2080592 | 08/30/02 | 09/05/02 | EPA 6020 | J |
| **Arsenic** | **2.6** | 1.3 | 5.0 | " | " | " | " | " | " | J |
| Beryllium | ND | 0.89 | 4.0 | " | " | " | " | " | " | |
| **Cadmium** | **0.54** | 0.13 | 0.50 | " | " | " | " | " | " | |
| **Chromium** | **19** | 0.65 | 10 | " | " | " | " | " | " | |
| **Copper** | **13** | 0.48 | 10 | " | " | " | " | " | " | |
| **Lead** | **5.9** | 0.21 | 3.0 | " | " | " | " | " | " | |
| **Nickel** | **7.0** | 0.48 | 10 | " | " | " | " | " | " | J |
| Selenium | ND | 1.4 | 5.0 | " | " | " | " | " | " | |
| Silver | ND | 0.12 | 1.0 | " | " | " | " | " | " | |
| Thallium | ND | 0.23 | 2.0 | " | " | " | " | " | " | |
| **Zinc** | **94** | 2.8 | 30 | " | " | " | " | " | " | |

## Total Metals by EPA 6000/7000 Series Methods - Quality Control
## Sequoia Analytical - Petaluma

| Analyte | Result | MDL | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 2080449 - EPA 7470A** | | | | | | | | | | | |
| **Blank (2080449-BLK1)** | | | | | Prepared & Analyzed: 08/30/02 | | | | | | |
| Mercury | ND | 0.0070 | 0.20 | ug/l | | | | | | | |
| **Laboratory Control Sample (2080449-BS1)** | | | | | Prepared & Analyzed: 08/30/02 | | | | | | |
| Mercury | 1.64 | 0.0070 | 0.20 | ug/l | 1.60 | | 102 | 80-120 | | | |
| **Matrix Spike (2080449-MS1)** | | **Source: P208284-02** | | | Prepared & Analyzed: 08/30/02 | | | | | | |
| Mercury | 1.66 | 0.0070 | 0.20 | ug/l | 1.60 | 0.026 | 102 | 80-120 | | | |
| **Matrix Spike Dup (2080449-MSD1)** | | **Source: P208284-02** | | | Prepared & Analyzed: 08/30/02 | | | | | | |
| Mercury | 1.66 | 0.0070 | 0.20 | ug/l | 1.60 | 0.026 | 102 | 80-120 | 0 | 20 | |
| **Batch 2080592 - EPA 3010A** | | | | | | | | | | | |
| **Blank (2080592-BLK1)** | | | | | Prepared: 08/30/02 Analyzed: 09/05/02 | | | | | | |
| Antimony | 1.38 | 0.55 | 5.0 | ug/l | | | | | | | J |
| Barium | ND | 0.50 | 10 | " | | | | | | | |
| Arsenic | ND | 1.3 | 5.0 | " | | | | | | | |
| Beryllium | ND | 0.89 | 4.0 | " | | | | | | | |
| Cadmium | ND | 0.13 | 0.50 | " | | | | | | | |
| Chromium | ND | 0.65 | 10 | " | | | | | | | |
| Copper | 0.595 | 0.48 | 10 | " | | | | | | | J |
| Lead | ND | 0.21 | 3.0 | " | | | | | | | |
| Nickel | ND | 0.48 | 10 | " | | | | | | | |
| Selenium | 2.11 | 1.4 | 5.0 | " | | | | | | | J |
| Silver | ND | 0.12 | 1.0 | " | | | | | | | |
| Thallium | ND | 0.23 | 2.0 | " | | | | | | | |
| Zinc | 28.1 | 2.8 | 30 | " | | | | | | | J |

# Total Metals by EPA 6000/7000 Series Methods - Quality Control

## Sequoia Analytical - Petaluma

| Analyte | Result | MDL | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 2080592 - EPA 3010A** | | | | | | | | | | | |
| **Laboratory Control Sample (2080592-BS1)** | | | | | Prepared: 08/30/02 Analyzed: 09/05/02 | | | | | | |
| Antimony | 543 | 0.55 | 5.0 | ug/l | 500 | | 109 | 80-120 | | | |
| Barium | 547 | 0.50 | 10 | " | 500 | | 109 | 80-120 | | | |
| Arsenic | 530 | 1.3 | 5.0 | " | 500 | | 106 | 80-120 | | | |
| Beryllium | 53.5 | 0.89 | 4.0 | " | 50.0 | | 107 | 80-120 | | | |
| Cadmium | 54.6 | 0.13 | 0.50 | " | 50.0 | | 109 | 80-120 | | | |
| Chromium | 550 | 0.65 | 10 | " | 500 | | 110 | 80-120 | | | |
| Copper | 525 | 0.48 | 10 | " | 500 | | 105 | 80-120 | | | |
| Lead | 533 | 0.21 | 3.0 | " | 500 | | 107 | 80-120 | | | |
| Nickel | 557 | 0.48 | 10 | " | 500 | | 111 | 80-120 | | | |
| Selenium | 519 | 1.4 | 5.0 | " | 500 | | 104 | 80-120 | | | |
| Silver | 52.1 | 0.12 | 1.0 | " | 50.0 | | 104 | 80-120 | | | |
| Thallium | 533 | 0.23 | 2.0 | " | 500 | | 107 | 80-120 | | | |
| Zinc | 549 | 2.8 | 30 | " | 500 | | 110 | 80-120 | | | |
| **Matrix Spike (2080592-MS1)** | | **Source: P208284-01** | | | Prepared: 08/30/02 Analyzed: 09/05/02 | | | | | | |
| Antimony | 544 | 0.55 | 5.0 | ug/l | 500 | 1.5 | 108 | 80-120 | | | |
| Barium | 565 | 0.50 | 10 | " | 500 | 23 | 108 | 80-120 | | | |
| Arsenic | 534 | 1.3 | 5.0 | " | 500 | 3.8 | 106 | 80-120 | | | |
| Beryllium | 54.3 | 0.89 | 4.0 | " | 50.0 | ND | 109 | 80-120 | | | |
| Cadmium | 53.8 | 0.13 | 0.50 | " | 50.0 | 0.83 | 106 | 80-120 | | | |
| Chromium | 562 | 0.65 | 10 | " | 500 | 13 | 110 | 80-120 | | | |
| Copper | 521 | 0.48 | 10 | " | 500 | 23 | 100 | 80-120 | | | |
| Lead | 529 | 0.21 | 3.0 | " | 500 | 8.6 | 104 | 80-120 | | | |
| Nickel | 534 | 0.48 | 10 | " | 500 | 8.2 | 105 | 80-120 | | | |
| Selenium | 510 | 1.4 | 5.0 | " | 500 | 2.2 | 102 | 80-120 | | | |
| Silver | 50.8 | 0.12 | 1.0 | " | 50.0 | 0.17 | 101 | 80-120 | | | |
| Thallium | 526 | 0.23 | 2.0 | " | 500 | ND | 105 | 80-120 | | | |
| Zinc | 648 | 2.8 | 30 | " | 500 | 130 | 104 | 80-120 | | | |

## Notes and Definitions

| | |
|---|---|
| HT-04 | This sample was analyzed beyond the EPA recommended holding time. The results may still be useful for their intended purpose. |
| J | Estimated value. |
| DET | Analyte DETECTED |
| ND | Analyte NOT DETECTED at or above the reporting limit |
| NR | Not Reported |
| dry | Sample results reported on a dry weight basis |
| RPD | Relative Percent Difference |

# Chain of Custody

**Environet**
2850 Paa Street, Suite 212, Honolulu, HI 96819
Ph: (808) 833-225 Fax: (808) 833-2231

Project Name/Number: Saipan AER F01009.

Sampler(s) Signature: Matt Neal

| Sample Identification Number | Date | Time | Priority Pollutant Metals | Barium | | No. of Containers |
|---|---|---|---|---|---|---|
| F01009SW06 | 8/12/02 | 08:12 | X | X | P208284-01 | 1 |
| F01009SW 11 | \| | 08:16 | \| | \| | -02 | 1 |
| F01009SW14 | \| | 08:21 | \| | \| | -03 | 1 |
| F01009SW Dai Ichi. | | | X | X | -04 | |
| DRAIN 4 | 8/12/02 | 8:18 | X | X | -05 | 1 |
| DRAIN 6 | 8/12/02 | 8:35 | X | X | -06 | 1 |
| DRAIN 11 | 8/12/02 | 846 | X | X | -07 | 1 |
| DRAIN 4 | 7/29/02 | 2012 | X | X | -08 | 1 |
| DRAIN 6 | 7/29/02 | 2023 | X | X | -09 | 1 |
| DRAIN 11 | 7/29/02 | 2039 | X | X | -10 | 1 |
| HAFA ADAI HOTEL. | 7/29/02 | 2050 | X | X | -11 | 1 |

COOLER CUSTODY SEALS INTACT ☐
NOT INTACT ☐
COOLER TEMPERATURE 6.0 °C

Total No. of Containers:

Special Instructions:
All Samples Tested For 13 priority pollutants plus barium
please give estimated "J" flagged values for low level detections

| | | | | | |
|---|---|---|---|---|---|
| Relinquished by: Matt Neal AGS. | Date: 8/14/02 | Time: 1630 | Received by: | Date: 8/16/02 | Time: 1040 |
| Relinquished by: | Date: | Time: | Received by: | Date: | Time: |
| Relinquished by: | Date: | Time: | Received by Laboratory: | Date: | Time: |

Sequoia
Analytical

1455 McDowell Blvd. North, Ste. D
Petaluma, CA 94954
(707) 792-1865
FAX (707) 792-0342
www.sequoialabs.com

January 27 , 2003

Matt Neal
Environet, Inc.
2850 Paa Street, Suite 212
Honolulu, HI 96819
RE: Saipan AES / P212376

Enclosed are the results of analyses for samples received by the laboratory on 12/19/02. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Angelee Cari

Angelee Cari
Project Manager

CA ELAP Certificate Number 2374

|  |  |  |
|---|---|---|
| Environet, Inc.<br>2850 Paa Street, Suite 212<br>Honolulu HI, 96819 | Project: Saipan AES<br>Project Number: F01009<br>Project Manager: Matt Neal | P212376<br>**Reported:**<br>01/27/03 12:02 |

## ANALYTICAL REPORT FOR SAMPLES

| Sample ID | Laboratory ID | Matrix | Date Sampled | Date Received |
|---|---|---|---|---|
| Drain 4 | P212376-01 | Water | 10/07/02 10:32 | 12/19/02 12:30 |
| Drain 6 | P212376-02 | Water | 10/07/02 10:44 | 12/19/02 12:30 |
| Drain 11 | P212376-03 | Water | 10/07/02 10:52 | 12/19/02 12:30 |
| Drain 4 | P212376-04 | Water | 12/04/02 10:03 | 12/19/02 12:30 |
| Drain 6 | P212376-05 | Water | 12/04/02 10:11 | 12/19/02 12:30 |
| HAFA ADAI HOTEL | P212376-06 | Water | 12/04/02 10:32 | 12/19/02 12:30 |
| DAI ICMI HOTEL | P212376-07 | Water | 12/04/02 10:40 | 12/19/02 12:30 |

| | | |
|---|---|---|
| Environet, Inc.<br>2850 Paa Street, Suite 212<br>Honolulu HI, 96819 | Project: Saipan AES<br>Project Number: F01009<br>Project Manager: Matt Neal | P212376<br>**Reported:**<br>01/27/03 12:02 |

## Total Metals by EPA 6000/7000 Series Methods
## Sequoia Analytical - Petaluma

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Drain 4 (P212376-01) Water Sampled: 10/07/02 10:32 Received: 12/19/02 12:30** | | | | | | | | | | |
| **Barium** | **27** | 0.50 | 10 | ug/l | 1 | 2120840 | 12/31/02 | 01/02/03 | EPA 6020 | |
| **Mercury** | **0.048** | 0.0070 | 0.20 | " | " | 2120641 | 01/02/03 | 01/03/03 | EPA 7470A | J, HT-05 |
| **Antimony** | **2.2** | 0.55 | 5.0 | " | " | 2120840 | 12/31/02 | 01/02/03 | EPA 6020 | J |
| Arsenic | ND | 1.3 | 5.0 | " | " | " | " | 01/06/03 | " | |
| Beryllium | ND | 0.89 | 4.0 | " | " | " | " | 01/02/03 | " | |
| **Cadmium** | **2.1** | 0.13 | 0.50 | " | " | " | " | " | " | |
| **Chromium** | **17** | 0.65 | 10 | " | " | " | " | " | " | |
| **Copper** | **33** | 0.48 | 10 | " | " | " | " | " | " | |
| **Lead** | **15** | 0.21 | 3.0 | " | " | " | " | " | " | |
| **Nickel** | **15** | 0.48 | 10 | " | " | " | " | " | " | |
| **Selenium** | **2.4** | 1.4 | 5.0 | " | " | " | " | " | " | J |
| Silver | ND | 0.12 | 1.0 | " | " | " | " | " | " | |
| Thallium | ND | 0.23 | 2.0 | " | " | " | " | " | " | |
| **Zinc** | **170** | 2.8 | 20 | " | " | " | " | 01/06/03 | " | |
| **Drain 6 (P212376-02) Water Sampled: 10/07/02 10:44 Received: 12/19/02 12:30** | | | | | | | | | | |
| **Barium** | **17** | 0.50 | 10 | ug/l | 1 | 2120840 | 12/31/02 | 01/02/03 | EPA 6020 | |
| **Mercury** | **0.017** | 0.0070 | 0.20 | " | " | 2120641 | 01/02/03 | 01/03/03 | EPA 7470A | J, HT-05 |
| **Antimony** | **1.2** | 0.55 | 5.0 | " | " | 2120840 | 12/31/02 | 01/02/03 | EPA 6020 | J |
| Arsenic | ND | 1.3 | 5.0 | " | " | " | " | 01/06/03 | " | |
| Beryllium | ND | 0.89 | 4.0 | " | " | " | " | 01/02/03 | " | |
| **Cadmium** | **1.3** | 0.13 | 0.50 | " | " | " | " | " | " | |
| **Chromium** | **2.7** | 0.65 | 10 | " | " | " | " | " | " | J |
| **Copper** | **18** | 0.48 | 10 | " | " | " | " | " | " | |
| **Lead** | **8.9** | 0.21 | 3.0 | " | " | " | " | " | " | |
| **Nickel** | **6.4** | 0.48 | 10 | " | " | " | " | " | " | J |
| **Selenium** | **3.6** | 1.4 | 5.0 | " | " | " | " | " | " | J |
| Silver | ND | 0.12 | 1.0 | " | " | " | " | " | " | |
| Thallium | ND | 0.23 | 2.0 | " | " | " | " | " | " | |
| **Zinc** | **100** | 2.8 | 20 | " | " | " | " | 01/06/03 | " | |

| | | |
|---|---|---|
| Environet, Inc.<br>2850 Paa Street, Suite 212<br>Honolulu HI, 96819 | Project: Saipan AES<br>Project Number: F01009<br>Project Manager: Matt Neal | P212376<br>**Reported:**<br>01/27/03 12:02 |

## Total Metals by EPA 6000/7000 Series Methods
## Sequoia Analytical - Petaluma

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Drain 11 (P212376-03) Water Sampled: 10/07/02 10:52 Received: 12/19/02 12:30** | | | | | | | | | | |
| **Barium** | **26** | 0.50 | 10 | ug/l | 1 | 2120840 | 12/31/02 | 01/02/03 | EPA 6020 | |
| **Mercury** | **0.026** | 0.0070 | 0.20 | " | " | 2120641 | 01/02/03 | 01/03/03 | EPA 7470A | J, HT-05 |
| **Antimony** | **4.6** | 0.55 | 5.0 | " | " | 2120840 | 12/31/02 | 01/02/03 | EPA 6020 | J |
| Arsenic | ND | 1.3 | 5.0 | " | " | " | " | 01/06/03 | " | |
| Beryllium | ND | 0.89 | 4.0 | " | " | " | " | 01/02/03 | " | |
| **Cadmium** | **2.2** | 0.13 | 0.50 | " | " | " | " | " | " | |
| **Chromium** | **28** | 0.65 | 10 | " | " | " | " | " | " | |
| **Copper** | **71** | 0.48 | 10 | " | " | " | " | " | " | |
| **Lead** | **40** | 0.21 | 3.0 | " | " | " | " | " | " | |
| **Nickel** | **14** | 0.48 | 10 | " | " | " | " | " | " | |
| Selenium | ND | 1.4 | 5.0 | " | " | " | " | " | " | |
| Silver | ND | 0.12 | 1.0 | " | " | " | " | " | " | |
| Thallium | ND | 0.23 | 2.0 | " | " | " | " | " | " | |
| **Zinc** | **160** | 2.8 | 20 | " | " | " | " | 01/06/03 | " | |
| **Drain 4 (P212376-04) Water Sampled: 12/04/02 10:03 Received: 12/19/02 12:30** | | | | | | | | | | |
| **Barium** | **74** | 0.50 | 10 | ug/l | 1 | 2120840 | 12/31/02 | 01/03/03 | EPA 6020 | |
| **Mercury** | **0.15** | 0.0070 | 0.20 | " | " | 2120641 | 01/02/03 | 01/03/03 | EPA 7470A | J, HT-04 |
| **Antimony** | **3.3** | 0.55 | 5.0 | " | " | 2120840 | 12/31/02 | 01/03/03 | EPA 6020 | J |
| **Arsenic** | **11** | 1.3 | 5.0 | " | " | " | " | 01/07/03 | " | |
| Beryllium | ND | 0.89 | 4.0 | " | " | " | " | 01/03/03 | " | |
| **Cadmium** | **5.2** | 0.13 | 0.50 | " | " | " | " | " | " | |
| **Chromium** | **40** | 0.65 | 10 | " | " | " | " | " | " | |
| **Copper** | **57** | 0.48 | 10 | " | " | " | " | " | " | |
| **Lead** | **36** | 0.21 | 3.0 | " | " | " | " | " | " | |
| **Nickel** | **51** | 0.48 | 10 | " | " | " | " | " | " | |
| **Selenium** | **6.1** | 1.4 | 5.0 | " | " | " | " | " | " | |
| Silver | ND | 0.12 | 1.0 | " | " | " | " | " | " | |
| **Thallium** | **0.44** | 0.23 | 2.0 | " | " | " | " | " | " | J |
| **Zinc** | **290** | 2.8 | 20 | " | " | " | " | 01/07/03 | " | |

| | | |
|---|---|---|
| Environet, Inc.<br>2850 Paa Street, Suite 212<br>Honolulu HI, 96819 | Project: Saipan AES<br>Project Number: F01009<br>Project Manager: Matt Neal | P212376<br>**Reported:**<br>01/27/03 12:02 |

## Total Metals by EPA 6000/7000 Series Methods
## Sequoia Analytical - Petaluma

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Drain 6 (P212376-05) Water Sampled: 12/04/02 10:11 Received: 12/19/02 12:30** | | | | | | | | | | |
| **Barium** | **14** | 0.50 | 10 | ug/l | 1 | 2120840 | 12/31/02 | 01/03/03 | EPA 6020 | |
| **Mercury** | **0.015** | 0.0070 | 0.20 | " | " | 2120641 | 01/02/03 | 01/03/03 | EPA 7470A | J, HT-04 |
| **Antimony** | **1.2** | 0.55 | 5.0 | " | " | 2120840 | 12/31/02 | 01/03/03 | EPA 6020 | J |
| Arsenic | ND | 1.3 | 5.0 | " | " | " | " | 01/07/03 | " | |
| Beryllium | ND | 0.89 | 4.0 | " | " | " | " | 01/03/03 | " | |
| **Cadmium** | **1.2** | 0.13 | 0.50 | " | " | " | " | " | " | |
| **Chromium** | **2.0** | 0.65 | 10 | " | " | " | " | " | " | J |
| **Copper** | **11** | 0.48 | 10 | " | " | " | " | " | " | |
| **Lead** | **4.0** | 0.21 | 3.0 | " | " | " | " | " | " | |
| **Nickel** | **4.5** | 0.48 | 10 | " | " | " | " | " | " | J |
| Selenium | ND | 1.4 | 5.0 | " | " | " | " | " | " | |
| Silver | ND | 0.12 | 1.0 | " | " | " | " | " | " | |
| Thallium | ND | 0.23 | 2.0 | " | " | " | " | " | " | |
| **Zinc** | **64** | 2.8 | 20 | " | " | " | " | 01/07/03 | " | |
| **HAFA ADAI HOTEL (P212376-06) Water Sampled: 12/04/02 10:32 Received: 12/19/02 12:30** | | | | | | | | | | |
| **Barium** | **11** | 0.50 | 10 | ug/l | 1 | 2120840 | 12/31/02 | 01/03/03 | EPA 6020 | |
| Mercury | ND | 0.0070 | 0.20 | " | " | 2120641 | 01/02/03 | 01/03/03 | EPA 7470A | HT-04 |
| **Antimony** | **0.85** | 0.55 | 5.0 | " | " | 2120840 | 12/31/02 | 01/03/03 | EPA 6020 | J |
| **Arsenic** | **91** | 2.7 | 10 | " | 2 | " | " | 01/24/03 | " | |
| Beryllium | ND | 0.89 | 4.0 | " | 1 | " | " | 01/03/03 | " | |
| **Cadmium** | **1.1** | 0.13 | 0.50 | " | " | " | " | " | " | |
| Chromium | ND | 0.65 | 10 | " | " | " | " | " | " | |
| **Copper** | **14** | 0.48 | 10 | " | " | " | " | " | " | |
| **Lead** | **0.69** | 0.21 | 3.0 | " | " | " | " | " | " | J |
| **Nickel** | **27** | 0.48 | 10 | " | " | " | " | " | " | |
| Selenium | ND | 1.4 | 5.0 | " | " | " | " | " | " | |
| Silver | ND | 0.12 | 1.0 | " | " | " | " | " | " | |
| Thallium | ND | 0.23 | 2.0 | " | " | " | " | " | " | |
| **Zinc** | **69** | 2.8 | 20 | " | " | " | " | 01/07/03 | " | |

## Total Metals by EPA 6000/7000 Series Methods
## Sequoia Analytical - Petaluma

**DAI ICMI HOTEL (P212376-07) Water Sampled: 12/04/02 10:40 Received: 12/19/02 12:30**

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **Barium** | **14** | 0.50 | 10 | ug/l | 1 | 2120840 | 12/31/02 | 01/03/03 | EPA 6020 | |
| **Mercury** | **0.020** | 0.0070 | 0.20 | " | " | 2120641 | 01/02/03 | 01/03/03 | EPA 7470A | HT-04, J |
| **Antimony** | **0.93** | 0.55 | 5.0 | " | " | 2120840 | 12/31/02 | 01/03/03 | EPA 6020 | J |
| **Arsenic** | **110** | 2.7 | 10 | " | 2 | " | " | 01/24/03 | " | |
| Beryllium | ND | 0.89 | 4.0 | " | 1 | " | " | 01/03/03 | " | |
| **Cadmium** | **0.67** | 0.13 | 0.50 | " | " | " | " | " | " | |
| Chromium | ND | 0.65 | 10 | " | " | " | " | " | " | |
| **Copper** | **22** | 0.48 | 10 | " | " | " | " | " | " | |
| **Lead** | **0.95** | 0.21 | 3.0 | " | " | " | " | " | " | J |
| **Nickel** | **31** | 0.48 | 10 | " | " | " | " | " | " | |
| **Selenium** | **130** | 1.4 | 5.0 | " | " | " | " | " | " | |
| Silver | ND | 0.12 | 1.0 | " | " | " | " | " | " | |
| Thallium | ND | 0.23 | 2.0 | " | " | " | " | " | " | |
| **Zinc** | **82** | 2.8 | 20 | " | " | " | " | 01/07/03 | " | |

|  |  |  |
|---|---|---|
| Environet, Inc.<br>2850 Paa Street, Suite 212<br>Honolulu HI, 96819 | Project: Saipan AES<br>Project Number: F01009<br>Project Manager: Matt Neal | P212376<br>**Reported:**<br>01/27/03 12:02 |

## Total Metals by EPA 6000/7000 Series Methods - Quality Control
## Sequoia Analytical - Petaluma

| Analyte | Result | MDL | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 2120641 - EPA 7470A** | | | | | | | | | | | |
| **Blank (2120641-BLK1)** | | | | | Prepared: 01/02/03 Analyzed: 01/03/03 | | | | | | |
| Mercury | ND | 0.0070 | 0.20 | ug/l | | | | | | | |
| **Laboratory Control Sample (2120641-BS1)** | | | | | Prepared: 01/02/03 Analyzed: 01/03/03 | | | | | | |
| Mercury | 1.71 | 0.0070 | 0.20 | ug/l | 1.60 | | 107 | 80-120 | | | |
| **Matrix Spike (2120641-MS1)** | | **Source: P212372-02** | | | Prepared: 01/02/03 Analyzed: 01/03/03 | | | | | | |
| Mercury | 1.32 | 0.0070 | 0.20 | ug/l | 1.60 | 0.065 | 78 | 80-120 | | | QM-07 |
| **Matrix Spike (2120641-MS2)** | | **Source: P212415-01** | | | Prepared: 01/02/03 Analyzed: 01/03/03 | | | | | | |
| Mercury | 1.63 | 0.0070 | 0.20 | ug/l | 1.60 | 0.035 | 100 | 80-120 | | | |
| **Matrix Spike Dup (2120641-MSD1)** | | **Source: P212372-02** | | | Prepared: 01/02/03 Analyzed: 01/03/03 | | | | | | |
| Mercury | 1.40 | 0.0070 | 0.20 | ug/l | 1.60 | 0.065 | 83 | 80-120 | 6 | 20 | |
| **Matrix Spike Dup (2120641-MSD2)** | | **Source: P212415-01** | | | Prepared: 01/02/03 Analyzed: 01/03/03 | | | | | | |
| Mercury | 1.69 | 0.0070 | 0.20 | ug/l | 1.60 | 0.035 | 103 | 80-120 | 4 | 20 | |
| **Batch 2120840 - EPA 3010A** | | | | | | | | | | | |
| **Blank (2120840-BLK1)** | | | | | Prepared: 12/31/02 Analyzed: 01/02/03 | | | | | | |
| Antimony | ND | 0.55 | 5.0 | ug/l | | | | | | | |
| Barium | 0.883 | 0.50 | 10 | " | | | | | | | J |
| Arsenic | ND | 1.3 | 5.0 | " | | | | | | | |
| Beryllium | ND | 0.89 | 4.0 | " | | | | | | | |
| Cadmium | 0.379 | 0.13 | 0.50 | " | | | | | | | J |
| Chromium | 5.05 | 0.65 | 10 | " | | | | | | | J |
| Copper | 5.58 | 0.48 | 10 | " | | | | | | | J |
| Lead | ND | 0.21 | 3.0 | " | | | | | | | |
| Nickel | 2.07 | 0.48 | 10 | " | | | | | | | J |
| Selenium | ND | 1.4 | 5.0 | " | | | | | | | |
| Silver | ND | 0.12 | 1.0 | " | | | | | | | |
| Thallium | ND | 0.23 | 2.0 | " | | | | | | | |
| Zinc | 6.26 | 2.8 | 20 | " | | | | | | | J |

| | | |
|---|---|---|
| Environet, Inc.<br>2850 Paa Street, Suite 212<br>Honolulu HI, 96819 | Project: Saipan AES<br>Project Number: F01009<br>Project Manager: Matt Neal | P212376<br>**Reported:**<br>01/27/03 12:02 |

## Total Metals by EPA 6000/7000 Series Methods - Quality Control
## Sequoia Analytical - Petaluma

**Batch 2120840 - EPA 3010A**

**Laboratory Control Sample (2120840-BS1)** Prepared: 12/31/02 Analyzed: 01/03/03

| Analyte | Result | MDL | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Antimony | 471 | 0.55 | 5.0 | ug/l | 500 | | 94 | 80-120 | | | |
| Barium | 463 | 0.50 | 10 | " | 500 | | 93 | 80-120 | | | |
| Arsenic | 492 | 1.3 | 5.0 | " | 500 | | 98 | 80-120 | | | |
| Beryllium | 46.9 | 0.89 | 4.0 | " | 50.0 | | 94 | 80-120 | | | |
| Cadmium | 52.8 | 0.13 | 0.50 | " | 50.0 | | 106 | 80-120 | | | |
| Chromium | 506 | 0.65 | 10 | " | 500 | | 101 | 80-120 | | | |
| Copper | 451 | 0.48 | 10 | " | 500 | | 90 | 80-120 | | | |
| Lead | 524 | 0.21 | 3.0 | " | 500 | | 105 | 80-120 | | | |
| Nickel | 489 | 0.48 | 10 | " | 500 | | 98 | 80-120 | | | |
| Selenium | 586 | 1.4 | 5.0 | " | 500 | | 117 | 80-120 | | | |
| Silver | 51.4 | 0.12 | 1.0 | " | 50.0 | | 103 | 80-120 | | | |
| Thallium | 532 | 0.23 | 2.0 | " | 500 | | 106 | 80-120 | | | |
| Zinc | 527 | 2.8 | 20 | " | 500 | | 105 | 80-120 | | | |

**Matrix Spike (2120840-MS1)** Source: P212349-03 Prepared: 12/31/02 Analyzed: 01/03/03

| Analyte | Result | MDL | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Antimony | 472 | 0.55 | 5.0 | ug/l | 500 | 1.0 | 94 | 80-120 | | | |
| Barium | 588 | 0.50 | 10 | " | 500 | 170 | 84 | 80-120 | | | |
| Arsenic | 495 | 1.3 | 5.0 | " | 500 | 6.3 | 98 | 80-120 | | | |
| Beryllium | 44.6 | 0.89 | 4.0 | " | 50.0 | ND | 89 | 80-120 | | | |
| Cadmium | 56.6 | 0.13 | 0.50 | " | 50.0 | 0.79 | 112 | 80-120 | | | |
| Chromium | 498 | 0.65 | 10 | " | 500 | 2.2 | 99 | 80-120 | | | |
| Copper | 399 | 0.48 | 10 | " | 500 | ND | 80 | 80-120 | | | |
| Lead | 517 | 0.21 | 3.0 | " | 500 | ND | 103 | 80-120 | | | |
| Nickel | 424 | 0.48 | 10 | " | 500 | 4.8 | 84 | 80-120 | | | |
| Selenium | 610 | 1.4 | 5.0 | " | 500 | 1.4 | 122 | 80-120 | | | QM-07 |
| Silver | 50.7 | 0.12 | 1.0 | " | 50.0 | ND | 101 | 80-120 | | | |
| Thallium | 519 | 0.23 | 2.0 | " | 500 | ND | 104 | 80-120 | | | |
| Zinc | 540 | 2.8 | 20 | " | 500 | 6.6 | 107 | 80-120 | | | |

| | | |
|---|---|---|
| Environet, Inc.<br>2850 Paa Street, Suite 212<br>Honolulu HI, 96819 | Project: Saipan AES<br>Project Number: F01009<br>Project Manager: Matt Neal | P212376<br>**Reported:**<br>01/27/03 12:02 |

## Total Metals by EPA 6000/7000 Series Methods - Quality Control
## Sequoia Analytical - Petaluma

| Analyte | Result | MDL | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 2120840 - EPA 3010A** | | | | | | | | | | | |
| **Matrix Spike Dup (2120840-MSD1)** | | **Source: P212349-03** | | | Prepared: 12/31/02 Analyzed: 01/03/03 | | | | | | |
| Antimony | 484 | 0.55 | 5.0 | ug/l | 500 | 1.0 | 97 | 80-120 | 3 | 20 | |
| Barium | 628 | 0.50 | 10 | " | 500 | 170 | 92 | 80-120 | 7 | 20 | |
| Arsenic | 493 | 1.3 | 5.0 | " | 500 | 6.3 | 97 | 80-120 | 0.4 | 20 | |
| Beryllium | 46.2 | 0.89 | 4.0 | " | 50.0 | ND | 92 | 80-120 | 4 | 20 | |
| Cadmium | 53.8 | 0.13 | 0.50 | " | 50.0 | 0.79 | 106 | 80-120 | 5 | 20 | |
| Chromium | 499 | 0.65 | 10 | " | 500 | 2.2 | 99 | 80-120 | 0.2 | 20 | |
| Copper | 433 | 0.48 | 10 | " | 500 | ND | 87 | 80-120 | 8 | 20 | |
| Lead | 502 | 0.21 | 3.0 | " | 500 | ND | 100 | 80-120 | 3 | 20 | |
| Nickel | 475 | 0.48 | 10 | " | 500 | 4.8 | 94 | 80-120 | 11 | 20 | |
| Selenium | 572 | 1.4 | 5.0 | " | 500 | 1.4 | 114 | 80-120 | 6 | 20 | |
| Silver | 49.3 | 0.12 | 1.0 | " | 50.0 | ND | 99 | 80-120 | 3 | 20 | |
| Thallium | 510 | 0.23 | 2.0 | " | 500 | ND | 102 | 80-120 | 2 | 20 | |
| Zinc | 517 | 2.8 | 20 | " | 500 | 6.6 | 102 | 80-120 | 4 | 20 | |

| | | |
|---|---|---|
| Environet, Inc.<br>2850 Paa Street, Suite 212<br>Honolulu HI, 96819 | Project: Saipan AES<br>Project Number: F01009<br>Project Manager: Matt Neal | P212376<br>**Reported:**<br>01/27/03 12:02 |

## Notes and Definitions

| | |
|---|---|
| HT-04 | This sample was analyzed beyond the EPA recommended holding time. The results may still be useful for their intended purpose. |
| HT-05 | This sample was requested to be analyzed beyond the EPA recommended holding time. The results may be useful for their intended purpose. |
| J | Estimated value. |
| QM-07 | The spike recovery was outside control limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery. |
| DET | Analyte DETECTED |
| ND | Analyte NOT DETECTED at or above the reporting limit |
| NR | Not Reported |
| dry | Sample results reported on a dry weight basis |
| RPD | Relative Percent Difference |

# Chain of Custody

Page 1 of 1

## Environet, Inc.

2850 Paa Street, Suite 212, Honolulu, HI 96819
Ph: (808) 833-2225 Fax: (808) 833-2231

Project Name/Number: SAIPAN AER E01009

Sampler(s) Name (Print): MAX SIMIAN

Sampler(s) Signature:

| Item No. | Sample Identification Number | Date | Time | Matrix: Soil | Matrix: Water | Matrix: Other | Type: Grab | Type: Comp | Type: Other | Analyses Required: PRIORITY POLLUTANT METALS | Barium | | No. of Containers |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | DRAIN 4 | 10-7-02 | 1032 | | X | | X | | | X | X | P212370-1 | 1 |
| 2 | DRAIN 4 | 10-7-02 | 1044 | | X | | X | | | X | X | -2 | 1 |
| 3 | DRAIN 11 | 10-7-02 | 1052 | | X | | X | | | X | X | -3 | 1 |
| 4 | DRAIN 4 | 12-4-02 | 1003 | | X | | X | | | X | X | -4 | 1 |
| 5 | DRAIN 6 | 12-4-02 | 1011 | | X | | X | | | X | X | -5 | 1 |
| 6 | HAFA ADAI HOTEL | 12-4-02 | 1032 | | X | | X | | | X | X | -6 | 1 |
| 7 | DAI ICHI HOTEL | 12-4-02 | 1040 | | X | | X | | | X | X | -7 | 1 |
| 8 | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | |
| 11 | | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | | |
| 13 | | | | | | | | | | | | | |
| 14 | | | | | | | | | | | | | |
| 15 | | | | | | | | | | | | | |
| 16 | | | | | | | | | | | | | |
| 17 | | | | | | | | | | | | | |
| 18 | | | | | | | | | | | | | |
| 19 | | | | | | | | | | | | | |
| 20 | | | | | | | | | | | | | |

COOLER CUSTODY SEALS INTACT ☐

NOT INTACT ☐

COOLER TEMPERATURE 5.2 °c

Total No. of Containers (this page) 7

Total No. of Containers in Shipment 7

Special Instructions:
ALL SAMPLES TESTED FOR 13 PRIORITY POLLUTANTS PLUS BARIUM. PLEASE PROVIDE ESTIMATED "J" FLAGGED VALUES FOR LOW LEVEL DETECTIONS.

| Relinquished by (Print/Signature): | Date | Time | Received by (Print/Signature): | Date | Time |
|---|---|---|---|---|---|
| (AGS) | 12-17-02 | 1700 | | | |

| Relinquished by (Print/Signature): | Date | Time | Received by (Print/Signature): | Date | Time |
|---|---|---|---|---|---|
| | | | | | |

| Relinquished by (Print/Signature): | Date | Time | Received by Laboratory (Print/Signature): | Date | Time |
|---|---|---|---|---|---|
| | | | SAguillon | 12/19/02 | 1230 |

## *C.2*
## *Lagoon Sediment Physical and Chemical Parameters*

# APPENDIX C.2

# LAGOON SEDIMENT PHYSICAL AND CHEMICAL PARAMETERS

Increasing development along the shoreline of Saipan Lagoon has led to an increase in the introduction of potentially toxic pollutants to the lagoon. The Water and Environmental Research Institute of the Western Pacific (WERI) initiated a pollution monitoring and assessment program for the northern half of Saipan Lagoon (Tanapag Lagoon) in 1997 and identified heavy metals as the contaminants of primary concern in this area (Denton et al., 2009; 2008; 2006; 2001).

Sediments are often an accumulation point for potentially toxic organic and inorganic chemicals introduced into an aquatic environment (Ingersoll, 1995). Analytical data derived from sediment samples is often more useful than that from water samples because of the more immobile nature of sediment. Analysis of sediments can yield data that lends valuable insight as to the nature of contaminants entering the aquatic ecosystem from onshore pollutant sources.

As part of an effort to characterize the general distribution and abundance of pollutants in sediments in the study area, a total of 18 surface sediment samples were collected from the lagoon bottom in September 2002. Samples were collected from six transects extending from nearshore to the outer lagoon, stretching the entire length of the study area. The starting point for each transect was established at storm drains 1 (Dai Ichi Hotel), 4 (13 Fisherman Memorial), 7 (Gold Beach Hotel), 11 (China House Restaurant), and 13 (Quartermaster Road) located along the shoreline of the study area as well as a wetland location adjacent to storm drain 14 (Figure C.2).

Each transect included a sample location within the nearshore *Enhalus* beds, within the nearshore *Halodule* band, and within off-shore *Enhalus* beds located beyond the channel. These sampling locations were estimated to be at 250 meters (m), 500 m, and 1000 m from shore. Samples consisted of a composite of surface sediments collected from three discrete locations around each transect point. Each sediment sample was analyzed for priority pollutant metals, polychlorinated biphenyls (PCBs), and polycyclic aromatic hydrocarbons (PAHs), as well as specific PCB congeners known to be found north of the study area in the Tanapag area during the WERI study.

Table C.3, Table C.4, Table C.5, and Table C.6 summarize analytical results for metals, PCBs, PAHs, and PCB congeners, respectively. The final two numerals of each sample number indicate the specific location of the sample. The first of the final two numerals indicates which of the six transects was sampled. The second numeral indicates whether the sample was collected from the nearshore *Enhalus* bed (1), the nearshore *Halodule* band (2), or the seaward, off-shore *Enhalus* bed (3). Laboratory analytical reports for the sediment samples are included at the end of this report.

As a non-regulatory comparison, analytical results of sediment samples were compared to the EPA regional screening levels (RSLs) for residential soil (EPA, 2012). Overall metals concentrations detected in lagoon sediment were low, but analytical results indicate that in general, sediment collected from the nearshore contained slightly higher concentrations of metals than those samples collected from mid to off-shore locations. Concentrations of arsenic exceeded the EPA RSL for residential soil in some or all of the locations for all six transects. Concentrations of arsenic detected in samples ranged from 5.1 to 12 milligrams per kilogram (mg/kg), compared to the residential RSL of 0.39 mg/kg.

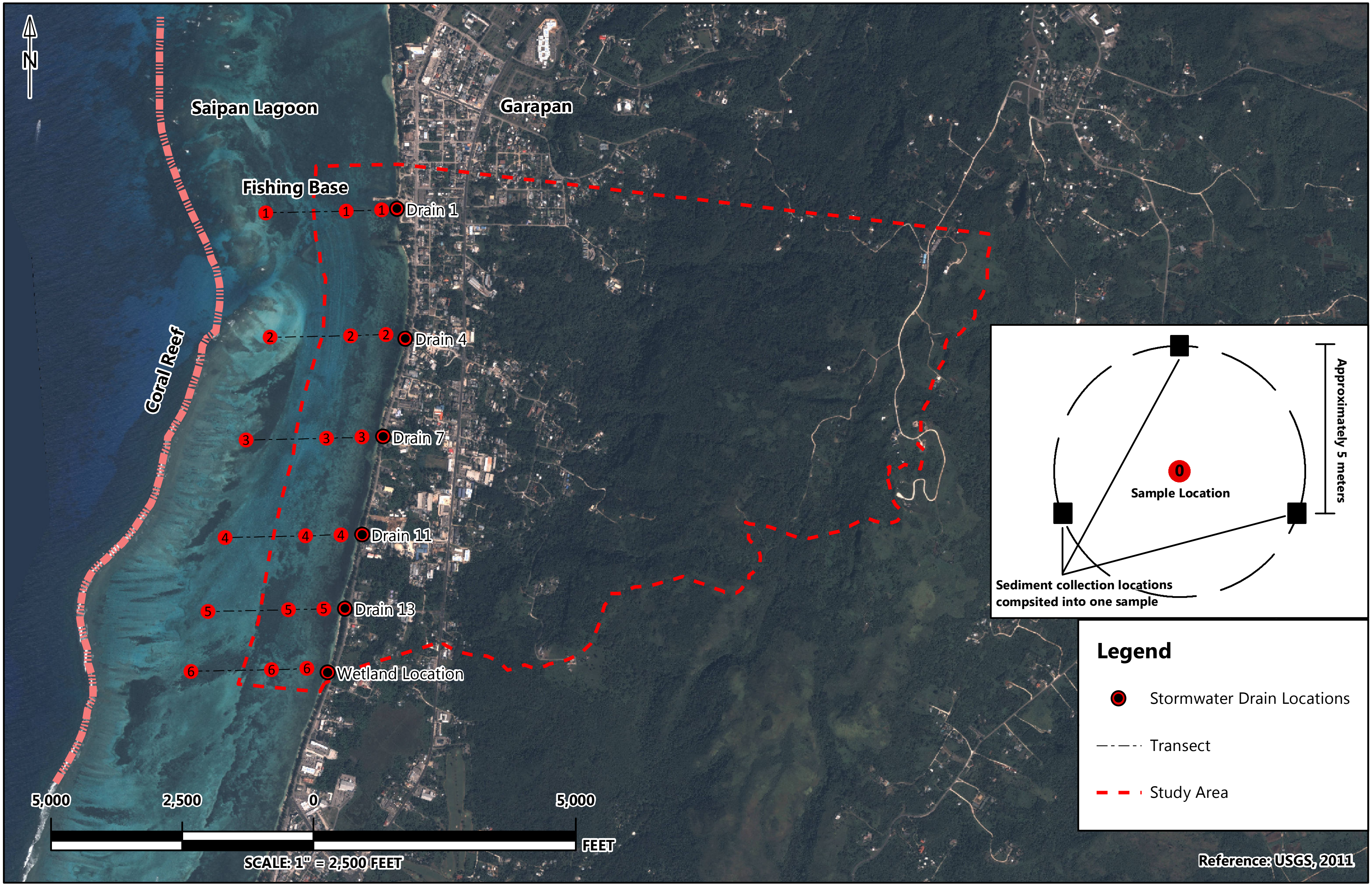
PCBs, PAHs, and PCB congeners were not detected in any of the samples above the laboratory reporting limits. All laboratory reporting limits were below the EPA RSLs except for benzo(a)anthracene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene.

More recent data characterizing the sediment composition of Saipan Lagoon are available from a study conducted by Denton and Starmer (2009) in which sediment samples for heavy metals analysis were collected from 16 of 22 coastal stormwater discharge points that currently exist along the southern half of the lagoon. Surface sediments were collected at offshore locations at 0 m, 10 m, 25 m, 50 m, 100 m, and 250 m from shore along transect lines perpendicular to the discharge points. Samples were also collected from 500 m and 1,000 m offshore where possible. Geometric means were calculated at each distance and the minimum and maximum concentrations were determined. Table C.7 provides a summary of data collected by Denton and Starmer (2009).

Metals concentrations found in surface sediment samples collected in 2009 were all below the EPA RSL, and were similar to those found in sediment samples collected in 2002. The units for the 2002 data are mg/kg and the 2009 data units are micrograms per gram (µg/g), which are comparable without conversions. There are some differences between the metals concentrations found in 2002 and 2009, however these do not follow any major trends and are not significant enough to draw any conclusions.

The maximum concentration of copper in samples collected at 250 m offshore in 2009 (6.47 µg/g) was higher than the maximum concentration of copper found in samples collected at 250 m offshore in 2002 (1.6 mg/kg). The maximum concentration of mercury in samples collected at 250 m (0.1 µg/g) and 500 m (0.0558 µg/g) offshore in 2009 was also higher than the maximum concentration of mercury in samples collected at 250 m (0.015 mg/kg) and 500 m (0.025 mg/kg) offshore in 2002. In addition, the overall range of chromium detected in all samples collected (i.e., samples collected at 250 m, 500 m, and 1,000 m offshore) in 2002 (4.4 to 8.5 mg/kg) were higher than the range in concentration of chromium found in samples collected at 250 m, 500 m, and 1,000 m offshore during 2009 (1.48 to 3.86 µg/g). The maximum concentration of zinc in samples collected at 500 m (2.9 mg/kg) and 1,000 m (2.1 mg/kg) offshore in 2002 was also higher than those collected at 500 m (0.4 µg/g) and 1,000 m (0.4 µg/g) offshore in 2009. The differences of these metal concentrations detected in 2002 and 2009 are likely due to different sample locations that were included in each study.

The 2009 data collection found the highest levels of metals in sediment samples close to shore, as opposed to those collected further offshore. This is in agreement with findings from the 2002 data collection and appears to support the theory that urban runoff is one of the major contributing sources for metal contamination in the lagoon sediment.



**Environet, Inc.**

| | | | |
|---|---|---|---|
| PROJECT NO.: 1057 | ECOSYSTEM RESTORATION REPORT<br>SAIPAN LAGOON AQUATIC ECOSYSTEM RESTORATION STUDY | FIGURE<br>C.2 |
| DATE: SEPTEMBER 20, 2012 | | |
| DRAWN BY: CB | LAGOON SEDIMENT SAMPLE LOCATIONS<br>SAIPAN, CNMI | |
| REVIEWED BY: MA | | |

## Table C.3: Lagoon Sediment Composite Sample Metals Analytical Summary, 2002

| | **Sample Location** | **GPS** | **Date** | **Time** | **Arsenic** | **Cadmium** | **Chromium** | **Copper** | **Lead** | **Mercury** | **Nickel** | **Selenium** | **Tin** | **Zinc** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **EPA RSL** | | | | **0.39** | **70** | **NL*** | **3,100** | **400** | **10** | **1,500** | **390** | **47,000** | **23,000** |
| Transect 1 | F01009LS1,3 | 0361280, 1682181 | 9/17/02 | 1220 | 14U | 1.4U | 5.5 | 1.4U | 10U | 0.018J | 4.1U | 14U | 29J | 2.1J |
| | F01009LS1,2 | 0361500, 1682134 | 9/17/02 | 1239 | **10J** | 1.5U | 5.3 | 1.5U | 11U | 0.025J | 1.8U | 15U | 25J | 2.3J |
| | F01009LS1,1 | 0361699, 1682071 | 9/17/02 | 1245 | 12U | 1.2U | 6.7 | 1.6 | 9.1U | 0.015J | 3.7U | 12U | 46 | 3.3 |
| Transect 2 | F01009LS2,3 | 0361284, 1680184 | 9/17/02 | 1300 | 13U | 1.3U | 5.6 | 1.3U | 9.8U | 0.0064J | 3.9U | 13U | 22J | 2J |
| | F01009LS2,2 | 0361636, 1680199 | 9/17/02 | 1315 | 13U | 1.3U | 5.8 | 1.3U | 9.7U | 0.0049J | 1.1U | 13U | 61 | 1.6J |
| | F01009LS2,1 | 0361732, 1680202 | 9/17/02 | 1325 | **7.7J** | 1.2U | 4.5 | 1.2U | 9.2U | 0.01J | 1.2J | 12U | 14J | 1.8J |
| Transect 3 | F01009LS3,3 | 0361222, 1679888 | 9/17/02 | 1340 | 13U | 1.3U | 6 | 1.3U | 9.6U | 0.0098J | 3.8U | 13U | 45U | 1J |
| | F01009LS3,2 | 0361574, 1679809 | 9/17/02 | 1350 | 14U | 1.4U | 5.3 | 1.4U | 11U | 0.012J | 1.2J | 14U | 31J | 2.9 |
| | F01009LS3,1 | 0361750, 1679808 | 9/17/02 | 1400 | **6.4J** | 1.2U | 7.3 | 1.6 | 9U | 0.011J | 1J | 12U | 51 | 4 |
| Transect 4 | F01009LS4,3 | 0361079, 1679483 | 9/17/02 | 1415 | **6.4J** | 1.3U | 5.3 | 1.3U | 9.4U | 0.0054J | 3.8U | 13U | 40J | 1.2J |
| | F01009LS4,2 | 0361515, 1679463 | 9/17/02 | 1430 | **5.7J** | 1.3U | 4.6 | 1.3U | 9.7U | 0.005J | 3.9U | 13U | 61 | 1.4J |
| | F01009LS4,1 | 0361669, 1679442 | 9/17/02 | 1445 | **6J** | 1.2U | 7.7 | 1J | 8.9U | 0.0072J | 3.6U | 12U | 19J | 2.6 |
| Transect 5 | F01009LS5,3 | 0360676, 1678799 | 9/17/02 | 1500 | **5.1J** | 1.2U | 4.5 | 1.2U | 9.2U | 0.004J | 1.1J | 12U | 46 | 0.75J |
| | F01009LS5,2 | 0361190, 1678636 | 9/17/02 | 1510 | 8.3 | 1.1U | 5.1 | 1.1U | 8.5U | 0.0071J | 3.4U | 11U | 48 | 0.97J |
| | F01009LS5,1 | 0361421, 1678585 | 9/17/02 | 1520 | **12J** | 1.5U | 8.5 | 1.3J | 12U | 0.0087J | 4.6U | 15U | 17J | 2.8J |
| Transect 6 | F01009LS6,3 | 0360315, 1677817 | 9/17/02 | 1540 | 12U | 1.2U | 4.6 | 1.2U | 9.2U | 0.0058J | 3.7U | 5.8U | 27J | 1.5J |
| | F01009LS6,2 | 0360968, 1677575 | 9/17/02 | 1550 | **5.6J** | 1.4U | 4.4 | 1.4U | 10U | 0.0062J | 4.1U | 14U | 64 | 1.7J |
| | F01009LS6,1 | 0361124, 1677509 | 9/17/02 | 1605 | **7.2J** | 1.4U | 5.4 | 1.4 | 10U | 0.0058J | 1.2J | 14U | 66 | 2.4J |

Notes:
All units in mg/kg.
* EPA RSL for total chromium is not listed. RSLs for chromium(III) and chromium (IV) are 120,000 mg/kg and 0.29 mg/kg, respectively.
- EPA RSL (EPA, 2012): US Environmental Protection Agency Regional Screening Levels, Residential Soil, updated May 2012.
- A value followed by “U” indicates that the analyte was not detected at or above the reporting limit.
- “J” indicates estimated value.
- **Bold** values exceed the EPA RSL.

## Table C.4: Lagoon Sediment Composite Sample PCBs Analytical Summary, 2002

| | Sample Location | Date | Time | PCB-1016 | PCB-1221 | PCB-1232 | PCB-1242 | PCB-1248 | PCB-1254 | PCB-1260 |
|---|---|---|---|---|---|---|---|---|---|---|
| | EPA RSL | | | 3.9 | 0.14 | 0.14 | 0.22 | 0.22 | 0.22 | 0.22 |
| Transect 1 | F01009LS1,3 | 9/17/02 | 1220 | 0.045U | 0.045U | 0.045U | 0.045U | 0.045U | 0.045U | 0.045U |
| | F01009LS1,2 | 9/17/02 | 1239 | 0.051U | 0.051U | 0.051U | 0.051U | 0.051U | 0.051U | 0.051U |
| | F01009LS1,1 | 9/17/02 | 1245 | 0.043U | 0.043U | 0.043U | 0.043U | 0.043U | 0.043U | 0.043U |
| Transect 2 | F01009LS2,3 | 9/17/02 | 1300 | 0.043U | 0.043U | 0.043U | 0.043U | 0.043U | 0.043U | 0.043U |
| | F01009LS2,2 | 9/17/02 | 1315 | 0.043U | 0.043U | 0.043U | 0.043U | 0.043U | 0.043U | 0.043U |
| | F01009LS2,1 | 9/17/02 | 1325 | 0.045U | 0.045U | 0.045U | 0.045U | 0.045U | 0.045U | 0.045U |
| Transect 3 | F01009LS3,3 | 9/17/02 | 1340 | 0.045U | 0.045U | 0.045U | 0.045U | 0.045U | 0.045U | 0.045U |
| | F01009LS3,2 | 9/17/02 | 1350 | 0.053U | 0.053U | 0.053U | 0.053U | 0.053U | 0.053U | 0.053U |
| | F01009LS3,1 | 9/17/02 | 1400 | 0.043U | 0.043U | 0.043U | 0.043U | 0.043U | 0.043U | 0.043U |
| Transect 4 | F01009LS4,3 | 9/17/02 | 1415 | 0.044U | 0.044U | 0.044U | 0.044U | 0.044U | 0.044U | 0.044U |
| | F01009LS4,2 | 9/17/02 | 1430 | 0.044U | 0.044U | 0.044U | 0.044U | 0.044U | 0.044U | 0.044U |
| | F01009LS4,1 | 9/17/02 | 1445 | 0.043U | 0.043U | 0.043U | 0.043U | 0.043U | 0.043U | 0.043U |
| Transect 5 | F01009LS5,3 | 9/17/02 | 1500 | 0.042U | 0.042U | 0.042U | 0.042U | 0.042U | 0.042U | 0.042U |
| | F01009LS5,2 | 9/17/02 | 1510 | 0.041U | 0.041U | 0.041U | 0.041U | 0.041U | 0.041U | 0.041U |
| | F01009LS5,1 | 9/17/02 | 1520 | 0.051U | 0.051U | 0.051U | 0.051U | 0.051U | 0.051U | 0.051U |
| Transect 6 | F01009LS6,3 | 9/17/02 | 1540 | 0.045U | 0.045U | 0.045U | 0.045U | 0.045U | 0.045U | 0.045U |
| | F01009LS6,2 | 9/17/02 | 1550 | 0.053U | 0.053U | 0.053U | 0.053U | 0.053U | 0.053U | 0.053U |
| | F01009LS6,1 | 9/17/02 | 1605 | 0.052U | 0.052U | 0.052U | 0.052U | 0.052U | 0.052U | 0.052U |

Notes:
All units in mg/kg.
- EPA RSL (EPA, 2012): US Environmental Protection Agency Regional Screening Levels, Residential Soil, updated May 2012.
- A value followed by “U” indicates that the analyte was not detected at or above the reporting limit.

**Table C.5: Lagoon Sediment Composite Sample PAHs Analytical Summary, 2002**

| | Sample Location | Date | Time | Acenaphthene | Acenaphthylene | Anthracene | Benzo(a)-anthracene | Benzo(b+k)-fluoranthene | Benzo(g,h,i)-pyrene | Benzo(a)-pyrene | Chrysene | Dibenz(a,h)-anthracene | Fluoranthene | Fluorene | Indeno(1,2,3-cd)-pyrene | Naphthalene | Phenanthrene | Pyrene |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **EPA RSL** | | | **3,400** | **NL** | **17,000** | **0.15** | **1.65** | **NL** | **0.015** | **15** | **0.015** | **2,300** | **2,300** | **0.15** | **3.6** | **NL** | **1,700** |
| Transect 1 | F01009LS1,3 | 9/17/02 | 1220 | 0.45U | 0.45U | 0.45U | 0.45U | 0.45U | 0.45U | 0.45U | 0.45U | 0.45U | 0.45U | 0.45U | 0.45U | 0.45U | 0.45U | 0.45U |
| | F01009LS1,2 | 9/17/02 | 1239 | 0.51U | 0.51U | 0.51U | 0.51U | 0.51U | 0.51U | 0.51U | 0.51U | 0.51U | 0.51U | 0.51U | 0.51U | 0.51U | 0.51U | 0.51U |
| | F01009LS1,1 | 9/17/02 | 1245 | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U |
| Transect 2 | F01009LS2,3 | 9/17/02 | 1300 | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U |
| | F01009LS2,2 | 9/17/02 | 1315 | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U |
| | F01009LS2,1 | 9/17/02 | 1325 | 0.45U | 0.45U | 0.45U | 0.45U | 0.45U | 0.45U | 0.45U | 0.45U | 0.45U | 0.45U | 0.45U | 0.45U | 0.45U | 0.45U | 0.45U |
| Transect 3 | F01009LS3,3 | 9/17/02 | 1340 | 0.45U | 0.45U | 0.45U | 0.45U | 0.45U | 0.45U | 0.45U | 0.45U | 0.45U | 0.45U | 0.45U | 0.45U | 0.45U | 0.45U | 0.45U |
| | F01009LS3,2 | 9/17/02 | 1350 | 0.53U | 0.53U | 0.53U | 0.53U | 0.53U | 0.53U | 0.53U | 0.53U | 0.53U | 0.53U | 0.53U | 0.53U | 0.53U | 0.53U | 0.53U |
| | F01009LS3,1 | 9/17/02 | 1400 | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U |
| Transect 4 | F01009LS4,3 | 9/17/02 | 1415 | 0.44U | 0.44U | 0.44U | 0.44U | 0.44U | 0.44U | 0.44U | 0.44U | 0.44U | 0.44U | 0.44U | 0.44U | 0.44U | 0.44U | 0.44U |
| | F01009LS4,2 | 9/17/02 | 1430 | 0.44U | 0.44U | 0.44U | 0.44U | 0.44U | 0.44U | 0.44U | 0.44U | 0.44U | 0.44U | 0.44U | 0.44U | 0.44U | 0.44U | 0.44U |
| | F01009LS4,1 | 9/17/02 | 1445 | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U | 0.43U |
| Transect 5 | F01009LS5,3 | 9/17/02 | 1500 | 0.42U | 0.42U | 0.42U | 0.42U | 0.42U | 0.42U | 0.42U | 0.42U | 0.42U | 0.42U | 0.42U | 0.42U | 0.42U | 0.42U | 0.42U |
| | F01009LS5,2 | 9/17/02 | 1510 | 0.41U | 0.41U | 0.41U | 0.41U | 0.41U | 0.41U | 0.41U | 0.41U | 0.41U | 0.41U | 0.41U | 0.41U | 0.41U | 0.41U | 0.41U |
| | F01009LS5,1 | 9/17/02 | 1520 | 0.51U | 0.51U | 0.51U | 0.51U | 0.51U | 0.51U | 0.51U | 0.51U | 0.51U | 0.51U | 0.51U | 0.51U | 0.51U | 0.51U | 0.51U |
| Transect 6 | F01009LS6,3 | 9/17/02 | 1540 | 0.45U | 0.45U | 0.45U | 0.45U | 0.45U | 0.45U | 0.45U | 0.45U | 0.45U | 0.45U | 0.45U | 0.45U | 0.45U | 0.45U | 0.45U |
| | F01009LS6,2 | 9/17/02 | 1550 | 0.53U | 0.53U | 0.53U | 0.53U | 0.53U | 0.53U | 0.53U | 0.53U | 0.53U | 0.53U | 0.53U | 0.53U | 0.53U | 0.53U | 0.53U |
| | F01009LS6,1 | 9/17/02 | 1605 | 0.52U | 0.52U | 0.52U | 0.52U | 0.52U | 0.52U | 0.52U | 0.52U | 0.52U | 0.52U | 0.52U | 0.52U | 0.52U | 0.52U | 0.52U |

Notes:
All units in mg/kg.
- EPA RSL (EPA, 2012): US Environmental Protection Agency Regional Screening Levels, Residential Soil, updated May 2012.
- A value followed by “U” indicates that the analyte was not detected at or above the reporting limit.

**Table C.6: Lagoon Sediment Composite Sample PCB Congeners Analytical Summary, 2002**

| | | | PCB Congeners (µg/kg) | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Sample ID** | **Date** | **8** | **18** | **28** | **44** | **52** | **66** | **77** | **101** | **105** | **118** | **126** | **128** | **138** | **153** | **170** | **180** | **187** | **195** | **206** | **209** |
| Transect 1 | LS1,3 | 9/17/02 | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U |
| | LS1,2 | 9/17/02 | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U |
| | LS 1,1 | 9/17/02 | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U |
| Transect 2 | LS 2,3 | 9/17/02 | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U |
| | LS 2,2 | 9/17/02 | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U |
| | LS 2,1 | 9/17/02 | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U |
| Transect 3 | LS 3,3 | 9/17/02 | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U |
| | LS 3,2 | 9/17/02 | 2.6U | 2.6U | 2.6U | 2.6U | 2.6U | 2.6U | 2.6U | 2.6U | 2.6U | 2.6U | 2.6U | 2.6U | 2.6U | 2.6U | 2.6U | 2.6U | 2.6U | 2.6U | 2.6U | 2.6U |
| | LS 3,1 | 9/17/02 | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U |
| Transect 4 | LS 4,3 | 9/17/02 | 2.4U | 2.4U | 2.4U | 2.4U | 2.4U | 2.4U | 2.4U | 2.4U | 2.4U | 2.4U | 2.4U | 2.4U | 2.4U | 2.4U | 2.4U | 2.4U | 2.4U | 2.4U | 2.4U | 2.4U |
| | LS 4,2 | 9/17/02 | 2.4U | 2.4U | 2.4U | 2.4U | 2.4U | 2.4U | 2.4U | 2.4U | 2.4U | 2.4U | 2.4U | 2.4U | 2.4U | 2.4U | 2.4U | 2.4U | 2.4U | 2.4U | 2.4U | 2.4U |
| | LS 4,1 | 9/17/02 | 2.3U | 2.3U | 2.3U | 2.3U | 2.3U | 2.3U | 2.3U | 2.3U | 2.3U | 2.3U | 2.3U | 2.3U | 2.3U | 2.3U | 2.3U | 2.3U | 2.3U | 2.3U | 2.3U | 2.3U |
| Transect 5 | LS 5,3 | 9/17/02 | 2.1U | 2.1U | 2.1U | 2.1U | 2.1U | 2.1U | 2.1U | 2.1U | 2.1U | 2.1U | 2.1U | 2.1U | 2.1U | 2.1U | 2.1U | 2.1U | 2.1U | 2.1U | 2.1U | 2.1U |
| | LS 5,2 | 9/17/02 | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U |
| | LS 5,1 | 9/17/02 | 2.7U | 2.7U | 2.7U | 2.7U | 2.7U | 2.7U | 2.7U | 2.7U | 2.7U | 2.7U | 2.7U | 2.7U | 2.7U | 2.7U | 2.7U | 2.7U | 2.7U | 2.7U | 2.7U | 2.7U |
| Transect 6 | LS 6,3 | 9/17/02 | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U | 2.2U |
| | LS 6,2 | 9/17/02 | 2.5U | 2.5U | 2.5U | 2.5U | 2.5U | 2.5U | 2.5U | 2.5U | 2.5U | 2.5U | 2.5U | 2.5U | 2.5U | 2.5U | 2.5U | 2.5U | 2.5U | 2.5U | 2.5U | 2.5U |
| | LS 6,1 | 9/17/02 | 2.5U | 2.5U | 2.5U | 2.5U | 2.5U | 2.5U | 2.5U | 2.5U | 2.5U | 2.5U | 2.5U | 2.5U | 2.5U | 2.5U | 2.5U | 2.5U | 2.5U | 2.5U | 2.5U | 2.5U |

Notes:

- A value followed by “U” indicates that the analyte was not detected at or above the reporting limit.

### Table C.7: Lagoon Surface Sediment Metals Analytical Summary, 2009

| Distance from Storm Drain (m) | Statistic | Cadmium | Chromium | Copper | Iron | Lead | Manganese | Mercury | Nickel | Silver | Zinc |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **EPA RSL** | | **70** | **NL*** | **3,100** | **55,000** | **400** | **1,800** | **10** | **1,500** | **390** | **23,000** |
| 0 | Range | <0.19-0.79 | 0.72-8.28 | 0.59-50.7 | 82.9-6,664 | 0.39-31 | 2.38-364 | 0.00357-0.0805 | 0.38-6.23 | all <0.2 | 2.75-98.5 |
| | Mean | NC | 4.13 | 2.87 | 660 | 3.67 | 19.3 | 0.0137 | 0.65 | NC | 11.5 |
| 10 | Range | <0.19-0.4 | 1.27-10.2 | 0.2-53.8 | 57-4,077 | 0.39-45.2 | 2.38-81.5 | 0.00059-0.103 | 0.38-3.53 | all <0.2 | 0.39-82 |
| | Mean | NC | 3.89 | 1.25 | 430 | 2.38 | 11.7 | 0.00682 | 0.5 | NC | 5.12 |
| 25 | Range | <0.19-0.6 | 2-9.36 | 0.2-16.5 | 61.8-4,437 | 0.39-45.7 | 2.58-92.6 | 0.00059-0.0791 | 0.38-3.53 | all <0.2 | 0.2-67.6 |
| | Mean | NC | 4.1 | 1.3 | 446 | 1.79 | 12.9 | 0.0113 | 0.49 | NC | 3.8 |
| 50 | Range | all <0.2 | 2.59-7.35 | 0.19-6.51 | 50.3-2,840 | 0.39-7.11 | 2.19-67.1 | 0.00238-0.0597 | 0.38-2.71 | all <0.2 | 0.19-18.8 |
| | Mean | NC | 3.83 | 0.76 | 384 | 0.74 | 11.1 | 0.0102 | 0.52 | NC | 1.76 |
| 100 | Range | all <0.2 | 2.04-5.12 | <0.2-2.94 | 50-1,221 | 0.39-4.8 | 2.35-39.9 | 0.00115-0.13 | 0.38-1.57 | all <0.2 | <0.19-7.45 |
| | Mean | NC | 3.47 | 0.51 | 259 | 0.52 | 10.1 | 0.0071 | 0.43 | NC | 0.68 |
| 250 | Range | all <0.2 | 1.85-3.86 | <0.19-6.47 | 31-300 | 0.39-2.8 | 1.38-31.2 | 0.0012-0.1 | all <0.4 | all <0.2 | <0.19-3.4 |
| | Mean | NC | 2.93 | 0.25 | 102 | 0.44 | 4.3 | 0.0065 | NC | NC | 0.34 |
| 500 | Range | all <0.2 | 1.82-3.24 | <0.19-0.4 | 22.9-127 | all <0.4 | 0.99-7.75 | 0.00071-0.0558 | all <0.4 | all <0.2 | <0.19-0.4 |
| | Mean | NC | 2.58 | 0.22 | 57.1 | NC | 1.9 | 0.00554 | NC | NC | 0.21 |
| 1000 | Range | all <0.2 | 1.48-3.39 | all <0.2 | 21-62.6 | all <0.4 | 1.18-7.55 | 0.00056-0.0134 | all <0.4 | all <0.2 | <0.19-0.4 |
| | Mean | NC | 2.26 | NC | 46 | NC | 1.98 | 0.00171 | NC | NC | NC |

Notes:
All units in µg/g.
NC = not calculated
* EPA RSL for total chromium is not listed. RSLs for chromium(III) and chromium (IV) are 120,000 mg/kg and 0.29 mg/kg, respectively.
- EPA RSL (EPA, 2012): US Environmental Protection Agency Regional Screening Levels, Residential Soil, updated May 2012.

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October 14 , 2002

Matt Neal
Environet, Inc.
2850 Paa Street, Suite 212
Honolulu, HI 96819
RE: Saipan AES / P209468

Enclosed are the results of analyses for samples received by the laboratory on 09/24/02. If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Angelee Cari

Angelee Cari
Project Manager

CA ELAP Certificate Number 2374

| | | |
|---|---|---|
| Environet, Inc.<br>2850 Paa Street, Suite 212<br>Honolulu HI, 96819 | Project: Saipan AES<br>Project Number: [none]<br>Project Manager: Matt Neal | P209468<br>**Reported:**<br>10/14/02 18:10 |

## ANALYTICAL REPORT FOR SAMPLES

| Sample ID | Laboratory ID | Matrix | Date Sampled | Date Received |
|---|---|---|---|---|
| F01009LS 1,3 | P209468-01 | Soil | 09/17/02 12:20 | 09/24/02 10:30 |
| F01009LS 1,2 | P209468-02 | Soil | 09/17/02 12:39 | 09/24/02 10:30 |
| F01009LS 1,1 | P209468-03 | Soil | 09/17/02 12:45 | 09/24/02 10:30 |
| F01009LS 2,3 | P209468-04 | Soil | 09/17/02 13:00 | 09/24/02 10:30 |
| F01009LS 2,2 | P209468-05 | Soil | 09/17/02 13:15 | 09/24/02 10:30 |
| F01009LS 2,1 | P209468-06 | Soil | 09/17/02 13:25 | 09/24/02 10:30 |
| F01009LS 3,3 | P209468-07 | Soil | 09/17/02 13:40 | 09/24/02 10:30 |
| F01009LS 3,2 | P209468-08 | Soil | 09/17/02 13:50 | 09/24/02 10:30 |
| F01009LS 3,1 | P209468-09 | Soil | 09/17/02 14:00 | 09/24/02 10:30 |
| F01009LS 4,3 | P209468-10 | Soil | 09/17/02 14:15 | 09/24/02 10:30 |
| F01009LS 4,2 | P209468-11 | Soil | 09/17/02 14:30 | 09/24/02 10:30 |
| F01009LS 4,1 | P209468-12 | Soil | 09/17/02 14:45 | 09/24/02 10:30 |
| F01009LS 5,3 | P209468-13 | Soil | 09/17/02 15:00 | 09/24/02 10:30 |
| F01009LS 5,2 | P209468-14 | Soil | 09/17/02 15:10 | 09/24/02 10:30 |
| F01009LS 5,1 | P209468-15 | Soil | 09/17/02 15:20 | 09/24/02 10:30 |
| F01009LS 6,3 | P209468-16 | Soil | 09/17/02 15:40 | 09/24/02 10:30 |
| F01009LS 6,2 | P209468-17 | Soil | 09/17/02 15:50 | 09/24/02 10:30 |
| F01009LS 6,1 | P209468-18 | Soil | 09/17/02 16:05 | 09/24/02 10:30 |

| | | |
|---|---|---|
| Environet, Inc.<br>2850 Paa Street, Suite 212<br>Honolulu HI, 96819 | Project: Saipan AES<br>Project Number: [none]<br>Project Manager: Matt Neal | P209468<br>**Reported:**<br>10/14/02 18:10 |

## Total Metals by EPA 6000/7000 Series Methods
## Sequoia Analytical - Petaluma

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **F01009LS 1,3 (P209468-01) Soil** | **Sampled: 09/17/02 12:20** | | **Received: 09/24/02 10:30** | | | | | | | |
| Arsenic | ND | 4.8 | 14 | mg/kg dry | 1 | 2090740 | 10/03/02 | 10/09/02 | EPA 6010B | |
| Cadmium | ND | 0.38 | 1.4 | " | " | " | " | " | " | |
| **Chromium** | **5.5** | 0.22 | 1.4 | " | " | " | " | " | " | |
| Copper | ND | 0.94 | 1.4 | " | " | " | " | " | " | |
| **Mercury** | **0.018** | 0.00076 | 0.025 | " | " | 2090710 | 10/06/02 | 10/09/02 | EPA 7471A | J |
| Nickel | ND | 1.0 | 4.1 | " | " | 2090740 | 10/03/02 | 10/09/02 | EPA 6010B | |
| Lead | ND | 1.7 | 10 | " | " | " | " | " | " | |
| Selenium | ND | 6.4 | 14 | " | " | " | " | " | " | |
| **Tin** | **29** | 8.4 | 48 | " | " | " | " | " | " | J |
| **Zinc** | **2.1** | 0.54 | 2.7 | " | " | " | " | " | " | J |
| **F01009LS 1,2 (P209468-02) Soil** | **Sampled: 09/17/02 12:39** | | **Received: 09/24/02 10:30** | | | | | | | |
| **Arsenic** | **10** | 5.3 | 15 | mg/kg dry | 1 | 2090740 | 10/03/02 | 10/09/02 | EPA 6010B | J |
| Cadmium | ND | 0.42 | 1.5 | " | " | " | " | " | " | |
| **Chromium** | **5.3** | 0.24 | 1.5 | " | " | " | " | " | " | |
| Copper | ND | 1.0 | 1.5 | " | " | " | " | " | " | |
| **Mercury** | **0.025** | 0.00084 | 0.028 | " | " | 2090710 | 10/06/02 | 10/09/02 | EPA 7471A | J |
| **Nickel** | **1.8** | 1.2 | 4.5 | " | " | 2090740 | 10/03/02 | 10/09/02 | EPA 6010B | J |
| Lead | ND | 1.8 | 11 | " | " | " | " | " | " | |
| Selenium | ND | 7.2 | 15 | " | " | " | " | " | " | |
| **Tin** | **25** | 9.3 | 53 | " | " | " | " | " | " | J |
| **Zinc** | **2.3** | 0.61 | 3.0 | " | " | " | " | " | " | J |
| **F01009LS 1,1 (P209468-03) Soil** | **Sampled: 09/17/02 12:45** | | **Received: 09/24/02 10:30** | | | | | | | |
| Arsenic | ND | 4.3 | 12 | mg/kg dry | 1 | 2090740 | 10/03/02 | 10/09/02 | EPA 6010B | |
| Cadmium | ND | 0.34 | 1.2 | " | " | " | " | " | " | |
| **Chromium** | **6.7** | 0.19 | 1.2 | " | " | " | " | " | " | |
| **Copper** | **1.6** | 0.84 | 1.2 | " | " | " | " | " | " | |
| **Mercury** | **0.015** | 0.00068 | 0.023 | " | " | 2090710 | 10/06/02 | 10/09/02 | EPA 7471A | J |
| Nickel | ND | 0.94 | 3.7 | " | " | 2090740 | 10/03/02 | 10/09/02 | EPA 6010B | |
| Lead | ND | 1.5 | 9.1 | " | " | " | " | " | " | |
| Selenium | ND | 5.8 | 12 | " | " | " | " | " | " | |
| **Tin** | **46** | 7.5 | 43 | " | " | " | " | " | " | |
| **Zinc** | **3.3** | 0.49 | 2.4 | " | " | " | " | " | " | |

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| Environet, Inc.<br>2850 Paa Street, Suite 212<br>Honolulu HI, 96819 | Project: Saipan AES<br>Project Number: [none]<br>Project Manager: Matt Neal | P209468<br>**Reported:**<br>10/14/02 18:10 |

## Total Metals by EPA 6000/7000 Series Methods
## Sequoia Analytical - Petaluma

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **F01009LS 2,3 (P209468-04) Soil Sampled: 09/17/02 13:00 Received: 09/24/02 10:30** | | | | | | | | | | |
| Arsenic | ND | 4.6 | 13 | mg/kg dry | 1 | 2090740 | 10/03/02 | 10/09/02 | EPA 6010B | |
| Cadmium | ND | 0.37 | 1.3 | " | " | " | " | " | " | |
| **Chromium** | **5.6** | 0.21 | 1.3 | " | " | " | " | " | " | |
| Copper | ND | 0.90 | 1.3 | " | " | " | " | " | " | |
| **Mercury** | **0.0064** | 0.00072 | 0.024 | " | " | 2090710 | 10/06/02 | 10/09/02 | EPA 7471A | J |
| Nickel | ND | 1.0 | 3.9 | " | " | 2090740 | 10/03/02 | 10/09/02 | EPA 6010B | |
| Lead | ND | 1.6 | 9.8 | " | " | " | " | " | " | |
| Selenium | ND | 6.2 | 13 | " | " | " | " | " | " | |
| **Tin** | **22** | 8.1 | 46 | " | " | " | " | " | " | J |
| **Zinc** | **2.0** | 0.52 | 2.6 | " | " | " | " | " | " | J |
| **F01009LS 2,2 (P209468-05) Soil Sampled: 09/17/02 13:15 Received: 09/24/02 10:30** | | | | | | | | | | |
| Arsenic | ND | 4.5 | 13 | mg/kg dry | 1 | 2090740 | 10/03/02 | 10/09/02 | EPA 6010B | |
| Cadmium | ND | 0.36 | 1.3 | " | " | " | " | " | " | |
| **Chromium** | **5.8** | 0.21 | 1.3 | " | " | " | " | " | " | |
| Copper | ND | 0.89 | 1.3 | " | " | " | " | " | " | |
| **Mercury** | **0.0049** | 0.00072 | 0.024 | " | " | 2090710 | 10/06/02 | 10/09/02 | EPA 7471A | J |
| **Nickel** | **1.1** | 0.99 | 3.9 | " | " | 2090740 | 10/03/02 | 10/09/02 | EPA 6010B | J |
| Lead | ND | 1.6 | 9.7 | " | " | " | " | " | " | |
| Selenium | ND | 6.1 | 13 | " | " | " | " | " | " | |
| **Tin** | **61** | 8.0 | 45 | " | " | " | " | " | " | |
| **Zinc** | **1.6** | 0.52 | 2.6 | " | " | " | " | " | " | J |
| **F01009LS 2,1 (P209468-06) Soil Sampled: 09/17/02 13:25 Received: 09/24/02 10:30** | | | | | | | | | | |
| **Arsenic** | **7.7** | 4.3 | 12 | mg/kg dry | 1 | 2090740 | 10/03/02 | 10/09/02 | EPA 6010B | J |
| Cadmium | ND | 0.34 | 1.2 | " | " | " | " | " | " | |
| **Chromium** | **4.5** | 0.20 | 1.2 | " | " | " | " | " | " | |
| Copper | ND | 0.85 | 1.2 | " | " | " | " | " | " | |
| **Mercury** | **0.010** | 0.00078 | 0.026 | " | " | 2090710 | 10/06/02 | 10/09/02 | EPA 7471A | J |
| **Nickel** | **1.2** | 0.95 | 3.7 | " | " | 2090740 | 10/03/02 | 10/09/02 | EPA 6010B | J |
| Lead | ND | 1.5 | 9.2 | " | " | " | " | " | " | |
| Selenium | ND | 5.8 | 12 | " | " | " | " | " | " | |
| **Tin** | **14** | 7.6 | 43 | " | " | " | " | " | " | J |
| **Zinc** | **1.8** | 0.49 | 2.5 | " | " | " | " | " | " | J |

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| Environet, Inc.<br>2850 Paa Street, Suite 212<br>Honolulu HI, 96819 | Project: Saipan AES<br>Project Number: [none]<br>Project Manager: Matt Neal | P209468<br>**Reported:**<br>10/14/02 18:10 |

## Total Metals by EPA 6000/7000 Series Methods
## Sequoia Analytical - Petaluma

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **F01009LS 3,3 (P209468-07) Soil** | **Sampled: 09/17/02 13:40** | | **Received: 09/24/02 10:30** | | | | | | | |
| Arsenic | ND | 4.5 | 13 | mg/kg dry | 1 | 2090740 | 10/03/02 | 10/09/02 | EPA 6010B | |
| Cadmium | ND | 0.36 | 1.3 | " | " | " | " | " | " | |
| **Chromium** | **6.0** | 0.20 | 1.3 | " | " | " | " | " | " | |
| Copper | ND | 0.88 | 1.3 | " | " | " | " | " | " | |
| **Mercury** | **0.0098** | 0.00068 | 0.023 | " | " | 2090710 | 10/06/02 | 10/09/02 | EPA 7471A | J |
| Nickel | ND | 0.98 | 3.8 | " | " | 2090740 | 10/03/02 | 10/09/02 | EPA 6010B | |
| Lead | ND | 1.6 | 9.6 | " | " | " | " | " | " | |
| Selenium | ND | 6.0 | 13 | " | " | " | " | " | " | |
| Tin | ND | 7.9 | 45 | " | " | " | " | " | " | |
| **Zinc** | **1.0** | 0.51 | 2.6 | " | " | " | " | " | " | J |
| **F01009LS 3,2 (P209468-08) Soil** | **Sampled: 09/17/02 13:50** | | **Received: 09/24/02 10:30** | | | | | | | |
| Arsenic | ND | 5.0 | 14 | mg/kg dry | 1 | 2090740 | 10/03/02 | 10/09/02 | EPA 6010B | |
| Cadmium | ND | 0.40 | 1.4 | " | " | " | " | " | " | |
| **Chromium** | **5.3** | 0.23 | 1.4 | " | " | " | " | " | " | |
| Copper | ND | 0.99 | 1.4 | " | " | " | " | " | " | |
| **Mercury** | **0.012** | 0.00096 | 0.032 | " | " | 2090710 | 10/06/02 | 10/09/02 | EPA 7471A | J |
| **Nickel** | **1.2** | 1.1 | 4.3 | " | " | 2090740 | 10/03/02 | 10/09/02 | EPA 6010B | J |
| Lead | ND | 1.8 | 11 | " | " | " | " | " | " | |
| Selenium | ND | 6.8 | 14 | " | " | " | " | " | " | |
| **Tin** | **31** | 8.9 | 50 | " | " | " | " | " | " | J |
| **Zinc** | **2.9** | 0.58 | 2.9 | " | " | " | " | " | " | |
| **F01009LS 3,1 (P209468-09) Soil** | **Sampled: 09/17/02 14:00** | | **Received: 09/24/02 10:30** | | | | | | | |
| **Arsenic** | **6.4** | 4.2 | 12 | mg/kg dry | 1 | 2090740 | 10/03/02 | 10/09/02 | EPA 6010B | J |
| Cadmium | ND | 0.34 | 1.2 | " | " | " | " | " | " | |
| **Chromium** | **7.3** | 0.19 | 1.2 | " | " | " | " | " | " | |
| **Copper** | **1.6** | 0.83 | 1.2 | " | " | " | " | " | " | |
| **Mercury** | **0.011** | 0.00076 | 0.025 | " | " | 2090710 | 10/06/02 | 10/09/02 | EPA 7471A | J |
| **Nickel** | **1.0** | 0.92 | 3.6 | " | " | 2090740 | 10/03/02 | 10/09/02 | EPA 6010B | J |
| Lead | ND | 1.5 | 9.0 | " | " | " | " | " | " | |
| Selenium | ND | 5.7 | 12 | " | " | " | " | " | " | |
| **Tin** | **51** | 7.4 | 42 | " | " | " | " | " | " | |
| **Zinc** | **4.0** | 0.48 | 2.4 | " | " | " | " | " | " | |

## Total Metals by EPA 6000/7000 Series Methods
## Sequoia Analytical - Petaluma

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **F01009LS 4,3 (P209468-10) Soil** | **Sampled: 09/17/02 14:15** | | **Received: 09/24/02 10:30** | | | | | | | |
| **Arsenic** | **6.4** | 4.4 | 13 | mg/kg dry | 1 | 2090740 | 10/03/02 | 10/09/02 | EPA 6010B | J |
| Cadmium | ND | 0.35 | 1.3 | " | " | " | " | " | " | |
| **Chromium** | **5.3** | 0.20 | 1.3 | " | " | " | " | " | " | |
| Copper | ND | 0.86 | 1.3 | " | " | " | " | " | " | |
| **Mercury** | **0.0054** | 0.00067 | 0.022 | " | " | 2090710 | 10/06/02 | 10/09/02 | EPA 7471A | J |
| Nickel | ND | 0.96 | 3.8 | " | " | 2090740 | 10/03/02 | 10/09/02 | EPA 6010B | |
| Lead | ND | 1.5 | 9.4 | " | " | " | " | " | " | |
| Selenium | ND | 5.9 | 13 | " | " | " | " | " | " | |
| **Tin** | **40** | 7.7 | 44 | " | " | " | " | " | " | J |
| **Zinc** | **1.2** | 0.50 | 2.5 | " | " | " | " | " | " | J |
| **F01009LS 4,2 (P209468-11) Soil** | **Sampled: 09/17/02 14:30** | | **Received: 09/24/02 10:30** | | | | | | | |
| **Arsenic** | **5.7** | 4.5 | 13 | mg/kg dry | 1 | 2090740 | 10/03/02 | 10/09/02 | EPA 6010B | J |
| Cadmium | ND | 0.36 | 1.3 | " | " | " | " | " | " | |
| **Chromium** | **4.6** | 0.21 | 1.3 | " | " | " | " | " | " | |
| Copper | ND | 0.89 | 1.3 | " | " | " | " | " | " | |
| **Mercury** | **0.0050** | 0.00072 | 0.024 | " | " | 2090710 | 10/06/02 | 10/09/02 | EPA 7471A | J |
| Nickel | ND | 0.99 | 3.9 | " | " | 2090740 | 10/03/02 | 10/09/02 | EPA 6010B | |
| Lead | ND | 1.6 | 9.7 | " | " | " | " | " | " | |
| Selenium | ND | 6.1 | 13 | " | " | " | " | " | " | |
| **Tin** | **61** | 7.9 | 45 | " | " | " | " | " | " | |
| **Zinc** | **1.4** | 0.51 | 2.6 | " | " | " | " | " | " | J |
| **F01009LS 4,1 (P209468-12) Soil** | **Sampled: 09/17/02 14:45** | | **Received: 09/24/02 10:30** | | | | | | | |
| **Arsenic** | **6.0** | 4.2 | 12 | mg/kg dry | 1 | 2090740 | 10/03/02 | 10/09/02 | EPA 6010B | J |
| Cadmium | ND | 0.33 | 1.2 | " | " | " | " | " | " | |
| **Chromium** | **7.7** | 0.19 | 1.2 | " | " | " | " | " | " | |
| **Copper** | **1.0** | 0.82 | 1.2 | " | " | " | " | " | " | J |
| **Mercury** | **0.0072** | 0.00075 | 0.025 | " | " | 2090710 | 10/06/02 | 10/09/02 | EPA 7471A | J |
| Nickel | ND | 0.92 | 3.6 | " | " | 2090740 | 10/03/02 | 10/09/02 | EPA 6010B | |
| Lead | ND | 1.4 | 8.9 | " | " | " | " | " | " | |
| Selenium | ND | 5.6 | 12 | " | " | " | " | " | " | |
| **Tin** | **19** | 7.3 | 42 | " | " | " | " | " | " | J |
| **Zinc** | **2.6** | 0.48 | 2.4 | " | " | " | " | " | " | |

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|---|---|---|
| Environet, Inc.<br>2850 Paa Street, Suite 212<br>Honolulu HI, 96819 | Project: Saipan AES<br>Project Number: [none]<br>Project Manager: Matt Neal | P209468<br>**Reported:**<br>10/14/02 18:10 |

## Total Metals by EPA 6000/7000 Series Methods
## Sequoia Analytical - Petaluma

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **F01009LS 5,3 (P209468-13) Soil** | **Sampled: 09/17/02 15:00** | | **Received: 09/24/02 10:30** | | | | | | | |
| **Arsenic** | **5.1** | 4.3 | 12 | mg/kg dry | 1 | 2090740 | 10/03/02 | 10/09/02 | EPA 6010B | J |
| Cadmium | ND | 0.34 | 1.2 | " | " | " | " | " | " | |
| **Chromium** | **4.5** | 0.20 | 1.2 | " | " | " | " | " | " | |
| Copper | ND | 0.84 | 1.2 | " | " | " | " | " | " | |
| **Mercury** | **0.0040** | 0.00071 | 0.024 | " | " | 2090710 | 10/06/02 | 10/09/02 | EPA 7471A | J |
| **Nickel** | **1.1** | 0.94 | 3.7 | " | " | 2090740 | 10/03/02 | 10/09/02 | EPA 6010B | J |
| Lead | ND | 1.5 | 9.2 | " | " | " | " | " | " | |
| Selenium | ND | 5.8 | 12 | " | " | " | " | " | " | |
| **Tin** | **46** | 7.5 | 43 | " | " | " | " | " | " | |
| **Zinc** | **0.75** | 0.49 | 2.4 | " | " | " | " | " | " | J |
| **F01009LS 5,2 (P209468-14) Soil** | **Sampled: 09/17/02 15:10** | | **Received: 09/24/02 10:30** | | | | | | | |
| **Arsenic** | **8.3** | 4.0 | 11 | mg/kg dry | 1 | 2090740 | 10/03/02 | 10/09/02 | EPA 6010B | J |
| Cadmium | ND | 0.32 | 1.1 | " | " | " | " | " | " | |
| **Chromium** | **5.1** | 0.18 | 1.1 | " | " | " | " | " | " | |
| Copper | ND | 0.79 | 1.1 | " | " | " | " | " | " | |
| **Mercury** | **0.0071** | 0.00063 | 0.021 | " | " | 2090710 | 10/06/02 | 10/09/02 | EPA 7471A | J |
| Nickel | ND | 0.88 | 3.4 | " | " | 2090740 | 10/03/02 | 10/09/02 | EPA 6010B | |
| Lead | ND | 1.4 | 8.5 | " | " | " | " | " | " | |
| Selenium | ND | 5.4 | 11 | " | " | " | " | " | " | |
| **Tin** | **48** | 7.0 | 40 | " | " | " | " | " | " | |
| **Zinc** | **0.97** | 0.46 | 2.3 | " | " | " | " | " | " | J |
| **F01009LS 5,1 (P209468-15) Soil** | **Sampled: 09/17/02 15:20** | | **Received: 09/24/02 10:30** | | | | | | | |
| **Arsenic** | **12** | 5.4 | 15 | mg/kg dry | 1 | 2090740 | 10/03/02 | 10/09/02 | EPA 6010B | J |
| Cadmium | ND | 0.43 | 1.5 | " | " | " | " | " | " | |
| **Chromium** | **8.5** | 0.25 | 1.5 | " | " | " | " | " | " | |
| **Copper** | **1.3** | 1.1 | 1.5 | " | " | " | " | " | " | J |
| **Mercury** | **0.0087** | 0.00088 | 0.029 | " | " | 2090710 | 10/06/02 | 10/09/02 | EPA 7471A | J |
| Nickel | ND | 1.2 | 4.6 | " | " | 2090740 | 10/03/02 | 10/09/02 | EPA 6010B | |
| Lead | ND | 1.9 | 12 | " | " | " | " | " | " | |
| Selenium | ND | 7.3 | 15 | " | " | " | " | " | " | |
| **Tin** | **17** | 9.5 | 54 | " | " | " | " | " | " | J |
| **Zinc** | **2.8** | 0.62 | 3.1 | " | " | " | " | " | " | J |

# Total Metals by EPA 6000/7000 Series Methods
## Sequoia Analytical - Petaluma

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **F01009LS 6,3 (P209468-16) Soil** | **Sampled: 09/17/02 15:40** | | **Received: 09/24/02 10:30** | | | | | | | |
| Arsenic | ND | 4.3 | 12 | mg/kg dry | 1 | 2090740 | 10/03/02 | 10/09/02 | EPA 6010B | |
| Cadmium | ND | 0.34 | 1.2 | " | " | " | " | " | " | |
| **Chromium** | **4.6** | 0.20 | 1.2 | " | " | " | " | " | " | |
| Copper | ND | 0.85 | 1.2 | " | " | " | " | " | " | |
| **Mercury** | **0.0058** | 0.00082 | 0.027 | " | " | 2090710 | 10/06/02 | 10/09/02 | EPA 7471A | J |
| Nickel | ND | 0.94 | 3.7 | " | " | 2090740 | 10/03/02 | 10/09/02 | EPA 6010B | |
| Lead | ND | 1.5 | 9.2 | " | " | " | " | " | " | |
| Selenium | ND | 5.8 | 12 | " | " | " | " | " | " | |
| **Tin** | **27** | 7.6 | 43 | " | " | " | " | " | " | J |
| **Zinc** | **1.5** | 0.49 | 2.5 | " | " | " | " | " | " | J |
| **F01009LS 6,2 (P209468-17) Soil** | **Sampled: 09/17/02 15:50** | | **Received: 09/24/02 10:30** | | | | | | | |
| **Arsenic** | **5.6** | 4.7 | 14 | mg/kg dry | 1 | 2090740 | 10/03/02 | 10/09/02 | EPA 6010B | J |
| Cadmium | ND | 0.38 | 1.4 | " | " | " | " | " | " | |
| **Chromium** | **4.4** | 0.22 | 1.4 | " | " | " | " | " | " | |
| Copper | ND | 0.93 | 1.4 | " | " | " | " | " | " | |
| **Mercury** | **0.0062** | 0.00093 | 0.031 | " | " | 2090710 | 10/06/02 | 10/09/02 | EPA 7471A | J |
| Nickel | ND | 1.0 | 4.1 | " | " | 2090740 | 10/03/02 | 10/09/02 | EPA 6010B | |
| Lead | ND | 1.6 | 10 | " | " | " | " | " | " | |
| Selenium | ND | 6.4 | 14 | " | " | " | " | " | " | |
| **Tin** | **64** | 8.3 | 47 | " | " | " | " | " | " | |
| **Zinc** | **1.7** | 0.54 | 2.7 | " | " | " | " | " | " | J |
| **F01009LS 6,1 (P209468-18) Soil** | **Sampled: 09/17/02 16:05** | | **Received: 09/24/02 10:30** | | | | | | | |
| **Arsenic** | **7.2** | 4.9 | 14 | mg/kg dry | 1 | 2090740 | 10/03/02 | 10/09/02 | EPA 6010B | J |
| Cadmium | ND | 0.39 | 1.4 | " | " | " | " | " | " | |
| **Chromium** | **5.4** | 0.22 | 1.4 | " | " | " | " | " | " | |
| **Copper** | **1.4** | 0.96 | 1.4 | " | " | " | " | " | " | |
| **Mercury** | **0.0058** | 0.00083 | 0.028 | " | " | 2090710 | 10/06/02 | 10/09/02 | EPA 7471A | J |
| **Nickel** | **1.2** | 1.1 | 4.2 | " | " | 2090740 | 10/03/02 | 10/09/02 | EPA 6010B | J |
| Lead | ND | 1.7 | 10 | " | " | " | " | " | " | |
| Selenium | ND | 6.6 | 14 | " | " | " | " | " | " | |
| **Tin** | **66** | 8.6 | 49 | " | " | " | " | " | " | |
| **Zinc** | **2.4** | 0.56 | 2.8 | " | " | " | " | " | " | J |

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| Environet, Inc.<br>2850 Paa Street, Suite 212<br>Honolulu HI, 96819 | Project: Saipan AES<br>Project Number: [none]<br>Project Manager: Matt Neal | P209468<br>**Reported:**<br>10/14/02 18:10 |

## Polychlorinated Biphenyls by EPA Method 8082
## Sequoia Analytical - Petaluma

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **F01009LS 1,3 (P209468-01) Soil** | **Sampled: 09/17/02 12:20** | | **Received: 09/24/02 10:30** | | | | | | | **C-01, C-06** |
| PCB-1016 | ND | | 45 | ug/kg dry | 1 | 2090779 | 09/30/02 | 10/02/02 | EPA 8082 | |
| PCB-1221 | ND | | 45 | " | " | " | " | " | " | |
| PCB-1232 | ND | | 45 | " | " | " | " | " | " | |
| PCB-1242 | ND | | 45 | " | " | " | " | " | " | |
| PCB-1248 | ND | | 45 | " | " | " | " | " | " | |
| PCB-1254 | ND | | 45 | " | " | " | " | " | " | |
| PCB-1260 | ND | | 45 | " | " | " | " | " | " | |
| *Surrogate: Decachlorobiphenyl* | | *51 %* | *46-115* | | | " | " | " | " | |
| **F01009LS 1,2 (P209468-02) Soil** | **Sampled: 09/17/02 12:39** | | **Received: 09/24/02 10:30** | | | | | | | **C-01, C-06** |
| PCB-1016 | ND | | 51 | ug/kg dry | 1 | 2090779 | 09/30/02 | 10/02/02 | EPA 8082 | |
| PCB-1221 | ND | | 51 | " | " | " | " | " | " | |
| PCB-1232 | ND | | 51 | " | " | " | " | " | " | |
| PCB-1242 | ND | | 51 | " | " | " | " | " | " | |
| PCB-1248 | ND | | 51 | " | " | " | " | " | " | |
| PCB-1254 | ND | | 51 | " | " | " | " | " | " | |
| PCB-1260 | ND | | 51 | " | " | " | " | " | " | |
| *Surrogate: Decachlorobiphenyl* | | *37 %* | *46-115* | | | " | " | " | " | *S-LIM* |
| **F01009LS 1,2 (P209468-02RE1) Soil** | **Sampled: 09/17/02 12:39** | | **Received: 09/24/02 10:30** | | | | | | | **C-01, C-06** |
| PCB-1016 | ND | | 51 | ug/kg dry | 1 | 2100154 | 09/30/02 | 10/07/02 | EPA 8082 | |
| PCB-1221 | ND | | 51 | " | " | " | " | " | " | |
| PCB-1232 | ND | | 51 | " | " | " | " | " | " | |
| PCB-1242 | ND | | 51 | " | " | " | " | " | " | |
| PCB-1248 | ND | | 51 | " | " | " | " | " | " | |
| PCB-1254 | ND | | 51 | " | " | " | " | " | " | |
| PCB-1260 | ND | | 51 | " | " | " | " | " | " | |
| *Surrogate: Decachlorobiphenyl* | | *78 %* | *46-115* | | | " | " | " | " | |

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| Environet, Inc.<br>2850 Paa Street, Suite 212<br>Honolulu HI, 96819 | Project: Saipan AES<br>Project Number: [none]<br>Project Manager: Matt Neal | P209468<br>**Reported:**<br>10/14/02 18:10 |

## Polychlorinated Biphenyls by EPA Method 8082
## Sequoia Analytical - Petaluma

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **F01009LS 1,1 (P209468-03) Soil** | **Sampled: 09/17/02 12:45** | | **Received: 09/24/02 10:30** | | | | | | | **C-01, C-06** |
| PCB-1016 | ND | | 43 | ug/kg dry | 1 | 2090779 | 09/30/02 | 10/02/02 | EPA 8082 | |
| PCB-1221 | ND | | 43 | " | " | " | " | " | " | |
| PCB-1232 | ND | | 43 | " | " | " | " | " | " | |
| PCB-1242 | ND | | 43 | " | " | " | " | " | " | |
| PCB-1248 | ND | | 43 | " | " | " | " | " | " | |
| PCB-1254 | ND | | 43 | " | " | " | " | " | " | |
| PCB-1260 | ND | | 43 | " | " | " | " | " | " | |
| *Surrogate: Decachlorobiphenyl* | | *66 %* | *46-115* | | | " | " | " | " | |
| **F01009LS 2,3 (P209468-04) Soil** | **Sampled: 09/17/02 13:00** | | **Received: 09/24/02 10:30** | | | | | | | **C-01, C-06** |
| PCB-1016 | ND | | 43 | ug/kg dry | 1 | 2090779 | 09/30/02 | 10/02/02 | EPA 8082 | |
| PCB-1221 | ND | | 43 | " | " | " | " | " | " | |
| PCB-1232 | ND | | 43 | " | " | " | " | " | " | |
| PCB-1242 | ND | | 43 | " | " | " | " | " | " | |
| PCB-1248 | ND | | 43 | " | " | " | " | " | " | |
| PCB-1254 | ND | | 43 | " | " | " | " | " | " | |
| PCB-1260 | ND | | 43 | " | " | " | " | " | " | |
| *Surrogate: Decachlorobiphenyl* | | *66 %* | *46-115* | | | " | " | " | " | |
| **F01009LS 2,2 (P209468-05) Soil** | **Sampled: 09/17/02 13:15** | | **Received: 09/24/02 10:30** | | | | | | | **C-01, C-06** |
| PCB-1016 | ND | | 43 | ug/kg dry | 1 | 2090779 | 09/30/02 | 10/02/02 | EPA 8082 | |
| PCB-1221 | ND | | 43 | " | " | " | " | " | " | |
| PCB-1232 | ND | | 43 | " | " | " | " | " | " | |
| PCB-1242 | ND | | 43 | " | " | " | " | " | " | |
| PCB-1248 | ND | | 43 | " | " | " | " | " | " | |
| PCB-1254 | ND | | 43 | " | " | " | " | " | " | |
| PCB-1260 | ND | | 43 | " | " | " | " | " | " | |
| *Surrogate: Decachlorobiphenyl* | | *71 %* | *46-115* | | | " | " | " | " | |

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| Environet, Inc. | Project: Saipan AES | P209468 |
| 2850 Paa Street, Suite 212 | Project Number: [none] | **Reported:** |
| Honolulu HI, 96819 | Project Manager: Matt Neal | 10/14/02 18:10 |

## Polychlorinated Biphenyls by EPA Method 8082
## Sequoia Analytical - Petaluma

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **F01009LS 2,1 (P209468-06) Soil** | **Sampled: 09/17/02 13:25** | | **Received: 09/24/02 10:30** | | | | | | | **C-01, C-06** |
| PCB-1016 | ND | | 45 | ug/kg dry | 1 | 2090779 | 09/30/02 | 10/02/02 | EPA 8082 | |
| PCB-1221 | ND | | 45 | " | " | " | " | " | " | |
| PCB-1232 | ND | | 45 | " | " | " | " | " | " | |
| PCB-1242 | ND | | 45 | " | " | " | " | " | " | |
| PCB-1248 | ND | | 45 | " | " | " | " | " | " | |
| PCB-1254 | ND | | 45 | " | " | " | " | " | " | |
| PCB-1260 | ND | | 45 | " | " | " | " | " | " | |
| *Surrogate: Decachlorobiphenyl* | | *50 %* | *46-115* | | | " | " | " | " | |
| **F01009LS 3,3 (P209468-07) Soil** | **Sampled: 09/17/02 13:40** | | **Received: 09/24/02 10:30** | | | | | | | **C-01, C-06** |
| PCB-1016 | ND | | 45 | ug/kg dry | 1 | 2090779 | 09/30/02 | 10/02/02 | EPA 8082 | |
| PCB-1221 | ND | | 45 | " | " | " | " | " | " | |
| PCB-1232 | ND | | 45 | " | " | " | " | " | " | |
| PCB-1242 | ND | | 45 | " | " | " | " | " | " | |
| PCB-1248 | ND | | 45 | " | " | " | " | " | " | |
| PCB-1254 | ND | | 45 | " | " | " | " | " | " | |
| PCB-1260 | ND | | 45 | " | " | " | " | " | " | |
| *Surrogate: Decachlorobiphenyl* | | *72 %* | *46-115* | | | " | " | " | " | |
| **F01009LS 3,2 (P209468-08) Soil** | **Sampled: 09/17/02 13:50** | | **Received: 09/24/02 10:30** | | | | | | | **C-01, C-06** |
| PCB-1016 | ND | | 53 | ug/kg dry | 1 | 2090779 | 09/30/02 | 10/02/02 | EPA 8082 | |
| PCB-1221 | ND | | 53 | " | " | " | " | " | " | |
| PCB-1232 | ND | | 53 | " | " | " | " | " | " | |
| PCB-1242 | ND | | 53 | " | " | " | " | " | " | |
| PCB-1248 | ND | | 53 | " | " | " | " | " | " | |
| PCB-1254 | ND | | 53 | " | " | " | " | " | " | |
| PCB-1260 | ND | | 53 | " | " | " | " | " | " | |
| *Surrogate: Decachlorobiphenyl* | | *59 %* | *46-115* | | | " | " | " | " | |

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| Environet, Inc. | Project: Saipan AES | P209468 |
| 2850 Paa Street, Suite 212 | Project Number: [none] | **Reported:** |
| Honolulu HI, 96819 | Project Manager: Matt Neal | 10/14/02 18:10 |

## Polychlorinated Biphenyls by EPA Method 8082
## Sequoia Analytical - Petaluma

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **F01009LS 3,1 (P209468-09) Soil** | **Sampled: 09/17/02 14:00** | | **Received: 09/24/02 10:30** | | | | | | | **C-01, C-06** |
| PCB-1016 | ND | | 43 | ug/kg dry | 1 | 2090779 | 09/30/02 | 10/02/02 | EPA 8082 | |
| PCB-1221 | ND | | 43 | " | " | " | " | " | " | |
| PCB-1232 | ND | | 43 | " | " | " | " | " | " | |
| PCB-1242 | ND | | 43 | " | " | " | " | " | " | |
| PCB-1248 | ND | | 43 | " | " | " | " | " | " | |
| PCB-1254 | ND | | 43 | " | " | " | " | " | " | |
| PCB-1260 | ND | | 43 | " | " | " | " | " | " | |
| *Surrogate: Decachlorobiphenyl* | | *62 %* | *46-115* | | | " | " | " | " | |
| **F01009LS 4,3 (P209468-10) Soil** | **Sampled: 09/17/02 14:15** | | **Received: 09/24/02 10:30** | | | | | | | **C-01, C-06** |
| PCB-1016 | ND | | 44 | ug/kg dry | 1 | 2090779 | 09/30/02 | 10/02/02 | EPA 8082 | |
| PCB-1221 | ND | | 44 | " | " | " | " | " | " | |
| PCB-1232 | ND | | 44 | " | " | " | " | " | " | |
| PCB-1242 | ND | | 44 | " | " | " | " | " | " | |
| PCB-1248 | ND | | 44 | " | " | " | " | " | " | |
| PCB-1254 | ND | | 44 | " | " | " | " | " | " | |
| PCB-1260 | ND | | 44 | " | " | " | " | " | " | |
| *Surrogate: Decachlorobiphenyl* | | *68 %* | *46-115* | | | " | " | " | " | |
| **F01009LS 4,2 (P209468-11) Soil** | **Sampled: 09/17/02 14:30** | | **Received: 09/24/02 10:30** | | | | | | | **C-01, C-06** |
| PCB-1016 | ND | | 44 | ug/kg dry | 1 | 2090779 | 09/30/02 | 10/02/02 | EPA 8082 | |
| PCB-1221 | ND | | 44 | " | " | " | " | " | " | |
| PCB-1232 | ND | | 44 | " | " | " | " | " | " | |
| PCB-1242 | ND | | 44 | " | " | " | " | " | " | |
| PCB-1248 | ND | | 44 | " | " | " | " | " | " | |
| PCB-1254 | ND | | 44 | " | " | " | " | " | " | |
| PCB-1260 | ND | | 44 | " | " | " | " | " | " | |
| *Surrogate: Decachlorobiphenyl* | | *70 %* | *46-115* | | | " | " | " | " | |

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| Environet, Inc.<br>2850 Paa Street, Suite 212<br>Honolulu HI, 96819 | Project: Saipan AES<br>Project Number: [none]<br>Project Manager: Matt Neal | P209468<br>**Reported:**<br>10/14/02 18:10 |

## Polychlorinated Biphenyls by EPA Method 8082
## Sequoia Analytical - Petaluma

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **F01009LS 4,1 (P209468-12) Soil** | **Sampled: 09/17/02 14:45** | | **Received: 09/24/02 10:30** | | | | | | | **C-01, C-06** |
| PCB-1016 | ND | | 43 | ug/kg dry | 1 | 2090779 | 09/30/02 | 10/02/02 | EPA 8082 | |
| PCB-1221 | ND | | 43 | " | " | " | " | " | " | |
| PCB-1232 | ND | | 43 | " | " | " | " | " | " | |
| PCB-1242 | ND | | 43 | " | " | " | " | " | " | |
| PCB-1248 | ND | | 43 | " | " | " | " | " | " | |
| PCB-1254 | ND | | 43 | " | " | " | " | " | " | |
| PCB-1260 | ND | | 43 | " | " | " | " | " | " | |
| *Surrogate: Decachlorobiphenyl* | | *67 %* | *46-115* | | | *"* | *"* | *"* | *"* | |
| **F01009LS 5,3 (P209468-13) Soil** | **Sampled: 09/17/02 15:00** | | **Received: 09/24/02 10:30** | | | | | | | **C-01, C-06** |
| PCB-1016 | ND | | 42 | ug/kg dry | 1 | 2090779 | 09/30/02 | 10/02/02 | EPA 8082 | |
| PCB-1221 | ND | | 42 | " | " | " | " | " | " | |
| PCB-1232 | ND | | 42 | " | " | " | " | " | " | |
| PCB-1242 | ND | | 42 | " | " | " | " | " | " | |
| PCB-1248 | ND | | 42 | " | " | " | " | " | " | |
| PCB-1254 | ND | | 42 | " | " | " | " | " | " | |
| PCB-1260 | ND | | 42 | " | " | " | " | " | " | |
| *Surrogate: Decachlorobiphenyl* | | *62 %* | *46-115* | | | *"* | *"* | *"* | *"* | |
| **F01009LS 5,2 (P209468-14) Soil** | **Sampled: 09/17/02 15:10** | | **Received: 09/24/02 10:30** | | | | | | | **C-01, C-06** |
| PCB-1016 | ND | | 41 | ug/kg dry | 1 | 2090779 | 09/30/02 | 10/02/02 | EPA 8082 | |
| PCB-1221 | ND | | 41 | " | " | " | " | " | " | |
| PCB-1232 | ND | | 41 | " | " | " | " | " | " | |
| PCB-1242 | ND | | 41 | " | " | " | " | " | " | |
| PCB-1248 | ND | | 41 | " | " | " | " | " | " | |
| PCB-1254 | ND | | 41 | " | " | " | " | " | " | |
| PCB-1260 | ND | | 41 | " | " | " | " | " | " | |
| *Surrogate: Decachlorobiphenyl* | | *70 %* | *46-115* | | | *"* | *"* | *"* | *"* | |

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| Environet, Inc. | Project: Saipan AES | P209468 |
| 2850 Paa Street, Suite 212 | Project Number: [none] | **Reported:** |
| Honolulu HI, 96819 | Project Manager: Matt Neal | 10/14/02 18:10 |

## Polychlorinated Biphenyls by EPA Method 8082
## Sequoia Analytical - Petaluma

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **F01009LS 5,1 (P209468-15) Soil** | **Sampled: 09/17/02 15:20** | | **Received: 09/24/02 10:30** | | | | | | | **C-01, C-06** |
| PCB-1016 | ND | | 51 | ug/kg dry | 1 | 2090779 | 09/30/02 | 10/02/02 | EPA 8082 | |
| PCB-1221 | ND | | 51 | " | " | " | " | " | " | |
| PCB-1232 | ND | | 51 | " | " | " | " | " | " | |
| PCB-1242 | ND | | 51 | " | " | " | " | " | " | |
| PCB-1248 | ND | | 51 | " | " | " | " | " | " | |
| PCB-1254 | ND | | 51 | " | " | " | " | " | " | |
| PCB-1260 | ND | | 51 | " | " | " | " | " | " | |
| *Surrogate: Decachlorobiphenyl* | | *63 %* | *46-115* | | | *"* | *"* | *"* | *"* | |
| **F01009LS 6,3 (P209468-16) Soil** | **Sampled: 09/17/02 15:40** | | **Received: 09/24/02 10:30** | | | | | | | **C-01, C-06** |
| PCB-1016 | ND | | 45 | ug/kg dry | 1 | 2090779 | 09/30/02 | 10/02/02 | EPA 8082 | |
| PCB-1221 | ND | | 45 | " | " | " | " | " | " | |
| PCB-1232 | ND | | 45 | " | " | " | " | " | " | |
| PCB-1242 | ND | | 45 | " | " | " | " | " | " | |
| PCB-1248 | ND | | 45 | " | " | " | " | " | " | |
| PCB-1254 | ND | | 45 | " | " | " | " | " | " | |
| PCB-1260 | ND | | 45 | " | " | " | " | " | " | |
| *Surrogate: Decachlorobiphenyl* | | *66 %* | *46-115* | | | *"* | *"* | *"* | *"* | |
| **F01009LS 6,2 (P209468-17) Soil** | **Sampled: 09/17/02 15:50** | | **Received: 09/24/02 10:30** | | | | | | | **C-01, C-06** |
| PCB-1016 | ND | | 53 | ug/kg dry | 1 | 2090779 | 09/30/02 | 10/02/02 | EPA 8082 | |
| PCB-1221 | ND | | 53 | " | " | " | " | " | " | |
| PCB-1232 | ND | | 53 | " | " | " | " | " | " | |
| PCB-1242 | ND | | 53 | " | " | " | " | " | " | |
| PCB-1248 | ND | | 53 | " | " | " | " | " | " | |
| PCB-1254 | ND | | 53 | " | " | " | " | " | " | |
| PCB-1260 | ND | | 53 | " | " | " | " | " | " | |
| *Surrogate: Decachlorobiphenyl* | | *59 %* | *46-115* | | | *"* | *"* | *"* | *"* | |

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| Environet, Inc.<br>2850 Paa Street, Suite 212<br>Honolulu HI, 96819 | Project: Saipan AES<br>Project Number: [none]<br>Project Manager: Matt Neal | P209468<br>**Reported:**<br>10/14/02 18:10 |

## Polychlorinated Biphenyls by EPA Method 8082
## Sequoia Analytical - Petaluma

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **F01009LS 6,1 (P209468-18) Soil** | **Sampled: 09/17/02 16:05** | | **Received: 09/24/02 10:30** | | | | | | | **C-01, C-06** |
| PCB-1016 | ND | | 52 | ug/kg dry | 1 | 2090779 | 09/30/02 | 10/02/02 | EPA 8082 | |
| PCB-1221 | ND | | 52 | " | " | " | " | " | " | |
| PCB-1232 | ND | | 52 | " | " | " | " | " | " | |
| PCB-1242 | ND | | 52 | " | " | " | " | " | " | |
| PCB-1248 | ND | | 52 | " | " | " | " | " | " | |
| PCB-1254 | ND | | 52 | " | " | " | " | " | " | |
| PCB-1260 | ND | | 52 | " | " | " | " | " | " | |
| *Surrogate: Decachlorobiphenyl* | | *65 %* | *46-115* | | | " | " | " | " | |

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| Environet, Inc.<br>2850 Paa Street, Suite 212<br>Honolulu HI, 96819 | Project: Saipan AES<br>Project Number: [none]<br>Project Manager: Matt Neal | P209468<br>**Reported:**<br>10/14/02 18:10 |

## Semivolatile Organic Compounds by EPA Method 8270C
## Sequoia Analytical - Petaluma

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **F01009LS 1,3 (P209468-01) Soil Sampled: 09/17/02 12:20 Received: 09/24/02 10:30** | | | | | | | | | | |
| Acenaphthene | ND | | 450 | ug/kg dry | 1 | 2090778 | 09/30/02 | 10/03/02 | EPA 8270C | |
| Acenaphthylene | ND | | 450 | " | " | " | " | " | " | |
| Anthracene | ND | | 450 | " | " | " | " | " | " | |
| Benzo (a) anthracene | ND | | 450 | " | " | " | " | " | " | |
| Benzo (b+k) fluoranthene (total) | ND | | 450 | " | " | " | " | " | " | |
| Benzo (g,h,i) perylene | ND | | 450 | " | " | " | " | " | " | |
| Benzo (a) pyrene | ND | | 450 | " | " | " | " | " | " | |
| Chrysene | ND | | 450 | " | " | " | " | " | " | |
| Dibenz (a,h) anthracene | ND | | 450 | " | " | " | " | " | " | |
| Fluoranthene | ND | | 450 | " | " | " | " | " | " | |
| Fluorene | ND | | 450 | " | " | " | " | " | " | |
| Indeno (1,2,3-cd) pyrene | ND | | 450 | " | " | " | " | " | " | |
| Naphthalene | ND | | 450 | " | " | " | " | " | " | |
| Phenanthrene | ND | | 450 | " | " | " | " | " | " | |
| Pyrene | ND | | 450 | " | " | " | " | " | " | |
| *Surrogate: Nitrobenzene-d5* | | *74 %* | *16-126* | | | " | " | " | " | |
| *Surrogate: 2-Fluorobiphenyl* | | *71 %* | *28-134* | | | " | " | " | " | |
| *Surrogate: Terphenyl-d14* | | *108 %* | *64-119* | | | " | " | " | " | |
| **F01009LS 1,2 (P209468-02) Soil Sampled: 09/17/02 12:39 Received: 09/24/02 10:30** | | | | | | | | | | |
| Acenaphthene | ND | | 510 | ug/kg dry | 1 | 2090778 | 09/30/02 | 10/04/02 | EPA 8270C | |
| Acenaphthylene | ND | | 510 | " | " | " | " | " | " | |
| Anthracene | ND | | 510 | " | " | " | " | " | " | |
| Benzo (a) anthracene | ND | | 510 | " | " | " | " | " | " | |
| Benzo (b+k) fluoranthene (total) | ND | | 510 | " | " | " | " | " | " | |
| Benzo (g,h,i) perylene | ND | | 510 | " | " | " | " | " | " | |
| Benzo (a) pyrene | ND | | 510 | " | " | " | " | " | " | |
| Chrysene | ND | | 510 | " | " | " | " | " | " | |
| Dibenz (a,h) anthracene | ND | | 510 | " | " | " | " | " | " | |
| Fluoranthene | ND | | 510 | " | " | " | " | " | " | |
| Fluorene | ND | | 510 | " | " | " | " | " | " | |
| Indeno (1,2,3-cd) pyrene | ND | | 510 | " | " | " | " | " | " | |
| Naphthalene | ND | | 510 | " | " | " | " | " | " | |
| Phenanthrene | ND | | 510 | " | " | " | " | " | " | |
| Pyrene | ND | | 510 | " | " | " | " | " | " | |
| *Surrogate: Nitrobenzene-d5* | | *66 %* | *16-126* | | | " | " | " | " | |
| *Surrogate: 2-Fluorobiphenyl* | | *50 %* | *28-134* | | | " | " | " | " | |
| *Surrogate: Terphenyl-d14* | | *85 %* | *64-119* | | | " | " | " | " | |

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| Environet, Inc. | Project: Saipan AES | P209468 |
| 2850 Paa Street, Suite 212 | Project Number: [none] | Reported: |
| Honolulu HI, 96819 | Project Manager: Matt Neal | 10/14/02 18:10 |

## Semivolatile Organic Compounds by EPA Method 8270C
## Sequoia Analytical - Petaluma

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **F01009LS 1,1 (P209468-03) Soil** | **Sampled: 09/17/02 12:45** | | **Received: 09/24/02 10:30** | | | | | | | |
| Acenaphthene | ND | | 430 | ug/kg dry | 1 | 2090778 | 09/30/02 | 10/04/02 | EPA 8270C | |
| Acenaphthylene | ND | | 430 | " | " | " | " | " | " | |
| Anthracene | ND | | 430 | " | " | " | " | " | " | |
| Benzo (a) anthracene | ND | | 430 | " | " | " | " | " | " | |
| Benzo (b+k) fluoranthene (total) | ND | | 430 | " | " | " | " | " | " | |
| Benzo (g,h,i) perylene | ND | | 430 | " | " | " | " | " | " | |
| Benzo (a) pyrene | ND | | 430 | " | " | " | " | " | " | |
| Chrysene | ND | | 430 | " | " | " | " | " | " | |
| Dibenz (a,h) anthracene | ND | | 430 | " | " | " | " | " | " | |
| Fluoranthene | ND | | 430 | " | " | " | " | " | " | |
| Fluorene | ND | | 430 | " | " | " | " | " | " | |
| Indeno (1,2,3-cd) pyrene | ND | | 430 | " | " | " | " | " | " | |
| Naphthalene | ND | | 430 | " | " | " | " | " | " | |
| Phenanthrene | ND | | 430 | " | " | " | " | " | " | |
| Pyrene | ND | | 430 | " | " | " | " | " | " | |
| *Surrogate: Nitrobenzene-d5* | | *60 %* | *16-126* | | | " | " | " | " | |
| *Surrogate: 2-Fluorobiphenyl* | | *60 %* | *28-134* | | | " | " | " | " | |
| *Surrogate: Terphenyl-d14* | | *100 %* | *64-119* | | | " | " | " | " | |
| **F01009LS 2,3 (P209468-04) Soil** | **Sampled: 09/17/02 13:00** | | **Received: 09/24/02 10:30** | | | | | | | |
| Acenaphthene | ND | | 430 | ug/kg dry | 1 | 2090778 | 09/30/02 | 10/04/02 | EPA 8270C | |
| Acenaphthylene | ND | | 430 | " | " | " | " | " | " | |
| Anthracene | ND | | 430 | " | " | " | " | " | " | |
| Benzo (a) anthracene | ND | | 430 | " | " | " | " | " | " | |
| Benzo (b+k) fluoranthene (total) | ND | | 430 | " | " | " | " | " | " | |
| Benzo (g,h,i) perylene | ND | | 430 | " | " | " | " | " | " | |
| Benzo (a) pyrene | ND | | 430 | " | " | " | " | " | " | |
| Chrysene | ND | | 430 | " | " | " | " | " | " | |
| Dibenz (a,h) anthracene | ND | | 430 | " | " | " | " | " | " | |
| Fluoranthene | ND | | 430 | " | " | " | " | " | " | |
| Fluorene | ND | | 430 | " | " | " | " | " | " | |
| Indeno (1,2,3-cd) pyrene | ND | | 430 | " | " | " | " | " | " | |
| Naphthalene | ND | | 430 | " | " | " | " | " | " | |
| Phenanthrene | ND | | 430 | " | " | " | " | " | " | |
| Pyrene | ND | | 430 | " | " | " | " | " | " | |
| *Surrogate: Nitrobenzene-d5* | | *76 %* | *16-126* | | | " | " | " | " | |
| *Surrogate: 2-Fluorobiphenyl* | | *78 %* | *28-134* | | | " | " | " | " | |
| *Surrogate: Terphenyl-d14* | | *99 %* | *64-119* | | | " | " | " | " | |

## Semivolatile Organic Compounds by EPA Method 8270C
## Sequoia Analytical - Petaluma

**F01009LS 2,2 (P209468-05) Soil Sampled: 09/17/02 13:15 Received: 09/24/02 10:30**

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | ND | | 430 | ug/kg dry | 1 | 2090778 | 09/30/02 | 10/04/02 | EPA 8270C | |
| Acenaphthylene | ND | | 430 | " | " | " | " | " | " | |
| Anthracene | ND | | 430 | " | " | " | " | " | " | |
| Benzo (a) anthracene | ND | | 430 | " | " | " | " | " | " | |
| Benzo (b+k) fluoranthene (total) | ND | | 430 | " | " | " | " | " | " | |
| Benzo (g,h,i) perylene | ND | | 430 | " | " | " | " | " | " | |
| Benzo (a) pyrene | ND | | 430 | " | " | " | " | " | " | |
| Chrysene | ND | | 430 | " | " | " | " | " | " | |
| Dibenz (a,h) anthracene | ND | | 430 | " | " | " | " | " | " | |
| Fluoranthene | ND | | 430 | " | " | " | " | " | " | |
| Fluorene | ND | | 430 | " | " | " | " | " | " | |
| Indeno (1,2,3-cd) pyrene | ND | | 430 | " | " | " | " | " | " | |
| Naphthalene | ND | | 430 | " | " | " | " | " | " | |
| Phenanthrene | ND | | 430 | " | " | " | " | " | " | |
| Pyrene | ND | | 430 | " | " | " | " | " | " | |
| *Surrogate: Nitrobenzene-d5* | | *81 %* | *16-126* | | | " | " | " | " | |
| *Surrogate: 2-Fluorobiphenyl* | | *81 %* | *28-134* | | | " | " | " | " | |
| *Surrogate: Terphenyl-d14* | | *102 %* | *64-119* | | | " | " | " | " | |

**F01009LS 2,1 (P209468-06) Soil Sampled: 09/17/02 13:25 Received: 09/24/02 10:30**

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | ND | | 450 | ug/kg dry | 1 | 2090778 | 09/30/02 | 10/04/02 | EPA 8270C | |
| Acenaphthylene | ND | | 450 | " | " | " | " | " | " | |
| Anthracene | ND | | 450 | " | " | " | " | " | " | |
| Benzo (a) anthracene | ND | | 450 | " | " | " | " | " | " | |
| Benzo (b+k) fluoranthene (total) | ND | | 450 | " | " | " | " | " | " | |
| Benzo (g,h,i) perylene | ND | | 450 | " | " | " | " | " | " | |
| Benzo (a) pyrene | ND | | 450 | " | " | " | " | " | " | |
| Chrysene | ND | | 450 | " | " | " | " | " | " | |
| Dibenz (a,h) anthracene | ND | | 450 | " | " | " | " | " | " | |
| Fluoranthene | ND | | 450 | " | " | " | " | " | " | |
| Fluorene | ND | | 450 | " | " | " | " | " | " | |
| Indeno (1,2,3-cd) pyrene | ND | | 450 | " | " | " | " | " | " | |
| Naphthalene | ND | | 450 | " | " | " | " | " | " | |
| Phenanthrene | ND | | 450 | " | " | " | " | " | " | |
| Pyrene | ND | | 450 | " | " | " | " | " | " | |
| *Surrogate: Nitrobenzene-d5* | | *71 %* | *16-126* | | | " | " | " | " | |
| *Surrogate: 2-Fluorobiphenyl* | | *73 %* | *28-134* | | | " | " | " | " | |
| *Surrogate: Terphenyl-d14* | | *102 %* | *64-119* | | | " | " | " | " | |

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| Environet, Inc.<br>2850 Paa Street, Suite 212<br>Honolulu HI, 96819 | Project: Saipan AES<br>Project Number: [none]<br>Project Manager: Matt Neal | P209468<br>**Reported:**<br>10/14/02 18:10 |

## Semivolatile Organic Compounds by EPA Method 8270C
## Sequoia Analytical - Petaluma

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **F01009LS 3,3 (P209468-07) Soil** | **Sampled: 09/17/02 13:40** | | **Received: 09/24/02 10:30** | | | | | | | |
| Acenaphthene | ND | | 450 | ug/kg dry | 1 | 2090778 | 09/30/02 | 10/04/02 | EPA 8270C | |
| Acenaphthylene | ND | | 450 | " | " | " | " | " | " | |
| Anthracene | ND | | 450 | " | " | " | " | " | " | |
| Benzo (a) anthracene | ND | | 450 | " | " | " | " | " | " | |
| Benzo (b+k) fluoranthene (total) | ND | | 450 | " | " | " | " | " | " | |
| Benzo (g,h,i) perylene | ND | | 450 | " | " | " | " | " | " | |
| Benzo (a) pyrene | ND | | 450 | " | " | " | " | " | " | |
| Chrysene | ND | | 450 | " | " | " | " | " | " | |
| Dibenz (a,h) anthracene | ND | | 450 | " | " | " | " | " | " | |
| Fluoranthene | ND | | 450 | " | " | " | " | " | " | |
| Fluorene | ND | | 450 | " | " | " | " | " | " | |
| Indeno (1,2,3-cd) pyrene | ND | | 450 | " | " | " | " | " | " | |
| Naphthalene | ND | | 450 | " | " | " | " | " | " | |
| Phenanthrene | ND | | 450 | " | " | " | " | " | " | |
| Pyrene | ND | | 450 | " | " | " | " | " | " | |
| *Surrogate: Nitrobenzene-d5* | | *70 %* | *16-126* | | | " | " | " | " | |
| *Surrogate: 2-Fluorobiphenyl* | | *72 %* | *28-134* | | | " | " | " | " | |
| *Surrogate: Terphenyl-d14* | | *96 %* | *64-119* | | | " | " | " | " | |
| **F01009LS 3,2 (P209468-08) Soil** | **Sampled: 09/17/02 13:50** | | **Received: 09/24/02 10:30** | | | | | | | |
| Acenaphthene | ND | | 530 | ug/kg dry | 1 | 2090778 | 09/30/02 | 10/04/02 | EPA 8270C | |
| Acenaphthylene | ND | | 530 | " | " | " | " | " | " | |
| Anthracene | ND | | 530 | " | " | " | " | " | " | |
| Benzo (a) anthracene | ND | | 530 | " | " | " | " | " | " | |
| Benzo (b+k) fluoranthene (total) | ND | | 530 | " | " | " | " | " | " | |
| Benzo (g,h,i) perylene | ND | | 530 | " | " | " | " | " | " | |
| Benzo (a) pyrene | ND | | 530 | " | " | " | " | " | " | |
| Chrysene | ND | | 530 | " | " | " | " | " | " | |
| Dibenz (a,h) anthracene | ND | | 530 | " | " | " | " | " | " | |
| Fluoranthene | ND | | 530 | " | " | " | " | " | " | |
| Fluorene | ND | | 530 | " | " | " | " | " | " | |
| Indeno (1,2,3-cd) pyrene | ND | | 530 | " | " | " | " | " | " | |
| Naphthalene | ND | | 530 | " | " | " | " | " | " | |
| Phenanthrene | ND | | 530 | " | " | " | " | " | " | |
| Pyrene | ND | | 530 | " | " | " | " | " | " | |
| *Surrogate: Nitrobenzene-d5* | | *76 %* | *16-126* | | | " | " | " | " | |
| *Surrogate: 2-Fluorobiphenyl* | | *65 %* | *28-134* | | | " | " | " | " | |
| *Surrogate: Terphenyl-d14* | | *99 %* | *64-119* | | | " | " | " | " | |

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| Environet, Inc.<br>2850 Paa Street, Suite 212<br>Honolulu HI, 96819 | Project: Saipan AES<br>Project Number: [none]<br>Project Manager: Matt Neal | P209468<br>**Reported:**<br>10/14/02 18:10 |

## Semivolatile Organic Compounds by EPA Method 8270C
## Sequoia Analytical - Petaluma

**F01009LS 3,1 (P209468-09) Soil Sampled: 09/17/02 14:00 Received: 09/24/02 10:30**

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | ND | | 430 | ug/kg dry | 1 | 2090778 | 09/30/02 | 10/04/02 | EPA 8270C | |
| Acenaphthylene | ND | | 430 | " | " | " | " | " | " | |
| Anthracene | ND | | 430 | " | " | " | " | " | " | |
| Benzo (a) anthracene | ND | | 430 | " | " | " | " | " | " | |
| Benzo (b+k) fluoranthene (total) | ND | | 430 | " | " | " | " | " | " | |
| Benzo (g,h,i) perylene | ND | | 430 | " | " | " | " | " | " | |
| Benzo (a) pyrene | ND | | 430 | " | " | " | " | " | " | |
| Chrysene | ND | | 430 | " | " | " | " | " | " | |
| Dibenz (a,h) anthracene | ND | | 430 | " | " | " | " | " | " | |
| Fluoranthene | ND | | 430 | " | " | " | " | " | " | |
| Fluorene | ND | | 430 | " | " | " | " | " | " | |
| Indeno (1,2,3-cd) pyrene | ND | | 430 | " | " | " | " | " | " | |
| Naphthalene | ND | | 430 | " | " | " | " | " | " | |
| Phenanthrene | ND | | 430 | " | " | " | " | " | " | |
| Pyrene | ND | | 430 | " | " | " | " | " | " | |
| *Surrogate: Nitrobenzene-d5* | | *23 %* | *16-126* | | | " | " | " | " | |
| *Surrogate: 2-Fluorobiphenyl* | | *25 %* | *28-134* | | | " | " | " | " | *S-LIM* |
| *Surrogate: Terphenyl-d14* | | *35 %* | *64-119* | | | " | " | " | " | *S-LIM* |

**F01009LS 3,1 (P209468-09RE1) Soil Sampled: 09/17/02 14:00 Received: 09/24/02 10:30 HT-03**

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | ND | | 430 | ug/kg dry | 1 | 2100198 | 10/07/02 | 10/09/02 | EPA 8270C | |
| Acenaphthylene | ND | | 430 | " | " | " | " | " | " | |
| Anthracene | ND | | 430 | " | " | " | " | " | " | |
| Benzo (a) anthracene | ND | | 430 | " | " | " | " | " | " | |
| Benzo (b+k) fluoranthene (total) | ND | | 430 | " | " | " | " | " | " | |
| Benzo (g,h,i) perylene | ND | | 430 | " | " | " | " | " | " | |
| Benzo (a) pyrene | ND | | 430 | " | " | " | " | " | " | |
| Chrysene | ND | | 430 | " | " | " | " | " | " | |
| Dibenz (a,h) anthracene | ND | | 430 | " | " | " | " | " | " | |
| Fluoranthene | ND | | 430 | " | " | " | " | " | " | |
| Fluorene | ND | | 430 | " | " | " | " | " | " | |
| Indeno (1,2,3-cd) pyrene | ND | | 430 | " | " | " | " | " | " | |
| Naphthalene | ND | | 430 | " | " | " | " | " | " | |
| Phenanthrene | ND | | 430 | " | " | " | " | " | " | |
| Pyrene | ND | | 430 | " | " | " | " | " | " | |
| *Surrogate: Nitrobenzene-d5* | | *40 %* | *16-126* | | | " | " | " | " | |
| *Surrogate: 2-Fluorobiphenyl* | | *47 %* | *28-134* | | | " | " | " | " | |
| *Surrogate: Terphenyl-d14* | | *79 %* | *64-119* | | | " | " | " | " | |

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| Environet, Inc.<br>2850 Paa Street, Suite 212<br>Honolulu HI, 96819 | Project: Saipan AES<br>Project Number: [none]<br>Project Manager: Matt Neal | P209468<br>**Reported:**<br>10/14/02 18:10 |

## Semivolatile Organic Compounds by EPA Method 8270C
## Sequoia Analytical - Petaluma

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **F01009LS 4,3 (P209468-10) Soil** | **Sampled: 09/17/02 14:15** | | **Received: 09/24/02 10:30** | | | | | | | |
| Acenaphthene | ND | | 440 | ug/kg dry | 1 | 2090778 | 09/30/02 | 10/04/02 | EPA 8270C | |
| Acenaphthylene | ND | | 440 | " | " | " | " | " | " | |
| Anthracene | ND | | 440 | " | " | " | " | " | " | |
| Benzo (a) anthracene | ND | | 440 | " | " | " | " | " | " | |
| Benzo (b+k) fluoranthene (total) | ND | | 440 | " | " | " | " | " | " | |
| Benzo (g,h,i) perylene | ND | | 440 | " | " | " | " | " | " | |
| Benzo (a) pyrene | ND | | 440 | " | " | " | " | " | " | |
| Chrysene | ND | | 440 | " | " | " | " | " | " | |
| Dibenz (a,h) anthracene | ND | | 440 | " | " | " | " | " | " | |
| Fluoranthene | ND | | 440 | " | " | " | " | " | " | |
| Fluorene | ND | | 440 | " | " | " | " | " | " | |
| Indeno (1,2,3-cd) pyrene | ND | | 440 | " | " | " | " | " | " | |
| Naphthalene | ND | | 440 | " | " | " | " | " | " | |
| Phenanthrene | ND | | 440 | " | " | " | " | " | " | |
| Pyrene | ND | | 440 | " | " | " | " | " | " | |
| *Surrogate: Nitrobenzene-d5* | | *82 %* | *16-126* | | | " | " | " | " | |
| *Surrogate: 2-Fluorobiphenyl* | | *79 %* | *28-134* | | | " | " | " | " | |
| *Surrogate: Terphenyl-d14* | | *100 %* | *64-119* | | | " | " | " | " | |
| **F01009LS 4,2 (P209468-11) Soil** | **Sampled: 09/17/02 14:30** | | **Received: 09/24/02 10:30** | | | | | | | |
| Acenaphthene | ND | | 440 | ug/kg dry | 1 | 2090778 | 09/30/02 | 10/04/02 | EPA 8270C | |
| Acenaphthylene | ND | | 440 | " | " | " | " | " | " | |
| Anthracene | ND | | 440 | " | " | " | " | " | " | |
| Benzo (a) anthracene | ND | | 440 | " | " | " | " | " | " | |
| Benzo (b+k) fluoranthene (total) | ND | | 440 | " | " | " | " | " | " | |
| Benzo (g,h,i) perylene | ND | | 440 | " | " | " | " | " | " | |
| Benzo (a) pyrene | ND | | 440 | " | " | " | " | " | " | |
| Chrysene | ND | | 440 | " | " | " | " | " | " | |
| Dibenz (a,h) anthracene | ND | | 440 | " | " | " | " | " | " | |
| Fluoranthene | ND | | 440 | " | " | " | " | " | " | |
| Fluorene | ND | | 440 | " | " | " | " | " | " | |
| Indeno (1,2,3-cd) pyrene | ND | | 440 | " | " | " | " | " | " | |
| Naphthalene | ND | | 440 | " | " | " | " | " | " | |
| Phenanthrene | ND | | 440 | " | " | " | " | " | " | |
| Pyrene | ND | | 440 | " | " | " | " | " | " | |
| *Surrogate: Nitrobenzene-d5* | | *69 %* | *16-126* | | | " | " | " | " | |
| *Surrogate: 2-Fluorobiphenyl* | | *72 %* | *28-134* | | | " | " | " | " | |
| *Surrogate: Terphenyl-d14* | | *98 %* | *64-119* | | | " | " | " | " | |

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| Environet, Inc. | Project: Saipan AES | P209468 |
| 2850 Paa Street, Suite 212 | Project Number: [none] | **Reported:** |
| Honolulu HI, 96819 | Project Manager: Matt Neal | 10/14/02 18:10 |

## Semivolatile Organic Compounds by EPA Method 8270C
## Sequoia Analytical - Petaluma

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **F01009LS 4,1 (P209468-12) Soil** | **Sampled: 09/17/02 14:45** | | **Received: 09/24/02 10:30** | | | | | | | |
| Acenaphthene | ND | | 430 | ug/kg dry | 1 | 2090778 | 09/30/02 | 10/04/02 | EPA 8270C | |
| Acenaphthylene | ND | | 430 | " | " | " | " | " | " | |
| Anthracene | ND | | 430 | " | " | " | " | " | " | |
| Benzo (a) anthracene | ND | | 430 | " | " | " | " | " | " | |
| Benzo (b+k) fluoranthene (total) | ND | | 430 | " | " | " | " | " | " | |
| Benzo (g,h,i) perylene | ND | | 430 | " | " | " | " | " | " | |
| Benzo (a) pyrene | ND | | 430 | " | " | " | " | " | " | |
| Chrysene | ND | | 430 | " | " | " | " | " | " | |
| Dibenz (a,h) anthracene | ND | | 430 | " | " | " | " | " | " | |
| Fluoranthene | ND | | 430 | " | " | " | " | " | " | |
| Fluorene | ND | | 430 | " | " | " | " | " | " | |
| Indeno (1,2,3-cd) pyrene | ND | | 430 | " | " | " | " | " | " | |
| Naphthalene | ND | | 430 | " | " | " | " | " | " | |
| Phenanthrene | ND | | 430 | " | " | " | " | " | " | |
| Pyrene | ND | | 430 | " | " | " | " | " | " | |
| *Surrogate: Nitrobenzene-d5* | | *56 %* | *16-126* | | | " | " | " | " | |
| *Surrogate: 2-Fluorobiphenyl* | | *58 %* | *28-134* | | | " | " | " | " | |
| *Surrogate: Terphenyl-d14* | | *100 %* | *64-119* | | | " | " | " | " | |
| **F01009LS 5,3 (P209468-13) Soil** | **Sampled: 09/17/02 15:00** | | **Received: 09/24/02 10:30** | | | | | | | |
| Acenaphthene | ND | | 420 | ug/kg dry | 1 | 2090778 | 09/30/02 | 10/04/02 | EPA 8270C | |
| Acenaphthylene | ND | | 420 | " | " | " | " | " | " | |
| Anthracene | ND | | 420 | " | " | " | " | " | " | |
| Benzo (a) anthracene | ND | | 420 | " | " | " | " | " | " | |
| Benzo (b+k) fluoranthene (total) | ND | | 420 | " | " | " | " | " | " | |
| Benzo (g,h,i) perylene | ND | | 420 | " | " | " | " | " | " | |
| Benzo (a) pyrene | ND | | 420 | " | " | " | " | " | " | |
| Chrysene | ND | | 420 | " | " | " | " | " | " | |
| Dibenz (a,h) anthracene | ND | | 420 | " | " | " | " | " | " | |
| Fluoranthene | ND | | 420 | " | " | " | " | " | " | |
| Fluorene | ND | | 420 | " | " | " | " | " | " | |
| Indeno (1,2,3-cd) pyrene | ND | | 420 | " | " | " | " | " | " | |
| Naphthalene | ND | | 420 | " | " | " | " | " | " | |
| Phenanthrene | ND | | 420 | " | " | " | " | " | " | |
| Pyrene | ND | | 420 | " | " | " | " | " | " | |
| *Surrogate: Nitrobenzene-d5* | | *75 %* | *16-126* | | | " | " | " | " | |
| *Surrogate: 2-Fluorobiphenyl* | | *74 %* | *28-134* | | | " | " | " | " | |
| *Surrogate: Terphenyl-d14* | | *98 %* | *64-119* | | | " | " | " | " | |

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| Environet, Inc.<br>2850 Paa Street, Suite 212<br>Honolulu HI, 96819 | Project: Saipan AES<br>Project Number: [none]<br>Project Manager: Matt Neal | P209468<br>**Reported:**<br>10/14/02 18:10 |

## Semivolatile Organic Compounds by EPA Method 8270C
## Sequoia Analytical - Petaluma

**F01009LS 5,2 (P209468-14) Soil Sampled: 09/17/02 15:10 Received: 09/24/02 10:30**

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | ND | | 410 | ug/kg dry | 1 | 2090778 | 09/30/02 | 10/04/02 | EPA 8270C | |
| Acenaphthylene | ND | | 410 | " | " | " | " | " | " | |
| Anthracene | ND | | 410 | " | " | " | " | " | " | |
| Benzo (a) anthracene | ND | | 410 | " | " | " | " | " | " | |
| Benzo (b+k) fluoranthene (total) | ND | | 410 | " | " | " | " | " | " | |
| Benzo (g,h,i) perylene | ND | | 410 | " | " | " | " | " | " | |
| Benzo (a) pyrene | ND | | 410 | " | " | " | " | " | " | |
| Chrysene | ND | | 410 | " | " | " | " | " | " | |
| Dibenz (a,h) anthracene | ND | | 410 | " | " | " | " | " | " | |
| Fluoranthene | ND | | 410 | " | " | " | " | " | " | |
| Fluorene | ND | | 410 | " | " | " | " | " | " | |
| Indeno (1,2,3-cd) pyrene | ND | | 410 | " | " | " | " | " | " | |
| Naphthalene | ND | | 410 | " | " | " | " | " | " | |
| Phenanthrene | ND | | 410 | " | " | " | " | " | " | |
| Pyrene | ND | | 410 | " | " | " | " | " | " | |
| *Surrogate: Nitrobenzene-d5* | | *78 %* | *16-126* | | | *"* | *"* | *"* | *"* | |
| *Surrogate: 2-Fluorobiphenyl* | | *79 %* | *28-134* | | | *"* | *"* | *"* | *"* | |
| *Surrogate: Terphenyl-d14* | | *101 %* | *64-119* | | | *"* | *"* | *"* | *"* | |

**F01009LS 5,1 (P209468-15) Soil Sampled: 09/17/02 15:20 Received: 09/24/02 10:30**

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | ND | | 510 | ug/kg dry | 1 | 2090778 | 09/30/02 | 10/04/02 | EPA 8270C | |
| Acenaphthylene | ND | | 510 | " | " | " | " | " | " | |
| Anthracene | ND | | 510 | " | " | " | " | " | " | |
| Benzo (a) anthracene | ND | | 510 | " | " | " | " | " | " | |
| Benzo (b+k) fluoranthene (total) | ND | | 510 | " | " | " | " | " | " | |
| Benzo (g,h,i) perylene | ND | | 510 | " | " | " | " | " | " | |
| Benzo (a) pyrene | ND | | 510 | " | " | " | " | " | " | |
| Chrysene | ND | | 510 | " | " | " | " | " | " | |
| Dibenz (a,h) anthracene | ND | | 510 | " | " | " | " | " | " | |
| Fluoranthene | ND | | 510 | " | " | " | " | " | " | |
| Fluorene | ND | | 510 | " | " | " | " | " | " | |
| Indeno (1,2,3-cd) pyrene | ND | | 510 | " | " | " | " | " | " | |
| Naphthalene | ND | | 510 | " | " | " | " | " | " | |
| Phenanthrene | ND | | 510 | " | " | " | " | " | " | |
| Pyrene | ND | | 510 | " | " | " | " | " | " | |
| *Surrogate: Nitrobenzene-d5* | | *65 %* | *16-126* | | | *"* | *"* | *"* | *"* | |
| *Surrogate: 2-Fluorobiphenyl* | | *64 %* | *28-134* | | | *"* | *"* | *"* | *"* | |
| *Surrogate: Terphenyl-d14* | | *100 %* | *64-119* | | | *"* | *"* | *"* | *"* | |

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| Environet, Inc. | Project: | Saipan AES | P209468 |
| 2850 Paa Street, Suite 212 | Project Number: | [none] | **Reported:** |
| Honolulu HI, 96819 | Project Manager: | Matt Neal | 10/14/02 18:10 |

## Semivolatile Organic Compounds by EPA Method 8270C
## Sequoia Analytical - Petaluma

**F01009LS 6,3 (P209468-16) Soil Sampled: 09/17/02 15:40 Received: 09/24/02 10:30**

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | ND | | 450 | ug/kg dry | 1 | 2090778 | 09/30/02 | 10/04/02 | EPA 8270C | |
| Acenaphthylene | ND | | 450 | " | " | " | " | " | " | |
| Anthracene | ND | | 450 | " | " | " | " | " | " | |
| Benzo (a) anthracene | ND | | 450 | " | " | " | " | " | " | |
| Benzo (b+k) fluoranthene (total) | ND | | 450 | " | " | " | " | " | " | |
| Benzo (g,h,i) perylene | ND | | 450 | " | " | " | " | " | " | |
| Benzo (a) pyrene | ND | | 450 | " | " | " | " | " | " | |
| Chrysene | ND | | 450 | " | " | " | " | " | " | |
| Dibenz (a,h) anthracene | ND | | 450 | " | " | " | " | " | " | |
| Fluoranthene | ND | | 450 | " | " | " | " | " | " | |
| Fluorene | ND | | 450 | " | " | " | " | " | " | |
| Indeno (1,2,3-cd) pyrene | ND | | 450 | " | " | " | " | " | " | |
| Naphthalene | ND | | 450 | " | " | " | " | " | " | |
| Phenanthrene | ND | | 450 | " | " | " | " | " | " | |
| Pyrene | ND | | 450 | " | " | " | " | " | " | |
| *Surrogate: Nitrobenzene-d5* | | *73 %* | *16-126* | | | " | " | " | " | |
| *Surrogate: 2-Fluorobiphenyl* | | *74 %* | *28-134* | | | " | " | " | " | |
| *Surrogate: Terphenyl-d14* | | *100 %* | *64-119* | | | " | " | " | " | |

**F01009LS 6,2 (P209468-17) Soil Sampled: 09/17/02 15:50 Received: 09/24/02 10:30**

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | ND | | 530 | ug/kg dry | 1 | 2090778 | 09/30/02 | 10/04/02 | EPA 8270C | |
| Acenaphthylene | ND | | 530 | " | " | " | " | " | " | |
| Anthracene | ND | | 530 | " | " | " | " | " | " | |
| Benzo (a) anthracene | ND | | 530 | " | " | " | " | " | " | |
| Benzo (b+k) fluoranthene (total) | ND | | 530 | " | " | " | " | " | " | |
| Benzo (g,h,i) perylene | ND | | 530 | " | " | " | " | " | " | |
| Benzo (a) pyrene | ND | | 530 | " | " | " | " | " | " | |
| Chrysene | ND | | 530 | " | " | " | " | " | " | |
| Dibenz (a,h) anthracene | ND | | 530 | " | " | " | " | " | " | |
| Fluoranthene | ND | | 530 | " | " | " | " | " | " | |
| Fluorene | ND | | 530 | " | " | " | " | " | " | |
| Indeno (1,2,3-cd) pyrene | ND | | 530 | " | " | " | " | " | " | |
| Naphthalene | ND | | 530 | " | " | " | " | " | " | |
| Phenanthrene | ND | | 530 | " | " | " | " | " | " | |
| Pyrene | ND | | 530 | " | " | " | " | " | " | |
| *Surrogate: Nitrobenzene-d5* | | *69 %* | *16-126* | | | " | " | " | " | |
| *Surrogate: 2-Fluorobiphenyl* | | *63 %* | *28-134* | | | " | " | " | " | |
| *Surrogate: Terphenyl-d14* | | *97 %* | *64-119* | | | " | " | " | " | |

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| Environet, Inc. | Project: Saipan AES | P209468 |
| 2850 Paa Street, Suite 212 | Project Number: [none] | **Reported:** |
| Honolulu HI, 96819 | Project Manager: Matt Neal | 10/14/02 18:10 |

## Semivolatile Organic Compounds by EPA Method 8270C
## Sequoia Analytical - Petaluma

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **F01009LS 6,1 (P209468-18) Soil Sampled: 09/17/02 16:05 Received: 09/24/02 10:30** | | | | | | | | | | |
| Acenaphthene | ND | | 520 | ug/kg dry | 1 | 2090778 | 09/30/02 | 10/04/02 | EPA 8270C | |
| Acenaphthylene | ND | | 520 | " | " | " | " | " | " | |
| Anthracene | ND | | 520 | " | " | " | " | " | " | |
| Benzo (a) anthracene | ND | | 520 | " | " | " | " | " | " | |
| Benzo (b+k) fluoranthene (total) | ND | | 520 | " | " | " | " | " | " | |
| Benzo (g,h,i) perylene | ND | | 520 | " | " | " | " | " | " | |
| Benzo (a) pyrene | ND | | 520 | " | " | " | " | " | " | |
| Chrysene | ND | | 520 | " | " | " | " | " | " | |
| Dibenz (a,h) anthracene | ND | | 520 | " | " | " | " | " | " | |
| Fluoranthene | ND | | 520 | " | " | " | " | " | " | |
| Fluorene | ND | | 520 | " | " | " | " | " | " | |
| Indeno (1,2,3-cd) pyrene | ND | | 520 | " | " | " | " | " | " | |
| Naphthalene | ND | | 520 | " | " | " | " | " | " | |
| Phenanthrene | ND | | 520 | " | " | " | " | " | " | |
| Pyrene | ND | | 520 | " | " | " | " | " | " | |
| *Surrogate: Nitrobenzene-d5* | | *71 %* | *16-126* | | | " | " | " | " | |
| *Surrogate: 2-Fluorobiphenyl* | | *67 %* | *28-134* | | | " | " | " | " | |
| *Surrogate: Terphenyl-d14* | | *93 %* | *64-119* | | | " | " | " | " | |

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|---|---|---|
| Environet, Inc.<br>2850 Paa Street, Suite 212<br>Honolulu HI, 96819 | Project: Saipan AES<br>Project Number: [none]<br>Project Manager: Matt Neal | P209468<br>**Reported:**<br>10/14/02 18:10 |

## Conventional Chemistry Parameters by APHA/EPA Methods
## Sequoia Analytical - Petaluma

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **F01009LS 1,3 (P209468-01) Soil** | **Sampled: 09/17/02 12:20** | | **Received: 09/24/02 10:30** | | | | | | | |
| **% Solids** | **74** | | 0.10 | % | 1 | 2090726 | 09/26/02 | 09/26/02 | SM 2540G | HT-04 |
| **F01009LS 1,2 (P209468-02) Soil** | **Sampled: 09/17/02 12:39** | | **Received: 09/24/02 10:30** | | | | | | | |
| **% Solids** | **65** | | 0.10 | % | 1 | 2090726 | 09/26/02 | 09/26/02 | SM 2540G | HT-04 |
| **F01009LS 1,1 (P209468-03) Soil** | **Sampled: 09/17/02 12:45** | | **Received: 09/24/02 10:30** | | | | | | | |
| **% Solids** | **78** | | 0.10 | % | 1 | 2090726 | 09/26/02 | 09/26/02 | SM 2540G | HT-04 |
| **F01009LS 2,3 (P209468-04) Soil** | **Sampled: 09/17/02 13:00** | | **Received: 09/24/02 10:30** | | | | | | | |
| **% Solids** | **76** | | 0.10 | % | 1 | 2090726 | 09/26/02 | 09/26/02 | SM 2540G | HT-04 |
| **F01009LS 2,2 (P209468-05) Soil** | **Sampled: 09/17/02 13:15** | | **Received: 09/24/02 10:30** | | | | | | | |
| **% Solids** | **76** | | 0.10 | % | 1 | 2090726 | 09/26/02 | 09/26/02 | SM 2540G | HT-04 |
| **F01009LS 2,1 (P209468-06) Soil** | **Sampled: 09/17/02 13:25** | | **Received: 09/24/02 10:30** | | | | | | | |
| **% Solids** | **73** | | 0.10 | % | 1 | 2090726 | 09/26/02 | 09/26/02 | SM 2540G | HT-04 |
| **F01009LS 3,3 (P209468-07) Soil** | **Sampled: 09/17/02 13:40** | | **Received: 09/24/02 10:30** | | | | | | | |
| **% Solids** | **74** | | 0.10 | % | 1 | 2090726 | 09/26/02 | 09/26/02 | SM 2540G | HT-04 |
| **F01009LS 3,2 (P209468-08) Soil** | **Sampled: 09/17/02 13:50** | | **Received: 09/24/02 10:30** | | | | | | | |
| **% Solids** | **62** | | 0.10 | % | 1 | 2090726 | 09/26/02 | 09/26/02 | SM 2540G | HT-04 |
| **F01009LS 3,1 (P209468-09) Soil** | **Sampled: 09/17/02 14:00** | | **Received: 09/24/02 10:30** | | | | | | | |
| **% Solids** | **76** | | 0.10 | % | 1 | 2090726 | 09/26/02 | 09/26/02 | SM 2540G | HT-04 |

## Conventional Chemistry Parameters by APHA/EPA Methods
## Sequoia Analytical - Petaluma

| Analyte | Result | MDL | Reporting Limit | Units | Dilution | Batch | Prepared | Analyzed | Method | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| **F01009LS 4,3 (P209468-10) Soil** | **Sampled: 09/17/02 14:15** | | **Received: 09/24/02 10:30** | | | | | | | |
| **% Solids** | **75** | | 0.10 | % | 1 | 2090726 | 09/26/02 | 09/26/02 | SM 2540G | HT-04 |
| **F01009LS 4,2 (P209468-11) Soil** | **Sampled: 09/17/02 14:30** | | **Received: 09/24/02 10:30** | | | | | | | |
| **% Solids** | **75** | | 0.10 | % | 1 | 2090726 | 09/26/02 | 09/26/02 | SM 2540G | HT-04 |
| **F01009LS 4,1 (P209468-12) Soil** | **Sampled: 09/17/02 14:45** | | **Received: 09/24/02 10:30** | | | | | | | |
| **% Solids** | **76** | | 0.10 | % | 1 | 2090726 | 09/26/02 | 09/26/02 | SM 2540G | HT-04 |
| **F01009LS 5,3 (P209468-13) Soil** | **Sampled: 09/17/02 15:00** | | **Received: 09/24/02 10:30** | | | | | | | |
| **% Solids** | **79** | | 0.10 | % | 1 | 2090726 | 09/26/02 | 09/26/02 | SM 2540G | HT-04 |
| **F01009LS 5,2 (P209468-14) Soil** | **Sampled: 09/17/02 15:10** | | **Received: 09/24/02 10:30** | | | | | | | |
| **% Solids** | **80** | | 0.10 | % | 1 | 2090726 | 09/26/02 | 09/26/02 | SM 2540G | HT-04 |
| **F01009LS 5,1 (P209468-15) Soil** | **Sampled: 09/17/02 15:20** | | **Received: 09/24/02 10:30** | | | | | | | |
| **% Solids** | **65** | | 0.10 | % | 1 | 2090726 | 09/26/02 | 09/26/02 | SM 2540G | HT-04 |
| **F01009LS 6,3 (P209468-16) Soil** | **Sampled: 09/17/02 15:40** | | **Received: 09/24/02 10:30** | | | | | | | |
| **% Solids** | **73** | | 0.10 | % | 1 | 2090726 | 09/26/02 | 09/26/02 | SM 2540G | HT-04 |
| **F01009LS 6,2 (P209468-17) Soil** | **Sampled: 09/17/02 15:50** | | **Received: 09/24/02 10:30** | | | | | | | |
| **% Solids** | **63** | | 0.10 | % | 1 | 2090726 | 09/26/02 | 09/26/02 | SM 2540G | HT-04 |
| **F01009LS 6,1 (P209468-18) Soil** | **Sampled: 09/17/02 16:05** | | **Received: 09/24/02 10:30** | | | | | | | |
| **% Solids** | **64** | | 0.10 | % | 1 | 2090726 | 09/26/02 | 09/26/02 | SM 2540G | HT-04 |

## Total Metals by EPA 6000/7000 Series Methods - Quality Control

### Sequoia Analytical - Petaluma

| Analyte | Result | MDL | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 2090710 - EPA 7471A** | | | | | | | | | | | |
| **Blank (2090710-BLK1)** | | | | | Prepared: 10/06/02 | Analyzed: 10/09/02 | | | | | |
| Mercury | 0.00537 | 0.00059 | 0.020 | mg/kg wet | | | | | | | J |
| **Laboratory Control Sample (2090710-BS1)** | | | | | Prepared: 10/06/02 | Analyzed: 10/09/02 | | | | | |
| Mercury | 0.114 | 0.00055 | 0.018 | mg/kg wet | 0.123 | | 93 | 80-120 | | | |
| **Matrix Spike (2090710-MS1)** | | **Source: P209468-01** | | | Prepared: 10/06/02 | Analyzed: 10/09/02 | | | | | |
| Mercury | 0.158 | 0.00074 | 0.025 | mg/kg dry | 0.165 | 0.018 | 85 | 80-120 | | | |
| **Matrix Spike Dup (2090710-MSD1)** | | **Source: P209468-01** | | | Prepared: 10/06/02 | Analyzed: 10/09/02 | | | | | |
| Mercury | 0.144 | 0.00065 | 0.022 | mg/kg dry | 0.144 | 0.018 | 88 | 80-120 | 9 | 20 | |
| **Batch 2090740 - EPA 3050B** | | | | | | | | | | | |
| **Blank (2090740-BLK1)** | | | | | Prepared: 10/03/02 | Analyzed: 10/09/02 | | | | | |
| Arsenic | ND | 3.5 | 10 | mg/kg wet | | | | | | | |
| Cadmium | ND | 0.28 | 1.0 | " | | | | | | | |
| Chromium | ND | 0.16 | 1.0 | " | | | | | | | |
| Copper | ND | 0.69 | 1.0 | " | | | | | | | |
| Lead | ND | 1.2 | 7.5 | " | | | | | | | |
| Nickel | ND | 0.77 | 3.0 | " | | | | | | | |
| Selenium | ND | 4.7 | 10 | " | | | | | | | |
| Tin | 15.6 | 6.2 | 35 | " | | | | | | | J |
| Zinc | 0.891 | 0.40 | 2.0 | " | | | | | | | J |
| **Laboratory Control Sample (2090740-BS1)** | | | | | Prepared: 10/03/02 | Analyzed: 10/09/02 | | | | | |
| Arsenic | 46.6 | 3.5 | 10 | mg/kg wet | 50.0 | | 93 | 80-120 | | | |
| Cadmium | 4.48 | 0.28 | 1.0 | " | 5.00 | | 90 | 80-120 | | | |
| Chromium | 46.2 | 0.16 | 1.0 | " | 50.0 | | 92 | 80-120 | | | |
| Copper | 46.4 | 0.69 | 1.0 | " | 50.0 | | 93 | 80-120 | | | |
| Lead | 45.6 | 1.2 | 7.5 | " | 50.0 | | 91 | 80-120 | | | |
| Nickel | 45.8 | 0.77 | 3.0 | " | 50.0 | | 92 | 80-120 | | | |
| Selenium | 49.5 | 4.7 | 10 | " | 50.0 | | 99 | 80-120 | | | |
| Tin | 225 | 6.2 | 35 | " | 250 | | 90 | 80-120 | | | |
| Zinc | 46.5 | 0.40 | 2.0 | " | 50.0 | | 93 | 80-120 | | | |

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| Environet, Inc. | Project: Saipan AES | P209468 |
| 2850 Paa Street, Suite 212 | Project Number: [none] | **Reported:** |
| Honolulu HI, 96819 | Project Manager: Matt Neal | 10/14/02 18:10 |

## Total Metals by EPA 6000/7000 Series Methods - Quality Control

## Sequoia Analytical - Petaluma

| Analyte | Result | MDL | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 2090740 - EPA 3050B** | | | | | | | | | | | |
| **Matrix Spike (2090740-MS1)** | | **Source: P209468-01** | | Prepared: 10/03/02 | | Analyzed: 10/09/02 | | | | | |
| Arsenic | 54.1 | 4.2 | 12 | mg/kg dry | 59.6 | ND | 91 | 80-120 | | | |
| Cadmium | 5.00 | 0.33 | 1.2 | " | 5.96 | ND | 84 | 80-120 | | | |
| Chromium | 51.1 | 0.19 | 1.2 | " | 59.6 | 5.5 | 77 | 80-120 | | | QM-RX |
| Copper | 52.2 | 0.82 | 1.2 | " | 59.6 | ND | 88 | 80-120 | | | |
| Lead | 43.4 | 1.5 | 8.9 | " | 59.6 | ND | 73 | 80-120 | | | QM-RX |
| Nickel | 43.7 | 0.92 | 3.6 | " | 59.6 | ND | 73 | 80-120 | | | QM-RX |
| Selenium | 51.1 | 5.6 | 12 | " | 59.6 | ND | 86 | 80-120 | | | |
| Tin | 282 | 7.4 | 42 | " | 298 | 29 | 85 | 80-120 | | | |
| Zinc | 49.6 | 0.48 | 2.4 | " | 59.6 | 2.1 | 80 | 80-120 | | | QM-RX |
| **Matrix Spike (2090740-MS2)** | | **Source: P209468-01** | | Prepared: 10/03/02 | | Analyzed: 10/09/02 | | | | | |
| Arsenic | 62.1 | 4.6 | 13 | mg/kg dry | 65.3 | ND | 95 | 80-120 | | | RA |
| Chromium | 55.5 | 0.21 | 1.3 | " | 65.3 | 5.5 | 77 | 80-120 | | | RA |
| Lead | 48.2 | 1.6 | 9.8 | " | 65.3 | ND | 74 | 80-120 | | | RA |
| Nickel | 50.7 | 1.0 | 3.9 | " | 65.3 | ND | 78 | 80-120 | | | RA |
| Tin | 295 | 8.1 | 46 | " | 327 | 29 | 81 | 80-120 | | | RA |
| Zinc | 55.9 | 0.52 | 2.6 | " | 65.3 | 2.1 | 82 | 80-120 | | | RA |
| **Matrix Spike Dup (2090740-MSD1)** | | **Source: P209468-01** | | Prepared: 10/03/02 | | Analyzed: 10/09/02 | | | | | |
| Arsenic | 71.0 | 4.7 | 13 | mg/kg dry | 66.6 | ND | 107 | 80-120 | 27 | 20 | QM-RX |
| Cadmium | 5.80 | 0.37 | 1.3 | " | 6.66 | ND | 87 | 80-120 | 15 | 20 | |
| Chromium | 57.6 | 0.21 | 1.3 | " | 66.6 | 5.5 | 78 | 80-120 | 12 | 20 | QM-RX |
| Copper | 59.4 | 0.92 | 1.3 | " | 66.6 | ND | 89 | 80-120 | 13 | 20 | |
| Lead | 51.3 | 1.6 | 10 | " | 66.6 | ND | 77 | 80-120 | 17 | 20 | QM-RX |
| Nickel | 52.5 | 1.0 | 4.0 | " | 66.6 | ND | 79 | 80-120 | 18 | 20 | QM-RX |
| Selenium | 62.7 | 6.3 | 13 | " | 66.6 | ND | 94 | 80-120 | 20 | 20 | |
| Tin | 287 | 8.2 | 47 | " | 333 | 29 | 77 | 80-120 | 2 | 20 | QM-RX |
| Zinc | 56.5 | 0.53 | 2.7 | " | 66.6 | 2.1 | 82 | 80-120 | 13 | 20 | |

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| Environet, Inc.<br>2850 Paa Street, Suite 212<br>Honolulu HI, 96819 | Project: Saipan AES<br>Project Number: [none]<br>Project Manager: Matt Neal | P209468<br>**Reported:**<br>10/14/02 18:10 |

## Total Metals by EPA 6000/7000 Series Methods - Quality Control

## Sequoia Analytical - Petaluma

**Batch 2090740 - EPA 3050B**

**Matrix Spike Dup (2090740-MSD2)** **Source: P209468-01** Prepared: 10/03/02 Analyzed: 10/09/02

| Analyte | Result | MDL | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Arsenic | 63.9 | 4.6 | 13 | mg/kg dry | 65.3 | ND | 98 | 80-120 | 3 | 20 | RA |
| Chromium | 57.7 | 0.21 | 1.3 | " | 65.3 | 5.5 | 80 | 80-120 | 4 | 20 | RA |
| Lead | 49.6 | 1.6 | 9.8 | " | 65.3 | ND | 76 | 80-120 | 3 | 20 | RA |
| Nickel | 51.8 | 1.0 | 3.9 | " | 65.3 | ND | 79 | 80-120 | 2 | 20 | RA |
| Tin | 316 | 8.1 | 46 | " | 327 | 29 | 88 | 80-120 | 7 | 20 | RA |
| Zinc | 56.7 | 0.52 | 2.6 | " | 65.3 | 2.1 | 84 | 80-120 | 1 | 20 | RA |

## Polychlorinated Biphenyls by EPA Method 8082 - Quality Control

## Sequoia Analytical - Petaluma

| Analyte | Result | MDL | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 2090779 - EPA 3550A** | | | | | | | | | | | |
| **Blank (2090779-BLK1)** | | | | | Prepared: 09/30/02 | Analyzed: 10/02/02 | | | | | **C-01, C-06** |
| PCB-1016 | ND | | 33 | ug/kg wet | | | | | | | |
| PCB-1221 | ND | | 33 | " | | | | | | | |
| PCB-1232 | ND | | 33 | " | | | | | | | |
| PCB-1242 | ND | | 33 | " | | | | | | | |
| PCB-1248 | ND | | 33 | " | | | | | | | |
| PCB-1254 | ND | | 33 | " | | | | | | | |
| PCB-1260 | ND | | 33 | " | | | | | | | |
| *Surrogate: Decachlorobiphenyl* | *52.3* | | | *"* | *66.7* | | *78* | *46-115* | | | |
| **Laboratory Control Sample (2090779-BS1)** | | | | | Prepared: 09/30/02 | Analyzed: 10/02/02 | | | | | **C-01, C-06** |
| PCB-1016 | 209 | | 33 | ug/kg wet | 333 | | 63 | 57-115 | | | |
| PCB-1260 | 242 | | 33 | " | 333 | | 73 | 71-120 | | | |
| *Surrogate: Decachlorobiphenyl* | *49.5* | | | *"* | *66.7* | | *74* | *46-115* | | | |
| **Matrix Spike (2090779-MS1)** | | **Source: P209468-02** | | | Prepared: 09/30/02 | Analyzed: 10/02/02 | | | | | **C-01, C-06** |
| PCB-1016 | 271 | | 51 | ug/kg dry | 515 | ND | 53 | 23-142 | | | |
| PCB-1260 | 270 | | 51 | " | 515 | ND | 52 | 28-148 | | | |
| *Surrogate: Decachlorobiphenyl* | *48.0* | | | *"* | *103* | | *47* | *46-115* | | | |
| **Matrix Spike Dup (2090779-MSD1)** | | **Source: P209468-02** | | | Prepared: 09/30/02 | Analyzed: 10/02/02 | | | | | **C-01, C-06** |
| PCB-1016 | 331 | | 51 | ug/kg dry | 515 | ND | 64 | 23-142 | 20 | 35 | |
| PCB-1260 | 336 | | 51 | " | 515 | ND | 65 | 28-148 | 22 | 35 | |
| *Surrogate: Decachlorobiphenyl* | *59.2* | | | *"* | *103* | | *57* | *46-115* | | | |
| **Batch 2100154 - EPA 3550A** | | | | | | | | | | | |
| **Blank (2100154-BLK1)** | | | | | Prepared: 10/04/02 | Analyzed: 10/07/02 | | | | | **C-01, C-06** |
| PCB-1016 | ND | | 33 | ug/kg wet | | | | | | | |
| PCB-1221 | ND | | 33 | " | | | | | | | |
| PCB-1232 | ND | | 33 | " | | | | | | | |
| PCB-1242 | ND | | 33 | " | | | | | | | |
| PCB-1248 | ND | | 33 | " | | | | | | | |
| PCB-1254 | ND | | 33 | " | | | | | | | |
| PCB-1260 | ND | | 33 | " | | | | | | | |
| *Surrogate: Decachlorobiphenyl* | *59.8* | | | *"* | *66.7* | | *90* | *46-115* | | | |

| | | |
|---|---|---|
| Environet, Inc.<br>2850 Paa Street, Suite 212<br>Honolulu HI, 96819 | Project: Saipan AES<br>Project Number: [none]<br>Project Manager: Matt Neal | P209468<br>**Reported:**<br>10/14/02 18:10 |

## Polychlorinated Biphenyls by EPA Method 8082 - Quality Control
## Sequoia Analytical - Petaluma

| Analyte | Result | MDL | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 2100154 - EPA 3550A** | | | | | | | | | | | |
| **Laboratory Control Sample (2100154-BS2)** | | | | | Prepared: 10/04/02 Analyzed: 10/07/02 | | | | | | **C-01, C-06** |
| PCB-1016 | 220 | | 33 | ug/kg wet | 333 | | 66 | 57-115 | | | |
| PCB-1260 | 282 | | 33 | " | 333 | | 85 | 71-120 | | | |
| *Surrogate: Decachlorobiphenyl* | *56.7* | | | *"* | *66.7* | | *85* | *46-115* | | | |
| **Matrix Spike (2100154-MS2)** | | **Source: P209468-02RE** | | | Prepared: 10/04/02 Analyzed: 10/07/02 | | | | | | **C-01, C-06** |
| PCB-1016 | 332 | | 51 | ug/kg dry | 515 | ND | 64 | 23-142 | | | |
| PCB-1260 | 399 | | 51 | " | 515 | ND | 77 | 28-148 | | | |
| *Surrogate: Decachlorobiphenyl* | *81.0* | | | *"* | *103* | | *79* | *46-115* | | | |
| **Matrix Spike Dup (2100154-MSD2)** | | **Source: P209468-02RE** | | | Prepared: 10/04/02 Analyzed: 10/07/02 | | | | | | **C-01, C-06** |
| PCB-1016 | 323 | | 51 | ug/kg dry | 515 | ND | 63 | 23-142 | 3 | 35 | |
| PCB-1260 | 391 | | 51 | " | 515 | ND | 76 | 28-148 | 2 | 35 | |
| *Surrogate: Decachlorobiphenyl* | *78.4* | | | *"* | *103* | | *76* | *46-115* | | | |

| | | |
|---|---|---|
| Environet, Inc.<br>2850 Paa Street, Suite 212<br>Honolulu HI, 96819 | Project: Saipan AES<br>Project Number: [none]<br>Project Manager: Matt Neal | P209468<br>**Reported:**<br>10/14/02 18:10 |

## Semivolatile Organic Compounds by EPA Method 8270C - Quality Control
## Sequoia Analytical - Petaluma

**Batch 2090778 - EPA 3550A Sonication**

**Blank (2090778-BLK1)** Prepared: 09/30/02 Analyzed: 10/02/02

| Analyte | Result | MDL | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | ND | | 330 | ug/kg wet | | | | | | | |
| Acenaphthylene | ND | | 330 | " | | | | | | | |
| Anthracene | ND | | 330 | " | | | | | | | |
| Benzo (a) anthracene | ND | | 330 | " | | | | | | | |
| Benzo (b+k) fluoranthene (total) | ND | | 330 | " | | | | | | | |
| Benzo (g,h,i) perylene | ND | | 330 | " | | | | | | | |
| Benzo (a) pyrene | ND | | 330 | " | | | | | | | |
| Chrysene | ND | | 330 | " | | | | | | | |
| Dibenz (a,h) anthracene | ND | | 330 | " | | | | | | | |
| Fluoranthene | ND | | 330 | " | | | | | | | |
| Fluorene | ND | | 330 | " | | | | | | | |
| Indeno (1,2,3-cd) pyrene | ND | | 330 | " | | | | | | | |
| Naphthalene | ND | | 330 | " | | | | | | | |
| Phenanthrene | ND | | 330 | " | | | | | | | |
| Pyrene | ND | | 330 | " | | | | | | | |
| *Surrogate: Nitrobenzene-d5* | *2580* | | | *"* | *3330* | | *77* | *16-126* | | | |
| *Surrogate: 2-Fluorobiphenyl* | *2600* | | | *"* | *3330* | | *78* | *28-134* | | | |
| *Surrogate: Terphenyl-d14* | *3650* | | | *"* | *3330* | | *110* | *64-119* | | | |

**Laboratory Control Sample (2090778-BS1)** Prepared: 09/30/02 Analyzed: 10/02/02

| Analyte | Result | MDL | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 2870 | | 330 | ug/kg wet | 3330 | | 86 | 58-120 | | | |
| Pyrene | 3280 | | 330 | " | 3330 | | 98 | 52-127 | | | |
| *Surrogate: Nitrobenzene-d5* | *2740* | | | *"* | *3330* | | *82* | *16-126* | | | |
| *Surrogate: 2-Fluorobiphenyl* | *2880* | | | *"* | *3330* | | *86* | *28-134* | | | |
| *Surrogate: Terphenyl-d14* | *3760* | | | *"* | *3330* | | *113* | *64-119* | | | |

**Matrix Spike (2090778-MS1)** **Source: P209468-01** Prepared: 09/30/02 Analyzed: 10/03/02

| Analyte | Result | MDL | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 3420 | | 450 | ug/kg dry | 4530 | ND | 75 | 21-123 | | | |
| Pyrene | 4780 | | 450 | " | 4530 | ND | 106 | 5-137 | | | |
| *Surrogate: Nitrobenzene-d5* | *3450* | | | *"* | *4530* | | *76* | *16-126* | | | |
| *Surrogate: 2-Fluorobiphenyl* | *3500* | | | *"* | *4530* | | *77* | *28-134* | | | |
| *Surrogate: Terphenyl-d14* | *5690* | | | *"* | *4530* | | *126* | *64-119* | | | *S-BN* |

## Semivolatile Organic Compounds by EPA Method 8270C - Quality Control
## Sequoia Analytical - Petaluma

| Analyte | Result | MDL | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 2090778 - EPA 3550A Sonication** | | | | | | | | | | | |
| **Matrix Spike (2090778-MS2)** | | | **Source: P209468-01** | | Prepared: 09/30/02 | Analyzed: 10/03/02 | | | | | |
| Acenaphthene | 3650 | | 450 | ug/kg dry | 4530 | ND | 81 | 21-123 | | | |
| Pyrene | 4350 | | 450 | " | 4530 | ND | 96 | 5-137 | | | |
| *Surrogate: Nitrobenzene-d5* | *3520* | | | " | *4530* | | *78* | *16-126* | | | |
| *Surrogate: 2-Fluorobiphenyl* | *3730* | | | " | *4530* | | *82* | *28-134* | | | |
| *Surrogate: Terphenyl-d14* | *5160* | | | " | *4530* | | *114* | *64-119* | | | |
| **Matrix Spike Dup (2090778-MSD1)** | | | **Source: P209468-01** | | Prepared: 09/30/02 | Analyzed: 10/03/02 | | | | | |
| Acenaphthene | 3480 | | 450 | ug/kg dry | 4530 | ND | 77 | 21-123 | 2 | 31 | |
| Pyrene | 4190 | | 450 | " | 4530 | ND | 92 | 5-137 | 13 | 44 | |
| *Surrogate: Nitrobenzene-d5* | *3480* | | | " | *4530* | | *77* | *16-126* | | | |
| *Surrogate: 2-Fluorobiphenyl* | *3580* | | | " | *4530* | | *79* | *28-134* | | | |
| *Surrogate: Terphenyl-d14* | *5030* | | | " | *4530* | | *111* | *64-119* | | | |
| **Matrix Spike Dup (2090778-MSD2)** | | | **Source: P209468-01** | | Prepared: 09/30/02 | Analyzed: 10/03/02 | | | | | |
| Acenaphthene | 3650 | | 450 | ug/kg dry | 4530 | ND | 81 | 21-123 | 0 | 31 | |
| Pyrene | 4210 | | 450 | " | 4530 | ND | 93 | 5-137 | 3 | 44 | |
| *Surrogate: Nitrobenzene-d5* | *3570* | | | " | *4530* | | *79* | *16-126* | | | |
| *Surrogate: 2-Fluorobiphenyl* | *3800* | | | " | *4530* | | *84* | *28-134* | | | |
| *Surrogate: Terphenyl-d14* | *5000* | | | " | *4530* | | *110* | *64-119* | | | |
| **Batch 2100198 - EPA 3550A Sonication** | | | | | | | | | | | |
| **Blank (2100198-BLK1)** | | | | | Prepared: 10/07/02 | Analyzed: 10/09/02 | | | | | |
| Acenaphthene | ND | | 330 | ug/kg wet | | | | | | | |
| Acenaphthylene | ND | | 330 | " | | | | | | | |
| Anthracene | ND | | 330 | " | | | | | | | |
| Benzo (a) anthracene | ND | | 330 | " | | | | | | | |
| Benzo (b+k) fluoranthene (total) | ND | | 330 | " | | | | | | | |
| Benzo (g,h,i) perylene | ND | | 330 | " | | | | | | | |
| Benzo (a) pyrene | ND | | 330 | " | | | | | | | |
| Chrysene | ND | | 330 | " | | | | | | | |
| Dibenz (a,h) anthracene | ND | | 330 | " | | | | | | | |
| Fluoranthene | ND | | 330 | " | | | | | | | |
| Fluorene | ND | | 330 | " | | | | | | | |
| Indeno (1,2,3-cd) pyrene | ND | | 330 | " | | | | | | | |
| Naphthalene | ND | | 330 | " | | | | | | | |
| Phenanthrene | ND | | 330 | " | | | | | | | |

| | | |
|---|---|---|
| Environet, Inc.<br>2850 Paa Street, Suite 212<br>Honolulu HI, 96819 | Project: Saipan AES<br>Project Number: [none]<br>Project Manager: Matt Neal | P209468<br>**Reported:**<br>10/14/02 18:10 |

## Semivolatile Organic Compounds by EPA Method 8270C - Quality Control
## Sequoia Analytical - Petaluma

| Analyte | Result | MDL | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 2100198 - EPA 3550A Sonication** | | | | | | | | | | | |
| **Blank (2100198-BLK1)** | | | | | Prepared: 10/07/02 Analyzed: 10/09/02 | | | | | | |
| Pyrene | ND | | 330 | ug/kg wet | | | | | | | |
| *Surrogate: Nitrobenzene-d5* | *2360* | | | " | *3330* | | *71* | *16-126* | | | |
| *Surrogate: 2-Fluorobiphenyl* | *2440* | | | " | *3330* | | *73* | *28-134* | | | |
| *Surrogate: Terphenyl-d14* | *3340* | | | " | *3330* | | *100* | *64-119* | | | |
| **Laboratory Control Sample (2100198-BS1)** | | | | | Prepared: 10/07/02 Analyzed: 10/09/02 | | | | | | |
| Acenaphthene | 2830 | | 330 | ug/kg wet | 3330 | | 85 | 58-120 | | | |
| Pyrene | 3180 | | 330 | " | 3330 | | 95 | 52-127 | | | |
| *Surrogate: Nitrobenzene-d5* | *2600* | | | " | *3330* | | *78* | *16-126* | | | |
| *Surrogate: 2-Fluorobiphenyl* | *2780* | | | " | *3330* | | *83* | *28-134* | | | |
| *Surrogate: Terphenyl-d14* | *3610* | | | " | *3330* | | *108* | *64-119* | | | |
| **Matrix Spike (2100198-MS1)** | | **Source: P210001-73** | | | Prepared: 10/07/02 Analyzed: 10/10/02 | | | | | | |
| Acenaphthene | 2650 | | 330 | ug/kg wet | 3330 | ND | 80 | 21-123 | | | |
| Pyrene | 3250 | | 330 | " | 3330 | 52 | 96 | 5-137 | | | |
| *Surrogate: Nitrobenzene-d5* | *2530* | | | " | *3330* | | *76* | *16-126* | | | |
| *Surrogate: 2-Fluorobiphenyl* | *2640* | | | " | *3330* | | *79* | *28-134* | | | |
| *Surrogate: Terphenyl-d14* | *3690* | | | " | *3330* | | *111* | *64-119* | | | |
| **Matrix Spike Dup (2100198-MSD1)** | | **Source: P210001-73** | | | Prepared: 10/07/02 Analyzed: 10/10/02 | | | | | | |
| Acenaphthene | 2640 | | 330 | ug/kg wet | 3330 | ND | 79 | 21-123 | 0.4 | 31 | |
| Pyrene | 3190 | | 330 | " | 3330 | 52 | 94 | 5-137 | 2 | 44 | |
| *Surrogate: Nitrobenzene-d5* | *2460* | | | " | *3330* | | *74* | *16-126* | | | |
| *Surrogate: 2-Fluorobiphenyl* | *2690* | | | " | *3330* | | *81* | *28-134* | | | |
| *Surrogate: Terphenyl-d14* | *3640* | | | " | *3330* | | *109* | *64-119* | | | |

| | | |
|---|---|---|
| Environet, Inc.<br>2850 Paa Street, Suite 212<br>Honolulu HI, 96819 | Project: Saipan AES<br>Project Number: [none]<br>Project Manager: Matt Neal | P209468<br>**Reported:**<br>10/14/02 18:10 |

## Conventional Chemistry Parameters by APHA/EPA Methods - Quality Control

## Sequoia Analytical - Petaluma

| Analyte | Result | MDL | Reporting Limit | Units | Spike Level | Source Result | %REC | %REC Limits | RPD | RPD Limit | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Batch 2090726 - General Preparation** | | | | | | | | | | | |
| **Duplicate (2090726-DUP1)** | | | **Source: P209468-01** | | Prepared & Analyzed: 09/26/02 | | | | | | |
| % Solids | 74.2 | | 0.10 | % | | 74 | | | 0.3 | 35 | |

| | | |
|---|---|---|
| Environet, Inc.<br>2850 Paa Street, Suite 212<br>Honolulu HI, 96819 | Project: Saipan AES<br>Project Number: [none]<br>Project Manager: Matt Neal | P209468<br>**Reported:**<br>10/14/02 18:10 |

## Notes and Definitions

| | |
|---|---|
| C-01 | To reduce matrix interference, the sample extract has undergone sulfuric acid clean-up, method 3665, which is specific to hydrocarbon contamination. |
| C-06 | To reduce matrix interference, the sample extract has undergone TBA (sulfur) clean-up, method 3660B. |
| HT-03 | This sample was extracted beyond the EPA recommended holding time. The results may still be useful for their intended purpose. |
| HT-04 | This sample was analyzed beyond the EPA recommended holding time. The results may still be useful for their intended purpose. |
| J | Estimated value. |
| QM-RX | The spike recovery was outside control limits for the MS and/or MSD due to matrix interference. Re-extraction/re-analysis performed to confirm original MS/MSD results. |
| RA | The result is from re-extraction and re-analysis to confirm original MS/MSD result. |
| S-BN | Base/Neutral surrogate recovery outside control limits. The data was accepted based on valid recovery of remaining two base/neutral surrogates. |
| S-LIM | The surrogate recovery was outside control limits. The result may still be useful for its intended purpose. |
| DET | Analyte DETECTED |
| ND | Analyte NOT DETECTED at or above the reporting limit |
| NR | Not Reported |
| dry | Sample results reported on a dry weight basis |
| RPD | Relative Percent Difference |

# SEQUOIA ANALYTICAL
# CHAIN OF CUSTODY

☐ 885 Jarvis Drive ◆ **Morgan Hill, CA 95037** ◆ (408) 776-9600 ◆ FAX (408) 782-6308
☒ 1455 McDowell Blvd, Suite D. ◆ **Petaluma, CA 94954** ◆ (707) 792-1865 ◆ FAX (707) 792-0342
☐ 819 Striker Ave., Suite 8 ◆ **Sacramento, CA 95834** ◆ (916) 921-9600 ◆ FAX (916) 921-0100
☐ 1551 Industrial Road ◆ **San Carlos, CA 94070** ◆ (650) 232-9600 ◆ FAX (650) 232-9612
☐ 404 N. Wiget Lane ◆ **Walnut Creek, CA 94598** ◆ (925) 988-9600 ◆ FAX (925) 988-9673

Company Name: Environet, Inc
Project: Saipan AER
Mailing Address: 2850 Paa St. #212
Billing Address (if different):
City: Honolulu State: HI Zip Code: 96819
Telephone: 808 833-2225 Fax #: 808 833-2231 P.O. #:
Report To: Matt Neal E-mail Address: mneal@hawaii.rr.com
QC Data: ☐ Level II (standard) ☐ Level III ☐ Level IV
Sampler: Matt Neal Date / Time Results Required: Stand TAT Sequoia's Work Order #

**Turnaround Time:**
☒ 10-15 Working Days (Standard TAT)
☐ 7 Working Days
☐ 5 Working Days
☐ 72 Hours
☐ 48 Hours
☐ 24 Hours
☐ 2-8 Hours

**MANDATORY:**
☐ **SDWA (Drinking Water)**
☐ **CWA (Waste Water)**
☐ **RCRA (Hazardous Waste)**
☒ **Other**

ANALYSES REQUESTED (Please provide method)

| | Client Sample I.D. | Date / Time Sampled | Matrix Desc. | # of Cont. | Container Type | Sequoia's Sample # | metals (arsenic, cd, Tl, cr, cu, Pb, Se, Zn, mercury, nickel) | | PAHs | PCBs | | | | | | Comments/ Temp.(If required) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | F0100GLS 1,3 | 9-17-02/12:20 | Sed. | 1 | 8-oz jar | | X | | X | X | | | | | | P209468-01 |
| 2. | 1,2 | 9-17-02/12:34 | | 1 | | | | | | | | | | | | -02 |
| 3. | 1,1 | 9-17-02/12:45 | | 1 | | | | | | | | | | | | -03 |
| 4. | 2,3 | 9-17-02/1300 | | 1 | | | | | | | | | | | | -04 |
| 5. | 2,2 | 9-17-02/1315 | | 1 | | | | | | | | | | | | -05 |
| 6. | 2,1 | 9-17-02/1325 | | 1 | | | | | | | | | | | | -06 |
| 7. | 3,3 | 9-17-02/1340 | | 1 | | | | | | | | | | | | -07 |
| 8. | 3,2 | 9-17-02/1350 | | 1 | | | | | | | | | | | | -08 |
| 9. | 3,1 | 9-17-02/1400 | | 1 | | | | | | | | | | | | -09 |
| 10. | 4,3 | 9-17-02/1415 | ↓ | 1 | ↓ | | ↓ | | ↓ | ↓ | | | | | | -10 |

| | | |
|---|---|---|
| Relinquished By: Matt Neal | Received By: Saul Aguilar | Date / Time: 9/24/02@1030 |
| Relinquished By: | Received By: | Date / Time: |
| Relinquished By: | Received By: | Date / Time: |
| Relinquished By: | Received By: | Date / Time: |

Were Samples Received in Good Condition? ☒ Yes ☐ No Samples on Ice? ☒ Yes ☐ No Method of Shipment: FedEx Page 1 of 2

White: Sequoia Yellow: Sequoia Pink: Client

# SEQUOIA ANALYTICAL
# CHAIN OF CUSTODY

☐ 885 Jarvis Drive ◆ **Morgan Hill, CA 95037** ◆ (408) 776-9600 ◆ FAX (408) 782-6308
☒ 1455 McDowell Blvd, Suite D. ◆ **Petaluma, CA 94954** ◆ (707) 792-1865 ◆ FAX (707) 792-0342
☐ 819 Striker Ave., Suite 8 ◆ **Sacramento, CA 95834** ◆ (916) 921-9600 ◆ FAX (916) 921-0100
☐ 1551 Industrial Road ◆ **San Carlos, CA 94070** ◆ (650) 232-9600 ◆ FAX (650) 232-9612
☐ 404 N. Wiget Lane ◆ **Walnut Creek, CA 94598** ◆ (925) 988-9600 ◆ FAX (925) 988-9673

Company Name: Envirocnet Inc
Project: Saipan AER
Mailing Address: 2850 Paa St #212
Billing Address (if different):
City: Honolulu State: HI Zip Code: 96819
Telephone: 808 833-2225 Fax #: 808 833-2231 P.O. #:
Report To: Matt Neal E-mail Address: mneal@hawaii.rr.com QC Data: ☐ Level II (standard) ☐ Level III ☐ Level IV
Sampler: Matt Neal Date / Time Results Required: Sequoia's Work Order #

**Turnaround Time:**
☒ 10-15 Working Days (Standard TAT)
☐ 7 Working Days
☐ 5 Working Days
☐ 72 Hours
☐ 48 Hours
☐ 24 Hours
☐ 2-8 Hours

**MANDATORY:**
☐ **SDWA (Drinking Water)**
☐ **CWA (Waste Water)**
☐ **RCRA (Hazardous Waste)**
☒ **Other**

ANALYSES REQUESTED (Please provide method)

| | Client Sample I.D. | Date / Time Sampled | Matrix Desc. | # of Cont. | Container Type | Sequoia's Sample # | metals (As, Cd, Cr, Cu, Pb, Se, Zn, Ti, | mercury, nickel) | DA ds | PCBs | | | | | | Comments/ Temp.(If required) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | F010092LS 4,2 | 9-17-02/1430 | sed | 1 | 8-oz jar | | X | | X | x | | | | | | P204468-11 |
| 2. | 4,1 | 9-17-02/1445 | ↓ | 1 | ↓ | | ↓ | | ↓ | ↓ | | | | | | -12 |
| 3. | 5,3 | 9-17-02/1500 | ↓ | 1 | ↓ | | ↓ | | ↓ | ↓ | | | | | | -13 |
| 4. | 5,2 | 9-17-02/1510 | ↓ | 1 | ↓ | | ↓ | | ↓ | ↓ | | | | | | -14 |
| 5. | 5,1 | 9-17-02/1520 | ↓ | 2 | 2 4-oz jars | | ↓ | | ↓ | ↓ | | | | | | -15 |
| 6. | 6,3 | 9-17-02/1540 | ↓ | 2 | ↓ | | ↓ | | ↓ | ↓ | | | | | | -16 |
| 7. | 6,2 | 9-17-02/1550 | ↓ | 2 | ↓ | | ↓ | | ↓ | ↓ | | | | | | -17 |
| 8. | 6,1 | 9-17-02/1605 | ↓ | 2 | ↓ | | ↓ | | ↓ | ↓ | | | | | | -18 |
| 9. | | | | | | | | | | | | | | | | |
| 10. | | | | | | | | | | | | | | | | |

COOLER CUSTODY SEALS INTACT ☐
NOT INTACT ☐
COOLER TEMPERATURE 4.0

| | | |
|---|---|---|
| Relinquished By: Matt Neal | Received By: | Date / Time: 9/24/02 @ 1031 |
| Relinquished By: | Received By: | Date / Time: |
| Relinquished By: | Received By: | Date / Time: |
| Relinquished By: | Received By: | Date / Time: |

Were Samples Received in Good Condition? ☐ Yes ☐ No Samples on Ice? ☐ Yes ☐ No Method of Shipment:________ Page 2 of 2

White: Sequoia Yellow: Sequoia Pink: Client

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**STL Burlington**
208 South Park Drive
Suite 1
Colchester, VT 05446

Tel: 802 655 1203
Fax: 802 655 1248
www.stl-inc.com

October 22, 2002

Mr. Matt Neal
Environet
2850 Paa Street
Suite 212
Honolulu, HI 96819

Re: Laboratory Project No. 22000
SDG: 89891

Dear Mr. Neal:

Enclosed are the analytical results of samples received intact by Severn Trent Laboratories on September 25, 2002. Laboratory numbers have been assigned and designated as follows:

| Lab ID | Client Sample ID | Sample Date | Sample Matrix |
|---|---|---|---|
| Received: 09/25/02 ETR No: 89891 | | | |
| 502104 | F01009 LS 1,3 | 09/17/02 | Solid |
| 502105 | F01009 LS 1,2 | 09/17/02 | Solid |
| 502106 | F01009 LS 1,1 | 09/17/02 | Solid |
| 502107 | F01009 LS 2,3 | 09/17/02 | Solid |
| 502108 | F01009 LS 2,2 | 09/17/02 | Solid |
| 502109 | F01009 LS 2,1 | 09/17/02 | Solid |
| 502110 | F01009 LS 3,3 | 09/17/02 | Solid |
| 502111 | F01009 LS 3,2 | 09/17/02 | Solid |
| 502112 | F01009 LS 3,1 | 09/17/02 | Solid |
| 502113 | F01009 LS 4,3 | 09/17/02 | Solid |
| 502114 | F01009 LS 4,2 | 09/17/02 | Solid |
| 502115 | F01009 LS 4,1 | 09/17/02 | Solid |
| 502116 | F01009 LS 5,3 | 09/17/02 | Solid |
| 502117 | F01009 LS 5,2 | 09/17/02 | Solid |
| 502118 | F01009 LS 5,1 | 09/17/02 | Solid |
| 502119 | F01009 LS 6,3 | 09/17/02 | Solid |
| 502120 | F01009 LS 6,2 | 09/17/02 | Solid |
| 502121 | F01009 LS 6,1 | 09/17/02 | Solid |

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**STL Burlington**

The continuing calibration sample analyzed on 10/3/02 at 2310 hours exhibited percent differences for BZ#77 and BZ#153 outside of the established quality control limits on the RTX-5 column. Congeners BZ#77 and BZ#118 also yielded percent differences slightly outside of the established quality control limits on the RTX-CLPII column.

If there are any questions regarding this submittal, please contact Chris Anderson at (802) 655-1203.

This report shall not be reproduced, except in full, without the written approval of the laboratory. This report is sequentially numbered starting with page 0001 and ending with page 0294.

I certify that this package is in compliance with the NELAC requirements, both technically and for completeness, for other than the conditions detailed above. The Laboratory Director or his designee, as verified by the following signature has authorized the release of the data contained in this hardcopy data package.

Sincerely,

Chris Anderson, for:

Michael F. Wheeler, Ph.D.
Laboratory Director

Enclosure

0001-R LAST ALPHA

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# PCB CONGENER ANALYSIS

Qualifier Definitions:

U= Compound not detected above reporting limit.

J= Compound reported at an estimated concentration below the reporting limit.

E= Compound reported at an estimated concentration which exceeds the calibration range.

S= Specific column result used for quantitation due to confirmation column coelution.

T= Tentative identification, specific column result used with no confirmation information.

X= Estimated concentration due to coelution on both columns.

P= Confirmation column result exceeds reported result by more than 25%.

H= Specific column or estimated result exceeds confirmation result by more than 25% despite expected confirmation coelution.

B= Compound detected above reporting limit in method blank.

N= Compound does not comply with initial and/or ongoing calibration criteria.

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**Severn Trent Laboratories, Inc.**

# Analytical Results for Wet Chemistry

**STL Burlington**
208 South Park Drive, Suite 1
Colchester, VT 05446

Tel: 802 655 1203
Fax: 802 655 1248

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# Analytical Report

Environet
2850 Paa Street
Suite 212
Honolulu, HI 96819

Attention : Matt Neal

Date : 10/01/02
ETR Number : 89891
Project No.: 22000
No. Samples: 18
Arrived : 09/25/02

Page 1

Case:22000 SDG:89891

Standard analyses were performed in accordance with Methods for Analysis of Water and Wastes, EPA-600/4/79-020, Test Methods for Evaluating Solid Waste, SW-846, or Standard Methods for the Examination of Water and Wastewater. All results are in mg/l unless otherwise noted.

| Lab No./ Method No. | | Sample Description/ Parameter | Result |
|---|---|---|---|
| 502104 | F01009 | LS 1,3:09/17/02 @1220(Solid) | |
| | IN623 | Solids, Percent | 75.4 c |
| 502105 | F01009 | LS 1,2:09/17/02 @1234(Solid) | |
| | IN623 | Solids, Percent | 74.0 c |
| 502106 | F01009 | LS 1,1:09/17/02 @1245(Solid) | |
| | IN623 | Solids, Percent | 76.5 c |
| 502107 | F01009 | LS 2,3:09/17/02 @1300(Solid) | |
| | IN623 | Solids, Percent | 75.0 c |
| 502108 | F01009 | LS 2,2:09/17/02 @1315(Solid) | |
| | IN623 | Solids, Percent | 76.0 c |
| 502109 | F01009 | LS 2,1:09/17/02 @1325(Solid) | |
| | IN623 | Solids, Percent | 74.0 c |
| 502110 | F01009 | LS 3,3:09/17/02 @1340(Solid) | |
| | IN623 | Solids, Percent | 74.6 c |
| 502111 | F01009 | LS 3,2:09/17/02 @1350(Solid) | |
| | IN623 | Solids, Percent | 63.5 c |

## Comments/Notes

c = %W/W as received

< Cont. Next Page >

~~0004~~ 0005

**STL Burlington**
208 South Park Drive, Suite 1
Colchester, VT 05446

Tel: 802 655 1203
Fax: 802 655 1248

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**STL Burlington**

# Analytical Report

Environet
2850 Paa Street
Suite 212
Honolulu, HI 96819

Attention : Matt Neal

Date : 10/01/02
ETR Number : 89891
Project No.: 22000
No. Samples: 18
Arrived : 09/25/02

Page 3

Case:22000 SDG:89891

Standard analyses were performed in accordance with Methods for Analysis of Water and Wastes, EPA-600/4/79-020, Test Methods for Evaluating Solid Waste, SW-846, or Standard Methods for the Examination of Water and Wastewater. All results are in mg/l unless otherwise noted.

| Lab No./ | Method No. | Sample Description/<br>Parameter | Result |
|---|---|---|---|
| 502120 | F01009 | LS 6,2:09/17/02 @1550(Solid) | |
| | IN623 | Solids, Percent | 66.7 c |
| 502121 | F01009 | LS 6,1:09/17/02 @1605(Solid) | |
| | IN623 | Solids, Percent | 65.9 c |

Comments/Notes

c = %W/W as received

< Last Page > Submitted By STL Burlington

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# PERCENT SOLIDS

(Method IN623)

Date In: 9/26/02
Time In: 1640
Analyst: MNM

Date Out: 9/27/02
Time Out: 1100
Analyst: MNM

| LAB ID plus EPA ID | Dish # | Mass of Dish (g) | Mass of Dish & Wet Sample (g) | Mass of Dish & Dry Sample (g) |
|---|---|---|---|---|
| S02049 | 19 | 096 | 14.22 | 12.74 |
| S02050 | 20 | 095 | 15.06 | 13.54 |
| S02051 | 21 | 096 | 14.57 | 13.35 |
| S02052 | 22 | 0.99 | 13.27 | 11.53 |
| S02053 | 23 | 0.99 | 14.18 | 12.80 |
| S02054 | 24 | 0.99 | 10.31 | 8.84 |
| S02055 | 25 | 099 | 8.54 | 7.47 |
| S02056 | 26 | 0.99 | 13.05 | 10.89 |
| S02057 | 27 | 0.99 | 10.16 | 8.68 |
| S02058 | 28 | 099 | 14.72 | 13.49 |
| S02058ms | | | | |
| S02058md | | | | |
| S02059 | 29 | 099 | 1092 | 9.50 |
| S02060 | 30 | 099 | 1374 | 1152 |
| S02104 | 31 | 096 | 14.09 | 10.86 |
| S02105 | 32 | 097 | 1314 | 9.98 |
| S02106 | 33 | 097 | 17.33 | 13.49 |
| S02107 | 34 | 097 | 11.62 | 8.96 |
| S02108 | 35 | 097 | 1358 | 1055 |
| S02109 | 36 | 097 | 11.06 | 8.44 |

Entered by: MNM
Date: 9/27/02
Batch: DL

%W/W = grams dry / grams wet X 100

grams dry = weight of dry sample (g) - weight of dish (g)
grams wet = weight of wet sample (g) - weight of dish (g)

111

Aquatec, Inc. --- PERCENT SOLID REPORT --- 30-SEP-2002 14:34:41 --- ASW

Method: IN623

Analyst: MNT

Date/Time in: 09/26/02 1640

Date/Time out: 09/27/02 1100

Batch: DL

Date Entered: 09-27-02
Entered by: MNT

Date Verified: 09-30-02
Verified by: ASW

| Lab ID | Mass of Dish (g) | Mass of Dish and Wet Sample (g) | Mass of Dish and Dry Sample (g) | Percent Solid |
|---|---|---|---|---|
| 502049 | 0.96 | 14.22 | 12.74 | 88.8386 |
| 502050 | 0.95 | 15.06 | 13.54 | 89.2275 |
| 502051 | 0.96 | 14.57 | 13.35 | 91.0360 |
| 502052 | 0.99 | 13.27 | 11.53 | 85.8306 |
| 502053 | 0.99 | 14.15 | 12.80 | 89.7416 |
| 502054 | 0.99 | 10.31 | 8.84 | 84.2275 |
| 502055 | 0.99 | 8.54 | 7.47 | 85.8278 |
| 502056 | 0.99 | 13.05 | 10.89 | 82.0896 |
| 502057 | 0.99 | 10.16 | 8.68 | 83.8604 |
| 502058 | 0.99 | 14.72 | 13.49 | 91.0415 |
| 502058MD | 0.99 | 14.72 | 13.49 | 91.0415 |
| 502058MS | 0.99 | 14.72 | 13.49 | 91.0415 |
| 502059 | 0.99 | 10.92 | 9.50 | 85.6999 |
| 502060 | 0.99 | 13.74 | 11.52 | 82.5882 |
| 502104 | 0.96 | 14.09 | 10.86 | 75.3998 |
| 502105 | 0.97 | 13.14 | 9.98 | 74.0345 |
| 502106 | 0.97 | 17.33 | 13.49 | 76.5281 |
| 502107 | 0.97 | 11.62 | 8.96 | 75.0235 |
| 502108 | 0.97 | 13.58 | 10.55 | 75.9715 |
| 502109 | 0.97 | 11.06 | 8.44 | 74.0337 |

Page 3 of 6

# Percent Solids Benchsheet

(Method IN623)

Date In: 9/26/02
Time In: 1640
Analyst: MNN

Date Out: 9/27/02
Time Out: 1100
Analyst: MNN

| LAB ID plus EPA ID | Dish # | Mass of Dish (g) | Mass of Dish & Wet Sample (g) | Mass of Dish & Dry Sample (g) |
|---|---|---|---|---|
| 502110 | 37 | 097 | 1680 | 1278 |
| 502111 | 38 | 097 | 1235 | 8.20 |
| 502112 | 39 | 097 | 1204 | 9.29 |
| 502113 | 40 | 096 | 1250 | 8.79 |
| 502114 | 41 | 0.97 | 1299 | 9.47 |
| 502115 | 42 | 097 | 15.34 | 11.46 |
| 502116 | 43 | 097 | 17.33 | 14.05 |
| 502117 | 44 | 097 | 18.00 | 1389 |
| 502118 | 45 | 097 | 1336 | 8.67 |
| 502119 | 46 | 098 | 16.36 | 12.72 |
| 502120 | 47 | 098 | 14.30 | 9.87 |
| 502121 | 48 | 098 | 18.06 | 12.23 |
| 502125 | 49 | 097 | 9.74 | 9.86 |
| 502126 | 50 | 097 | 682 | 4.69 |
| 502127 | 51 | 098 | 840 | 5.89 |
| 502128 | 52 | 098 | 624 | 361 |
| 502128MS | | | | |
| 502128MD | | | | |
| 502140 | 53 | 0.98 | 7.47 | 634 |
| 502217 | 54 | 097 | 1208 | 9.42 |

Entered by: MNN
Date: 9/27/02
Batch: DM

%W/W = grams dry / grams wet X 100

grams dry = weight of dry sample (g) - weight of dish (g)
grams wet = weight of wet sample (g) - weight of dish (g)

0010

Aquatec, Inc. --- PERCENT SOLID REPORT --- 30-SEP-2002 14:34:59 --- ASW

Method: IN623

Analyst: MNT

Date/Time in: 09/26/02 1640

Date/Time out: 09/27/02 1100

Batch: DM

Date Entered: 09-27-02
Entered by: MNT

Date Verified: 09-30-02
Verified by: ASW

| Lab ID | Mass of Dish (g) | Mass of Dish and Wet Sample (g) | Mass of Dish and Dry Sample (g) | Percent Solid |
|---|---|---|---|---|
| 502110 | 0.97 | 16.80 | 12.78 | 74.6052 |
| 502111 | 0.97 | 12.35 | 8.20 | 63.5325 |
| 502112 | 0.97 | 12.04 | 9.29 | 75.1581 |
| 502113 | 0.96 | 12.50 | 8.79 | 67.8510 |
| 502114 | 0.97 | 12.99 | 9.47 | 70.7155 |
| 502115 | 0.97 | 15.34 | 11.46 | 72.9993 |
| 502116 | 0.97 | 17.33 | 14.05 | 79.9511 |
| 502117 | 0.97 | 18.00 | 13.89 | 75.8661 |
| 502118 | 0.97 | 13.36 | 8.67 | 62.1469 |
| 502119 | 0.98 | 16.36 | 12.72 | 76.3329 |
| 502120 | 0.98 | 14.30 | 9.87 | 66.7417 |
| 502121 | 0.98 | 18.06 | 12.23 | 65.8665 |
| 502125 | 0.97 | 9.74 | 9.56 | 97.9476 |
| 502126 | 0.97 | 6.82 | 4.69 | 63.5897 |
| 502127 | 0.98 | 8.40 | 5.89 | 66.1725 |
| 502128 | 0.98 | 6.24 | 3.61 | 50.0000 |
| 502128MD | 0.98 | 6.24 | 3.61 | 50.0000 |
| 502128MS | 0.98 | 6.24 | 3.61 | 50.0000 |
| 502140 | 0.98 | 7.47 | 6.34 | 82.5886 |
| 502217 | 0.97 | 12.08 | 9.42 | 76.0576 |

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# PCB CONGENERS

# QC SUMMARY

# FORM 2
# SOIL OTHER SURROGATE RECOVERY

Lab Name: STL BURLINGTON Contract: 22000

Lab Code: STLVT Case No.: 22000 SAS No.: SDG No.: 89891

GC Column(1): RTX-5 ID: 0.25 (mm) GC Column(2): RTX-CLPII ID: 0.25 (mm)

| | CLIENT SAMPLE NO. | S1 1 %REC # | S1 2 %REC # | S2 1 %REC # | S2 2 %REC # | OTHER (1) | OTHER (2) | TOT OUT |
|---|---|---|---|---|---|---|---|---|
| | ============ | ====== | ====== | ====== | ====== | ====== | ====== | === |
| 01 | PBLKO8 | 97 | 96 | 96 | 94 | | | 0 |
| 02 | O8LCS | 90 | 89 | 92 | 89 | | | 0 |
| 03 | O8LCSD | 93 | 92 | 96 | 94 | | | 0 |
| 04 | F01009LS13 | 95 | 94 | 94 | 91 | | | 0 |
| 05 | F01009LS12 | 95 | 94 | 95 | 91 | | | 0 |
| 06 | F01009LS11 | 96 | 96 | 97 | 93 | | | 0 |
| 07 | F01009LS23 | 101 | 102 | 101 | 96 | | | 0 |
| 08 | F01009LS22 | 97 | 96 | 100 | 94 | | | 0 |
| 09 | F01009LS21 | 96 | 94 | 102 | 96 | | | 0 |
| 10 | F01009LS33 | 102 | 100 | 104 | 99 | | | 0 |
| 11 | F01009LS32 | 96 | 94 | 96 | 91 | | | 0 |
| 12 | PIBLK_SCU | 98 | 96 | 101 | 98 | | | 0 |
| 13 | F01009LS31 | 102 | 100 | 103 | 98 | | | 0 |
| 14 | F01009LS43 | 90 | 88 | 101 | 96 | | | 0 |
| 15 | F01009LS42 | 81 | 80 | 96 | 91 | | | 0 |
| 16 | F01009LS41 | 96 | 94 | 97 | 93 | | | 0 |
| 17 | F01009LS53 | 97 | 95 | 98 | 94 | | | 0 |
| 18 | F01009LS52 | 97 | 96 | 98 | 94 | | | 0 |
| 19 | F01009LS51 | 97 | 95 | 98 | 92 | | | 0 |
| 20 | F01009LS63 | 92 | 90 | 92 | 89 | | | 0 |
| 21 | F01009LS62 | 103 | 101 | 104 | 98 | | | 0 |
| 22 | F01009LS61 | 103 | 101 | 103 | 98 | | | 0 |
| 23 | | | | | | | | |
| 24 | | | | | | | | |
| 25 | | | | | | | | |
| 26 | | | | | | | | |
| 27 | | | | | | | | |
| 28 | | | | | | | | |

ADVISORY
QC LIMITS

S1 = Tetrachloro-meta-xylen (30-150)
S2 = BZ#198 (30-150)

# Column to be used to flag recovery values
* Values outside of QC limits
D Surrogate diluted out

## FORM 3
## SOIL OTHER LAB CONTROL SAMPLE

Lab Name: STL BURLINGTON Contract: 22000

Lab Code: STLVT Case No.: 22000 SAS No.: SDG No.: 89891

Matrix Spike - Sample No.: 08LCS

| COMPOUND | SPIKE ADDED (ug/Kg) | SAMPLE CONCENTRATION (ug/Kg) | LCS CONCENTRATION (ug/Kg) | LCS % REC # | QC. LIMITS REC. |
|---|---|---|---|---|---|
| BZ#8 | 33 | | 29 | 88 | 40-150 |
| BZ#18 | 33 | | 29 | 88 | 40-150 |
| BZ#28 | 33 | | 28 | 85 | 40-150 |
| BZ#44 | 33 | | 29 | 88 | 40-150 |
| BZ#52 | 33 | | 29 | 88 | 40-150 |
| BZ#66 | 33 | | 28 | 85 | 40-150 |
| BZ#77 | 33 | | 28 | 85 | 40-150 |
| BZ#101 | 33 | | 29 | 88 | 40-150 |
| BZ#105 | 33 | | 28 | 85 | 40-150 |
| BZ#118 | 33 | | 28 | 85 | 40-150 |
| BZ#126 | 33 | | 28 | 85 | 40-150 |
| BZ#128 | 33 | | 29 | 88 | 40-150 |
| BZ#138 | 33 | | 29 | 88 | 40-150 |
| BZ#153 | 33 | | 29 | 88 | 40-150 |
| BZ#170 | 33 | | 28 | 85 | 40-150 |
| BZ#180 | 33 | | 28 | 85 | 40-150 |
| BZ#187 | 33 | | 29 | 88 | 40-150 |
| BZ#195 | 33 | | 29 | 88 | 40-150 |
| BZ#206 | 33 | | 29 | 88 | 40-150 |
| BZ#209 | 33 | | 29 | 88 | 40-150 |

# Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

COMMENTS:

## FORM 3
## SOIL OTHER LAB CONTROL SAMPLE

Lab Name: STL BURLINGTON Contract: 22000

Lab Code: STLVT Case No.: 22000 SAS No.: SDG No.: 89891

Matrix Spike - Sample No.: O8LCS

| COMPOUND | SPIKE ADDED (ug/Kg) | LCSD CONCENTRATION (ug/Kg) | LCSD % REC # | % RPD # | QC LIMITS | |
|---|---|---|---|---|---|---|
| | | | | | RPD | REC. |
| BZ#8 | 33 | 32 | 97 | 10 | 40 | 40-150 |
| BZ#18 | 33 | 32 | 97 | 10 | 40 | 40-150 |
| BZ#28 | 33 | 32 | 97 | 13 | 40 | 40-150 |
| BZ#44 | 33 | 32 | 97 | 10 | 40 | 40-150 |
| BZ#52 | 33 | 32 | 97 | 10 | 40 | 40-150 |
| BZ#66 | 33 | 32 | 97 | 13 | 40 | 40-150 |
| BZ#77 | 33 | 31 | 94 | 10 | 40 | 40-150 |
| BZ#101 | 33 | 32 | 97 | 10 | 40 | 40-150 |
| BZ#105 | 33 | 32 | 97 | 13 | 40 | 40-150 |
| BZ#118 | 33 | 32 | 97 | 13 | 40 | 40-150 |
| BZ#126 | 33 | 32 | 97 | 13 | 40 | 40-150 |
| BZ#128 | 33 | 33 | 100 | 13 | 40 | 40-150 |
| BZ#138 | 33 | 32 | 97 | 10 | 40 | 40-150 |
| BZ#153 | 33 | 32 | 97 | 10 | 40 | 40-150 |
| BZ#170 | 33 | 32 | 97 | 13 | 40 | 40-150 |
| BZ#180 | 33 | 31 | 94 | 10 | 40 | 40-150 |
| BZ#187 | 33 | 33 | 100 | 13 | 40 | 40-150 |
| BZ#195 | 33 | 32 | 97 | 10 | 40 | 40-150 |
| BZ#206 | 33 | 32 | 97 | 10 | 40 | 40-150 |
| BZ#209 | 33 | 32 | 97 | 10 | 40 | 40-150 |

# Column to be used to flag recovery and RPD values with an asterisk

* Values outside of QC limits

RPD: 0 out of 20 outside limits
Spike Recovery: 0 out of 40 outside limits

COMMENTS: ______________________________
______________________________

# FORM 4
# OTHER METHOD BLANK SUMMARY

CLIENT SAMPLE NO.

PBLK08

Lab Name: STL BURLINGTON Contract: 22000

Lab Code: STLVT Case No.: 22000 SAS No.: SDG No.: 89891

Lab Sample ID: PBLK08 Lab File ID: 03OCT021608-R011

Matrix (soil/water) SOIL Extraction:(SepF/Cont/Sonc) SOXH

Sulfur Cleanup (Y/N) Y Date Extracted: 09/26/02

Date Analyzed (1): 10/03/02 Date Analyzed (2): 10/03/02

Time Analyzed (1): 2355 Time Analyzed (2): 2355

Instrument ID (1): 3327_1 Instrument ID (2): 3327_2

GC Column (1): RTX-5 ID: 0.25(mm) GC Column (2): RTX-CLPII ID: 0.25(mm)

THIS METHOD BLANK APPLIES TO THE FOLLOWING SAMPLES, MS and MSD:

| | SAMPLE NO. | LAB SAMPLE ID | DATE ANALYZED 1 | DATE ANALYZED 2 |
|---|---|---|---|---|
| 01 | 08LCS | 08LCS | 10/04/02 | 10/04/02 |
| 02 | 08LCSD | 08LCSD | 10/04/02 | 10/04/02 |
| 03 | F01009LS13 | 502104 | 10/04/02 | 10/04/02 |
| 04 | F01009LS12 | 502105 | 10/04/02 | 10/04/02 |
| 05 | F01009LS11 | 502106 | 10/04/02 | 10/04/02 |
| 06 | F01009LS23 | 502107 | 10/04/02 | 10/04/02 |
| 07 | F01009LS22 | 502108 | 10/04/02 | 10/04/02 |
| * 08 | F01009LS21 | 502109 | 10/04/02 | 10/04/02 |
| 09 | F01009LS33 | 502110 | 10/04/02 | 10/04/02 |
| 10 | F01009LS32 | 502111 | 10/04/02 | 10/04/02 |
| 11 | F01009LS31 | 502112 | 10/04/02 | 10/04/02 |
| * 12 | F01009LS43 | 502113 | 10/04/02 | 10/04/02 |
| * 13 | F01009LS42 | 502114 | 10/04/02 | 10/04/02 |
| 14 | F01009LS41 | 502115 | 10/04/02 | 10/04/02 |
| 15 | F01009LS53 | 502116 | 10/04/02 | 10/04/02 |
| 16 | F01009LS52 | 502117 | 10/04/02 | 10/04/02 |
| 17 | F01009LS51 | 502118 | 10/04/02 | 10/04/02 |
| 18 | F01009LS63 | 502119 | 10/04/02 | 10/04/02 |
| 19 | F01009LS62 | 502120 | 10/04/02 | 10/04/02 |
| 20 | F01009LS61 | 502121 | 10/04/02 | 10/04/02 |
| 21 | | | | |
| 22 | | | | |
| 23 | | | | |
| 24 | | | | |

COMMENTS: * Sample received an additional sulfur cleanup. Associated sulfur cleanup blank is PIBLK_SCU.

SEVERN
TRENT
SERVICES

**Severn Trent Laboratories, Inc.**

# PCB CONGENERS

# SUPPORTIVE DOCUMENTATION

## STL Burlington - Target GC Injection Report

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| 56 | 14.612 | | | 5188 | 1181 | | | |
| 57 | 14.832 | | | 450 | 93 | | | |
| 58 | 15.995 | | | 2255 | 261 | | | |
| 59 | 16.255 | | | 17554 | 1991 | | | |
| 60 | 17.306 | | | 2129 | 269 | | | |
| 61 | 17.999 | | | 1943 | 432 | | | |
| 62 | 18.414 | | | 577 | 99 | | | |
| 63 | 19.775 | | | 1203 | 229 | | | |
| 64 | 20.435 | | | 979 | 183 | | | |
| 65 | 20.766 | | | 2586 | 333 | | | |
| 66 | 21.938 | | | 851 | 170 | | | |
| 67 | 22.260 | | | 766 | 138 | | | |
| $ 68 | 22.539 | 22.559 | -0.020 | 329890 | 65035 | 43.5918 | | BZ#198 |
| 69 | 23.361 | | | 1482 | 270 | | | |
| 70 | 24.640 | | | 548 | 113 | | | |
| 71 | 25.228 | | | 877 | 129 | | | |
| 72 | 25.658 | | | 1103 | 171 | | | |
| 73 | 25.793 | | | 755 | 136 | | | |
| 74 | 27.635 | | | 2275 | 247 | | | |
| 75 | 27.890 | | | 1145 | 197 | | | |
| 76 | 28.059 | | | 871 | 157 | | | |
| 77 | 28.327 | | | 4699 | 920 | | | |
| 78 | 28.484 | | | 1234 | 200 | | | |
| 79 | 28.823 | | | 1908 | 238 | | | |
| 80 | 29.145 | | | 4642 | 347 | | | |
| 81 | 29.375 | | | 1888 | 222 | | | |
| 82 | 29.830 | | | 4363 | 339 | | | |
| 83 | 30.508 | | | 2197 | 346 | | | |
| 84 | 30.863 | | | 388 | 71 | | | |
| 85 | 31.472 | | | 568 | 134 | | | |
| 86 | 31.612 | | | 402 | 104 | | | |
| 87 | 31.721 | | | 2085 | 333 | | | |
| 88 | 31.964 | | | 505 | 148 | | | |
| 89 | 32.217 | | | 8658 | 2017 | | | |
| 90 | 32.485 | | | 432 | 119 | | | |
| 91 | 32.567 | | | 496 | 121 | | | |
| 92 | 32.780 | | | 5532 | 996 | | | |
| 93 | 32.873 | | | 2448 | 461 | | | |
| 94 | 33.002 | | | 2355 | 453 | | | |
| 95 | 33.210 | | | 2083 | 488 | | | |
| 96 | 33.292 | | | 4411 | 534 | | | |
| 97 | 33.494 | | | 17086 | 2372 | | | |
| 98 | 34.119 | | | 1594 | 376 | | | |
| 99 | 34.700 | | | 4040 | 518 | | | |
| 100 | 35.134 | | | 655 | 207 | | | |
| 101 | 35.254 | | | 2735 | 316 | | | |
| 102 | 35.484 | | | 2550 | 384 | | | |
| 103 | 35.624 | | | 1519 | 233 | | | |
| 104 | 36.256 | | | 252 | 67 | | | |
| 105 | 36.593 | | | 1392 | 256 | | | |
| 106 | 36.748 | | | 314 | 90 | | | |
| 107 | 37.058 | | | 1042 | 180 | | | |
| 108 | 37.464 | | | 847 | 159 | | | |
| 109 | 39.058 | | | 1021 | 191 | | | |

Flags:
- A - Peak quantitates above calibration range
- a - Peak quantitates below reporting limit
- H - User selected alternate compound hit
- M - Peak manually integrated or manually identified
- R - Peak fails recovery
- U - User disabled peak ID: either peak quantitates below reporting limit or peak identification not confirmed on second column

# STL Burlington - Target GC Injection Report

**Lab Sample ID: 502106** **Client Sample ID: F01009LS11**

| | | | |
|---|---|---|---|
| Matrix | : SOIL | Sample Type | : SAMPLE |
| Analyst | : | Injection Date | : 04-OCT-2002 03:40 |
| Instrument | : 3327_1.i | Dilution Factor | : 1.00 |
| Column | : RTX-5 | Data File | : 03oct021608-r061.d |
| Integrator | : Falcon | Compound Sublist | : ENVNET |

Method : /var/chem/3327_1.i/100302_1/03OCT021608.b/32CONG_3327RTX5_RAW.m
Reported : 17-Oct-2002 09:43 rrm

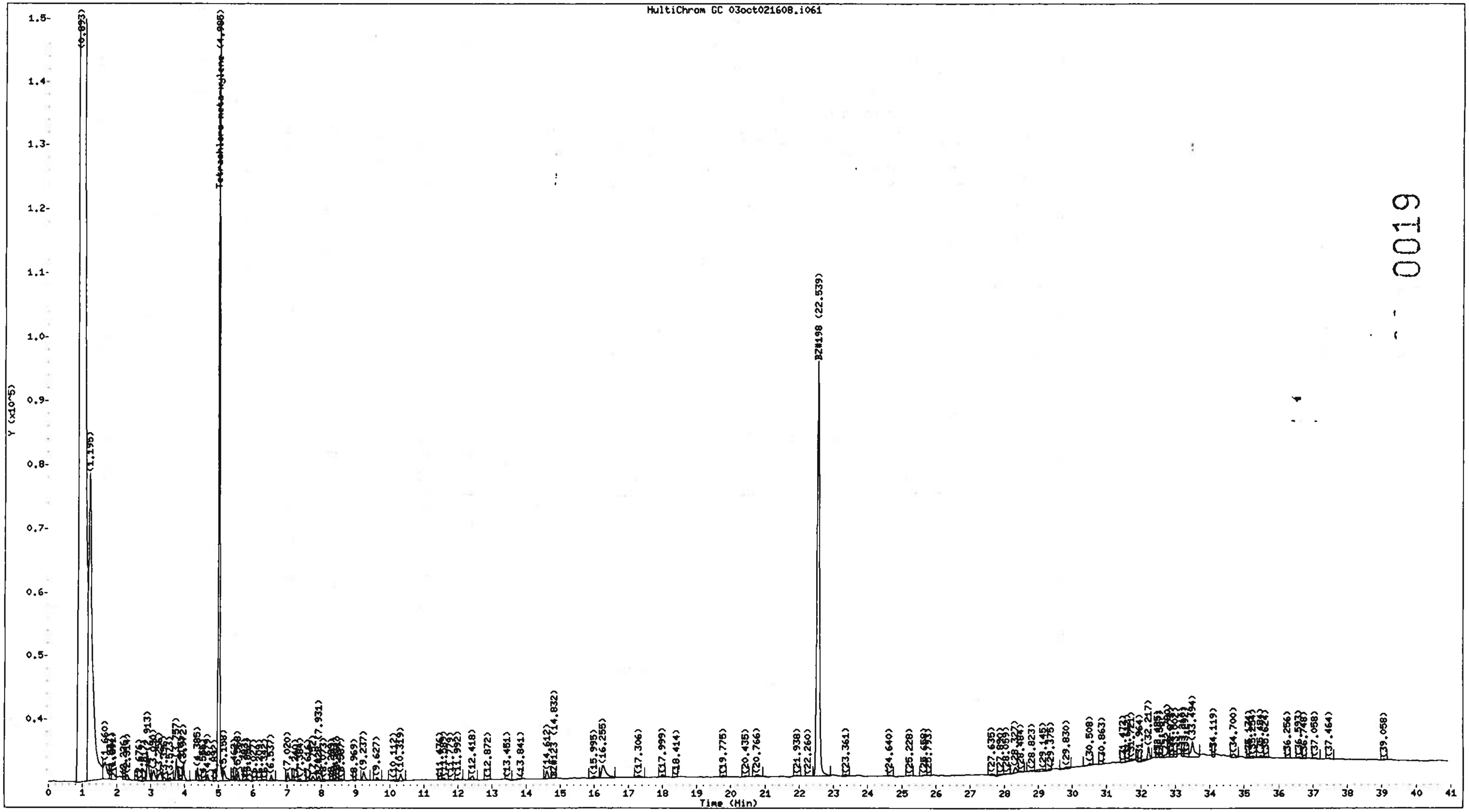
## Peaks

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.893 | | | 6323710 | 969798 | | | |
| 2 | 1.195 | | | 394917 | 48321 | | | |
| 3 | 1.660 | | | 19918 | 2670 | | | |
| 4 | 1.833 | | | 2956 | 806 | | | |
| 5 | 1.891 | | | 5890 | 962 | | | |
| 6 | 2.226 | | | 2235 | 547 | | | |
| 7 | 2.314 | | | 3660 | 785 | | | |
| 8 | 2.676 | | | 608 | 150 | | | |
| 9 | 2.817 | | | 247 | 94 | | | |
| 10 | 2.913 | | | 17391 | 4492 | | | |
| 11 | 3.090 | | | 8174 | 1587 | | | |
| 12 | 3.256 | | | 7467 | 1109 | | | |
| 13 | 3.396 | | | 2594 | 589 | | | |
| 14 | 3.573 | | | 1904 | 511 | | | |
| 15 | 3.757 | | | 10033 | 3360 | | | |
| 16 | 3.910 | | | 1387 | 357 | | | |
| 17 | 3.972 | | | 7832 | 2405 | | | |
| 18 | 4.385 | | | 5623 | 2050 | | | |
| 19 | 4.555 | | | 571 | 174 | | | |
| 20 | 4.679 | | | 2737 | 987 | | | |
| 21 | 4.892 | | | 252 | 79 | | | |
| $ 22 | 4.985 | 5.001 | -0.016 | 342839 | 136346 | 43.2615 | | Tetrachloro-meta-xylene |
| 23 | 5.158 | | | 7318 | 1522 | | | |
| 24 | 5.462 | | | 312 | 114 | | | |
| 25 | 5.568 | | | 3961 | 1404 | | | |
| 26 | 5.783 | | | 678 | 247 | | | |
| 27 | 5.852 | | | 860 | 290 | | | |
| 28 | 6.027 | | | 379 | 140 | | | |
| 29 | 6.209 | | | 238 | 70 | | | |
| 30 | 6.342 | | | 698 | 174 | | | |
| 31 | 6.537 | | | 2834 | 833 | | | |
| 32 | 7.020 | | | 4178 | 1299 | | | |
| 33 | 7.240 | | | 351 | 124 | | | |
| 34 | 7.384 | | | 1508 | 374 | | | |
| 35 | 7.616 | | | 377 | 140 | | | |
| 36 | 7.752 | | | 3142 | 692 | | | |
| 37 | 7.931 | 7.925 | 0.007 | 2719 | 712 | 0.674885 | a | BZ#28 |
| 38 | 8.073 | | | 2070 | 366 | | | |
| 39 | 8.299 | | | 612 | 198 | | | |
| 40 | 8.383 | | | 1233 | 386 | | | |
| 41 | 8.461 | | | 2022 | 600 | | | |
| 42 | 8.587 | | | 1721 | 295 | | | |
| 43 | 8.969 | | | 337 | 91 | | | |
| 44 | 9.237 | | | 6619 | 1309 | | | |
| 45 | 9.627 | | | 2290 | 489 | | | |
| 46 | 10.112 | | | 1585 | 210 | | | |
| 47 | 10.319 | | | 5244 | 1032 | | | |
| 48 | 11.476 | | | 671 | 181 | | | |
| 49 | 11.589 | | | 1359 | 315 | | | |
| 50 | 11.779 | | | 598 | 142 | | | |
| 51 | 11.992 | | | 1319 | 275 | | | |
| 52 | 12.418 | | | 3524 | 648 | | | |
| 53 | 12.872 | | | 663 | 122 | | | |
| 54 | 13.451 | | | 1034 | 165 | | | |
| 55 | 13.841 | | | 1401 | 126 | | | |

# STL Burlington - Target GC Chromatogram

**Lab Sample ID: 502106** **Client Sample ID: F01009LS11**

```
Matrix       : SOIL                       Sample Type     : SAMPLE
Analyst      :                            Injection Date  : 04-OCT-2002 03:40
Instrument   : 3327_1.i                   Dilution Factor : 1.00
Column       : RTX-5                      Data File       : 03oct021608-r061.d
Integrator   : Falcon                     Compound Sublist: ENVNET
Method       : /var/chem/3327_1.i/100302_1/03OCT021608.b/32CONG_3327RTX5_RAW.m
Reported     : 17-Oct-2002 09:43 rrm
```



FORM 1
OTHER ORGANICS ANALYSIS DATA SHEET

ENVNET SAMPLE NO.

F01009LS11

Lab Name: STL BURLINGTON Contract: 22000

Lab Code: STLVT Case No.: 22000 SAS No.: SDG No.: 89891

Matrix: (soil/water) SOIL Lab Sample ID: 502106

Sample wt/vol: 30.0 (g/mL) G Lab File ID: 03OCT021608-R061

% Moisture: 24 decanted: (Y/N) N Date Received: 09/25/02

Extraction: (SepF/Cont/Sonc) SOXH Date Extracted: 09/26/02

Concentrated Extract Volume: 10(mL) Date Analyzed: 10/04/02

Injection Volume: 1.0(uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: ___ Sulfur Cleanup: (Y/N) Y

| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG | Q |
|---|---|---|---|
| 34883-43-7 | BZ#8 | 2.2 | U |
| 37680-65-2 | BZ#18 | 2.2 | U |
| 7012-37-5 | BZ#28 | 2.2 | U |
| 41464-39-5 | BZ#44 | 2.2 | U |
| 35693-99-3 | BZ#52 | 2.2 | U |
| 32598-10-0 | BZ#66 | 2.2 | U |
| 32598-13-3 | BZ#77 | 2.2 | U |
| 37680-73-2 | BZ#101 | 2.2 | U |
| 32598-14-4 | BZ#105 | 2.2 | U |
| 31508-00-6 | BZ#118 | 2.2 | U |
| 57465-28-8 | BZ#126 | 2.2 | U |
| 38380-07-3 | BZ#128 | 2.2 | U |
| 35065-28-2 | BZ#138 | 2.2 | U |
| 35065-27-1 | BZ#153 | 2.2 | U |
| 35065-30-6 | BZ#170 | 2.2 | U |
| 35065-29-3 | BZ#180 | 2.2 | U |
| 52663-68-0 | BZ#187 | 2.2 | U |
| 52663-78-2 | BZ#195 | 2.2 | U |
| 40186-72-9 | BZ#206 | 2.2 | U |
| 2051-24-3 | BZ#209 | 2.2 | U |

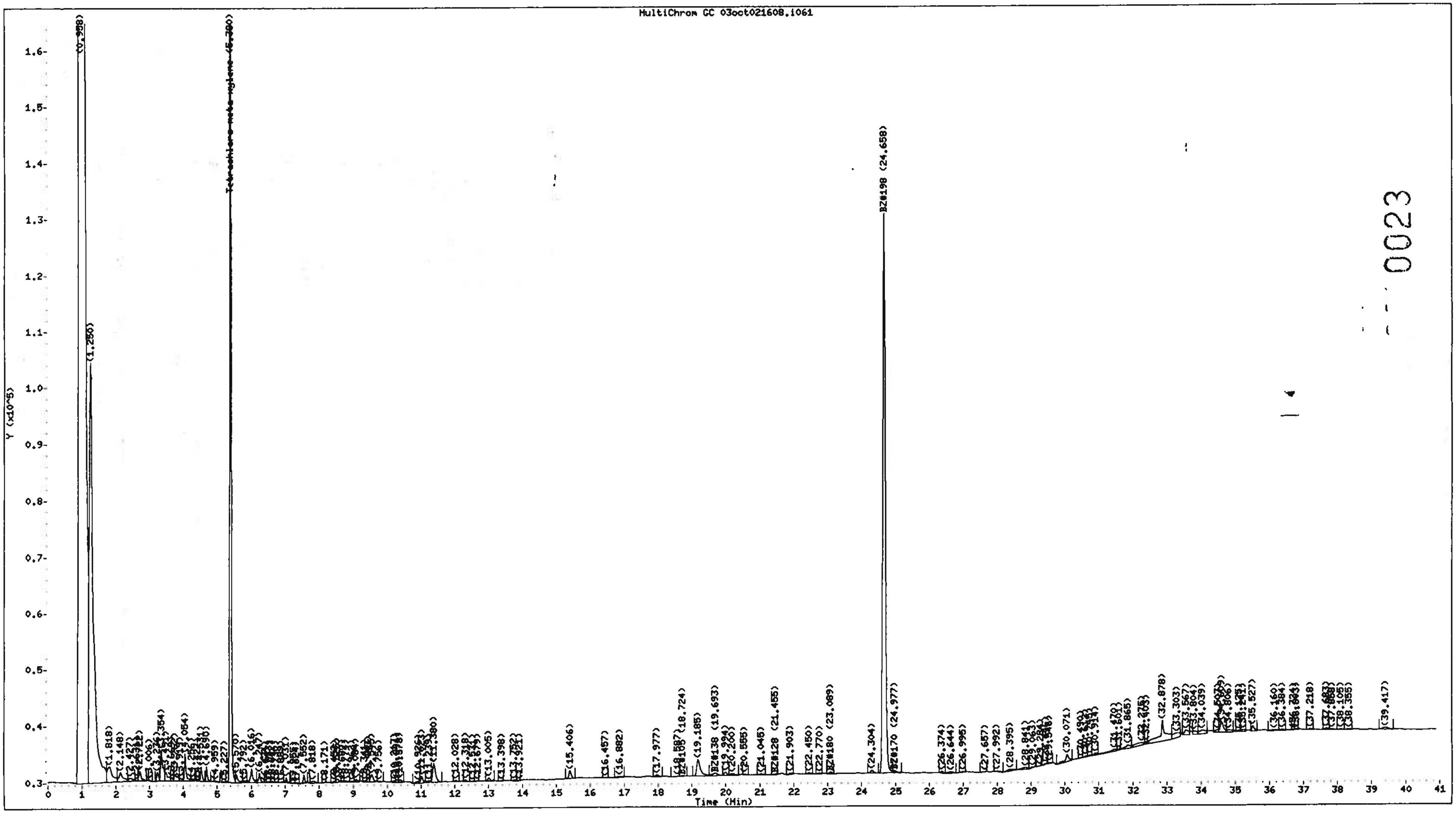
```
   Peak     Expected
    RT         RT                 Target Compound
 ========   ========   ======================================
_______________________ Target Compounds ______________________

   Peak     Expected
    RT         RT                 Target Compound
 ========   ========   ======================================
    4.985      5.001   Tetrachloro-meta-xylene
               5.761   BZ#8
               6.701   BZ#18
    7.931      7.925   BZ#28
               8.984   BZ#52
               9.667   BZ#44
              11.243   BZ#66
              12.207   BZ#101
              13.752   BZ#77
              14.938   BZ#118
              15.993   BZ#153
              16.155   BZ#105
              17.328   BZ#138
              17.762   BZ#126
              18.647   BZ#128
              20.781   BZ#180
              22.271   BZ#170
   22.539     22.559   BZ#198
              24.552   BZ#195
              27.655   BZ#206
              29.180   BZ#209
```

# STL Burlington - Target GC Chromatogram

Lab Sample ID: 502106 Client Sample ID: F01009LS11

Matrix : SOIL
Analyst :
Instrument : 3327_2.i
Column : RTX-CLPII
Integrator : Falcon
Method : /var/chem/3327_2.i/100302_1/03OCT021608.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 09:54 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 03:40
Dilution Factor : 1.00
Data File : 03oct021608-r061.d
Compound Sublist: ENVNET



# STL Burlington - Target GC Injection Report

Lab Sample ID: 502106 Client Sample ID: F01009LS11

Matrix : SOIL
Analyst :
Instrument : 3327_2.i
Column : RTX-CLPII
Integrator : Falcon
Method : /var/chem/3327_2.i/100302_1/03OCT021608.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 09:54 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 03:40
Dilution Factor : 1.00
Data File : 03oct021608-r061.d
Compound Sublist: ENVNET

## Peaks

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.958 | | | 8063389 | 969954 | | | |
| 2 | 1.250 | | | 651386 | 74482 | | | |
| 3 | 1.818 | | | 29447 | 2755 | | | |
| 4 | 2.148 | | | 14021 | 1577 | | | |
| 5 | 2.427 | | | 5147 | 551 | | | |
| 6 | 2.631 | | | 2917 | 644 | | | |
| 7 | 2.722 | | | 8831 | 1698 | | | |
| 8 | 3.006 | | | 538 | 174 | | | |
| 9 | 3.236 | | | 6010 | 1505 | | | |
| 10 | 3.354 | | | 26193 | 5420 | | | |
| 11 | 3.491 | | | 8280 | 1492 | | | |
| 12 | 3.669 | | | 1974 | 582 | | | |
| 13 | 3.762 | | | 7503 | 1225 | | | |
| 14 | 3.919 | | | 2086 | 484 | | | |
| 15 | 4.054 | | | 16188 | 4749 | | | |
| 16 | 4.256 | | | 1955 | 328 | | | |
| 17 | 4.427 | | | 1322 | 370 | | | |
| 18 | 4.531 | | | 8320 | 2493 | | | |
| 19 | 4.690 | | | 7001 | 2494 | | | |
| 20 | 4.959 | | | 1178 | 169 | | | |
| 21 | 5.227 | | | 683 | 159 | | | |
| $ 22 | 5.380 | 5.391 | -0.011 | 471619 | 162255 | 43.0460 | | Tetrachloro-meta-xylene |
| 23 | 5.570 | | | 6501 | 1425 | | | |
| 24 | 5.792 | | | 1890 | 304 | | | |
| 25 | 6.016 | | | 12118 | 2387 | | | |
| 26 | 6.247 | | | 6502 | 1628 | | | |
| 27 | 6.424 | | | 357 | 123 | | | |
| 28 | 6.533 | | | 1279 | 244 | | | |
| 29 | 6.612 | | | 1143 | 259 | | | |
| 30 | 6.730 | | | 786 | 222 | | | |
| 31 | 6.889 | | | 860 | 177 | | | |
| 32 | 7.031 | | | 2904 | 868 | | | |
| 33 | 7.255 | | | 494 | 130 | | | |
| 34 | 7.324 | | | 1041 | 211 | | | |
| 35 | 7.552 | | | 4669 | 1426 | | | |
| 36 | 7.818 | | | 2490 | 362 | | | |
| 37 | 8.171 | | | 261 | 71 | | | |
| 38 | 8.452 | | | 1240 | 277 | | | |
| 39 | 8.525 | | | 3301 | 612 | | | |
| 40 | 8.680 | | | 789 | 257 | | | |
| 41 | 8.774 | | | 1511 | 282 | | | |
| 42 | 8.962 | | | 809 | 222 | | | |
| 43 | 9.084 | | | 2619 | 451 | | | |
| 44 | 9.341 | | | 1315 | 301 | | | |
| 45 | 9.443 | | | 3103 | 834 | | | |
| 46 | 9.545 | | | 7847 | 1319 | | | |
| 47 | 9.756 | | | 1417 | 237 | | | |
| 48 | 10.217 | | | 1374 | 266 | | | |
| 49 | 10.294 | | | 1705 | 482 | | | |
| 50 | 10.378 | | | 2367 | 455 | | | |
| 51 | 10.926 | | | 2686 | 336 | | | |
| 52 | 11.023 | | | 5640 | 1197 | | | |
| 53 | 11.239 | | | 2650 | 349 | | | |
| 54 | 11.380 | | | 20358 | 3333 | | | |
| 55 | 12.028 | | | 1268 | 303 | | | |

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| 56 | 12.318 | | | 1220 | 311 | | | |
| 57 | 12.531 | | | 354 | 105 | | | |
| 58 | 12.679 | | | 480 | 95 | | | |
| 59 | 13.005 | | | 3591 | 608 | | | |
| 60 | 13.398 | | | 535 | 101 | | | |
| 61 | 13.752 | | | 847 | 163 | | | |
| 62 | 13.921 | | | 477 | 99 | | | |
| 63 | 15.406 | | | 7227 | 1412 | | | |
| 64 | 16.457 | | | 462 | 91 | | | |
| 65 | 16.882 | | | 2507 | 258 | | | |
| 66 | 17.977 | | | 2443 | 343 | | | |
| 67 | 18.587 | | | 1643 | 176 | | | |
| 68 | 18.724 | 18.720 | 0.004 | 1308 | 179 | 2.86163 | a | BZ#105 |
| 69 | 19.185 | | | 22643 | 2898 | | | |
| 70 | 19.693 | 19.713 | -0.020 | 6022 | 511 | 0.493629 | a | BZ#138 |
| 71 | 19.994 | | | 3837 | 640 | | | |
| 72 | 20.200 | | | 3183 | 367 | | | |
| 73 | 20.555 | | | 1051 | 177 | | | |
| 74 | 21.045 | | | 1112 | 146 | | | |
| 75 | 21.455 | 21.462 | -0.007 | 747 | 126 | 1.03395 | a | BZ#128 |
| 76 | 21.903 | | | 1466 | 267 | | | |
| 77 | 22.450 | | | 1397 | 255 | | | |
| 78 | 22.770 | | | 1057 | 144 | | | |
| 79 | 23.089 | 23.115 | -0.027 | 1730 | 344 | 0.595254 | a | BZ#180 |
| 80 | 24.304 | | | 3766 | 531 | | | |
| $ 81 | 24.658 | 24.678 | -0.020 | 529936 | 99401 | 41.7408 | | BZ#198 |
| 82 | 24.977 | 25.004 | -0.027 | 3532 | 427 | 0.946692 | a | BZ#170 |
| 83 | 26.374 | | | 1554 | 309 | | | |
| 84 | 26.644 | | | 3113 | 289 | | | |
| 85 | 26.995 | | | 815 | 136 | | | |
| 86 | 27.657 | | | 517 | 52 | | | |
| 87 | 27.992 | | | 1680 | 165 | | | |
| 88 | 28.395 | | | 4450 | 321 | | | |
| 89 | 28.841 | | | 4704 | 400 | | | |
| 90 | 29.063 | | | 1546 | 216 | | | |
| 91 | 29.284 | | | 284 | 42 | | | |
| 92 | 29.446 | | | 821 | 174 | | | |
| 93 | 29.546 | | | 1188 | 198 | | | |
| 94 | 30.071 | | | 10547 | 1271 | | | |
| 95 | 30.490 | | | 596 | 144 | | | |
| 96 | 30.612 | | | 986 | 204 | | | |
| 97 | 30.745 | | | 979 | 223 | | | |
| 98 | 30.914 | | | 2526 | 395 | | | |
| 99 | 31.470 | | | 5970 | 356 | | | |
| 100 | 31.601 | | | 1250 | 216 | | | |
| 101 | 31.865 | | | 7197 | 634 | | | |
| 102 | 32.275 | | | 10282 | 465 | | | |
| 103 | 32.403 | | | 1542 | 469 | | | |
| 104 | 32.878 | | | 43744 | 3632 | | | |
| 105 | 33.303 | | | 12408 | 828 | | | |
| 106 | 33.567 | | | 8283 | 890 | | | |
| 107 | 33.804 | | | 4656 | 540 | | | |
| 108 | 34.039 | | | 8333 | 656 | | | |
| 109 | 34.507 | | | 3367 | 460 | | | |
| 110 | 34.609 | | | 12808 | 1920 | | | |
| 111 | 34.806 | | | 3909 | 394 | | | |
| 112 | 35.125 | | | 1749 | 261 | | | |
| 113 | 35.241 | | | 2707 | 340 | | | |
| 114 | 35.527 | | | 5277 | 955 | | | |
| 115 | 36.160 | | | 2767 | 200 | | | |
| 116 | 36.384 | | | 1815 | 263 | | | |
| 117 | 36.724 | | | 500 | 129 | | | |
| 118 | 36.803 | | | 1234 | 207 | | | |
| 119 | 37.218 | | | 1646 | 236 | | | |
| 120 | 37.683 | | | 1601 | 302 | | | |
| 121 | 37.858 | | | 1020 | 148 | | | |
| 122 | 38.105 | | | 804 | 145 | | | |
| 123 | 38.355 | | | 1271 | 174 | | | |
| 124 | 39.417 | | | 4164 | 350 | | | |

# STL Burlington - Target GC Injection Report

```
Flags:  A - Peak quantitates above calibration range
        a - Peak quantitates below reporting limit
        H - User selected alternate compound hit
        M - Peak manually integrated or manually identified
        R - Peak fails recovery
        U - User disabled peak ID: either peak quantitates below reporting limit or
            peak identification not confirmed on second column
```

## Target Compounds

```
  Peak      Expected
   RT          RT                  Target Compound
========    ========    ======================================
   5.380       5.391    Tetrachloro-meta-xylene
               6.592    BZ#8
               7.698    BZ#18
               9.137    BZ#28
              10.341    BZ#52
              11.312    BZ#44
              13.056    BZ#66
              13.914    BZ#101
              16.080    BZ#77
              17.075    BZ#118
              17.995    BZ#153
  18.724      18.720    BZ#105
  19.693      19.713    BZ#138
              20.225    BZ#126
  21.455      21.462    BZ#128
  23.089      23.115    BZ#180
  24.658      24.678    BZ#198
  24.977      25.004    BZ#170
              27.203    BZ#195
              29.805    BZ#206
              30.754    BZ#209
```

FORM 1
OTHER ORGANICS ANALYSIS DATA SHEET

ENVNET SAMPLE NO.

F01009LS12

Lab Name: STL BURLINGTON Contract: 22000

Lab Code: STLVT Case No.: 22000 SAS No.: SDG No.: 89891

Matrix: (soil/water) SOIL Lab Sample ID: 502105

Sample wt/vol: 30.0 (g/mL) G Lab File ID: 03OCT021608-R051

% Moisture: 26 decanted: (Y/N) N Date Received: 09/25/02

Extraction: (SepF/Cont/Sonc) SOXH Date Extracted: 09/26/02

Concentrated Extract Volume: 10(mL) Date Analyzed: 10/04/02

Injection Volume: 1.0(uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: ___ Sulfur Cleanup: (Y/N) Y

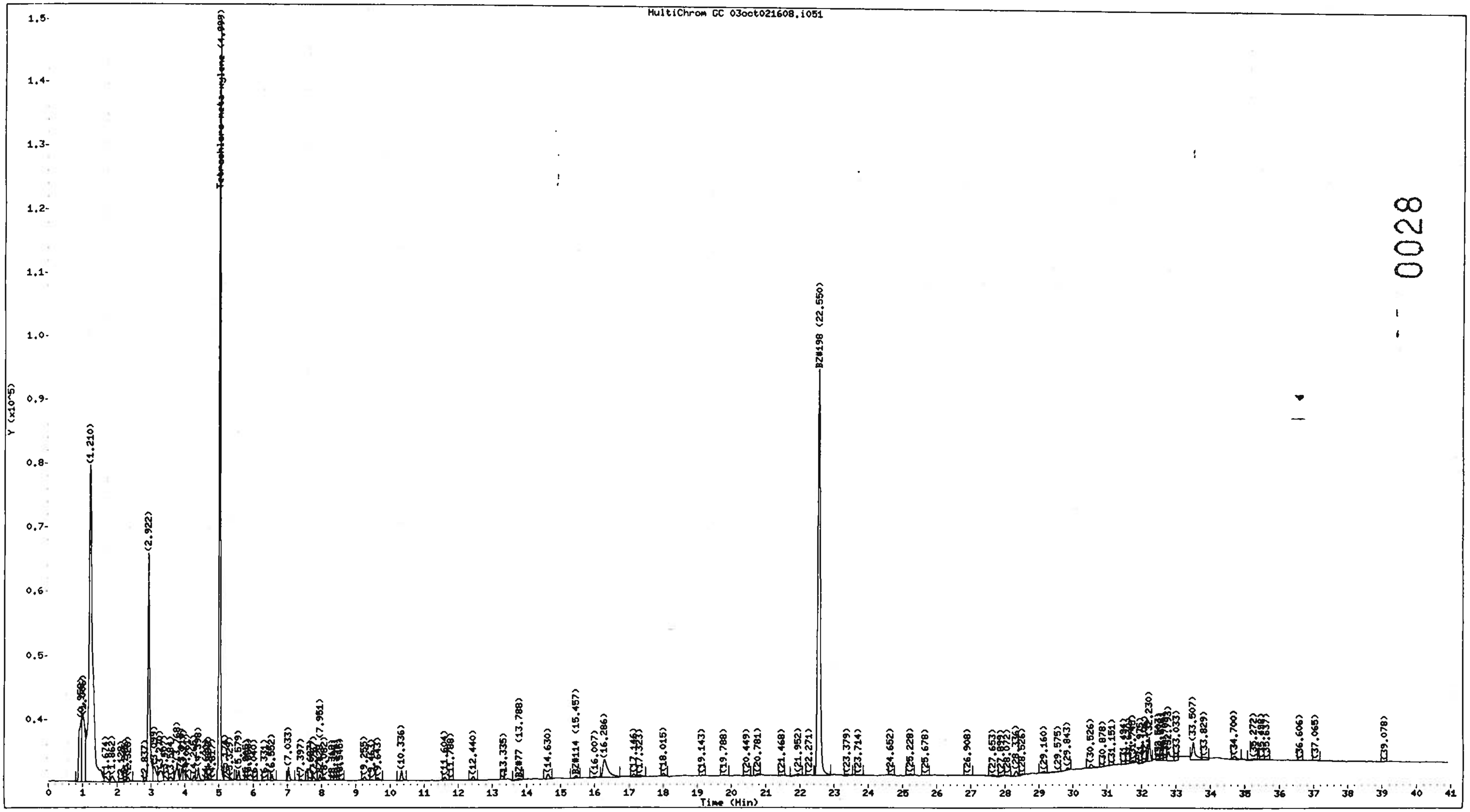
| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG | Q |
|---|---|---|---|
| 34883-43-7 | BZ#8 | 2.2 | U |
| 37680-65-2 | BZ#18 | 2.2 | U |
| 7012-37-5 | BZ#28 | 2.2 | U |
| 41464-39-5 | BZ#44 | 2.2 | U |
| 35693-99-3 | BZ#52 | 2.2 | U |
| 32598-10-0 | BZ#66 | 2.2 | U |
| 32598-13-3 | BZ#77 | 2.2 | U |
| 37680-73-2 | BZ#101 | 2.2 | U |
| 32598-14-4 | BZ#105 | 2.2 | U |
| 31508-00-6 | BZ#118 | 2.2 | U |
| 57465-28-8 | BZ#126 | 2.2 | U |
| 38380-07-3 | BZ#128 | 2.2 | U |
| 35065-28-2 | BZ#138 | 2.2 | U |
| 35065-27-1 | BZ#153 | 2.2 | U |
| 35065-30-6 | BZ#170 | 2.2 | U |
| 35065-29-3 | BZ#180 | 2.2 | U |
| 52663-68-0 | BZ#187 | 2.2 | U |
| 52663-78-2 | BZ#195 | 2.2 | U |
| 40186-72-9 | BZ#206 | 2.2 | U |
| 2051-24-3 | BZ#209 | 2.2 | U |

STL Burlington - Target GC Chromatogram

| Lab Sample ID: 502105 | Client Sample ID: F01009LS12 |
|---|---|

Matrix : SOIL
Analyst :
Instrument : 3327_1.i
Column : RTX-5
Integrator : Falcon
Method : /var/chem/3327_1.i/100302_1/03OCT021608.b/32CONG_3327RTX5_RAW.m
Reported : 17-Oct-2002 09:43 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 02:55
Dilution Factor : 1.00
Data File : 03oct021608-r051.d
Compound Sublist: ENVNET



```
                 STL Burlington - Target GC Injection Report

  Lab Sample ID: 502105                 Client Sample ID: F01009LS12

  Matrix        : SOIL                  Sample Type      : SAMPLE
  Analyst       :                       Injection Date   : 04-OCT-2002 02:55
  Instrument    : 3327_1.i              Dilution Factor  : 1.00
  Column        : RTX-5                 Data File        : 03oct021608-r051.d
  Integrator    : Falcon                Compound Sublist: ENVNET
  Method        : /var/chem/3327_1.i/100302_1/03OCT021608.b/32CONG_3327RTX5_RAW.m
  Reported      : 17-Oct-2002 09:43 rrm

 ______________________________ Peaks ______________________________

                                                         Extract
  Peak    Peak    Expected   Delta                       Conc.
   No.     RT        RT        RT      Area     Height   (ppb)     Flags        Peak Identification
 =====  ========  ========  ========  ========  ========  ==========  =====  =====================================
     1     0.958                         53444      9921
     2     1.006                         63139     10411
     3     1.210                        376983     49564
     4     1.674                          5549       866
     5     1.862                          6101       980
     6     2.128                           688       169
     7     2.245                          1333       390
     8     2.328                          3481       746
     9     2.837                           588       194
    10     2.922                        133727     35815
    11     3.099                         15276      2340
    12     3.270                         12759      1685
    13     3.407                          5022       867
    14     3.584                          4298       683
    15     3.768                         13174      2930
    16     3.910                          6964      1977
    17     3.977                          5950      1731
    18     4.061                          4572       990
    19     4.265                          3405       839
    20     4.398                          7962      2071
    21     4.620                           503       154
    22     4.693                          1769       588
    23     4.817                           881       195
 $  24     4.999     5.001    -0.002    338869    134451     42.6618          Tetrachloro-meta-xylene
    25     5.174                          5489       855
    26     5.329                          2272       475
    27     5.579                          6171      1529
    28     5.805                           451       131
    29     5.868                          1078       272
    30     6.040                           398       150
    31     6.331                           661       134
    32     6.552                          2966       948
    33     7.033                          6908      2147
    34     7.397                           883       293
    35     7.687                           399        80
    36     7.767                          2950       671
    37     7.951     7.925     0.027      3571      1018    0.906880   a      BZ#28
    38     8.082                          2104       535
    39     8.312                           373       117
    40     8.397                           360       119
    41     8.477                           605       200
    42     8.545                          2077       336
    43     9.255                          3373       616
    44     9.463                           699       152
    45     9.643                          2206       497
    46    10.336                          6294      1549
    47    11.604                          2282       558
    48    11.788                           660       184
    49    12.440                          3059       588
    50    13.335                           495       110
    51    13.788    13.752     0.035      2759       246     2.59181   a      BZ#77
    52    14.630                          3815       779
    53    15.457                          2305       429
    54    16.007                          1896       202
    55    16.286                         30094      2825
```

| | Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|---|
| | 56 | 17.146 | | | 2179 | 425 | | | |
| | 57 | 17.323 | | | 2604 | 271 | | | |
| | 58 | 18.015 | | | 2408 | 461 | | | |
| | 59 | 19.143 | | | 762 | 151 | | | |
| | 60 | 19.788 | | | 1026 | 159 | | | |
| | 61 | 20.449 | | | 817 | 158 | | | |
| | 62 | 20.781 | | | 1827 | 277 | | | |
| | 63 | 21.468 | | | 520 | 105 | | | |
| | 64 | 21.952 | | | 2810 | 299 | | | |
| | 65 | 22.271 | | | 806 | 142 | | | |
| $ | 66 | 22.550 | 22.559 | -0.009 | 323086 | 63938 | 42.8286 | | BZ#198 |
| | 67 | 23.379 | | | 2149 | 315 | | | |
| | 68 | 23.714 | | | 1175 | 125 | | | |
| | 69 | 24.652 | | | 924 | 168 | | | |
| | 70 | 25.228 | | | 1668 | 221 | | | |
| | 71 | 25.678 | | | 885 | 131 | | | |
| | 72 | 26.908 | | | 1027 | 153 | | | |
| | 73 | 27.653 | | | 2243 | 262 | | | |
| | 74 | 27.899 | | | 1010 | 176 | | | |
| | 75 | 28.072 | | | 764 | 130 | | | |
| | 76 | 28.336 | | | 4557 | 824 | | | |
| | 77 | 28.526 | | | 1182 | 191 | | | |
| | 78 | 29.160 | | | 1835 | 271 | | | |
| | 79 | 29.575 | | | 2438 | 129 | | | |
| | 80 | 29.843 | | | 2326 | 396 | | | |
| | 81 | 30.526 | | | 4186 | 564 | | | |
| | 82 | 30.878 | | | 248 | 47 | | | |
| | 83 | 31.151 | | | 362 | 85 | | | |
| | 84 | 31.494 | | | 407 | 102 | | | |
| | 85 | 31.630 | | | 293 | 72 | | | |
| | 86 | 31.745 | | | 2267 | 378 | | | |
| | 87 | 31.975 | | | 383 | 115 | | | |
| | 88 | 32.106 | | | 554 | 103 | | | |
| | 89 | 32.230 | | | 13775 | 3921 | | | |
| | 90 | 32.503 | | | 1641 | 291 | | | |
| | 91 | 32.578 | | | 2058 | 387 | | | |
| | 92 | 32.709 | | | 2752 | 545 | | | |
| | 93 | 32.793 | | | 10618 | 1444 | | | |
| | 94 | 33.033 | | | 4472 | 674 | | | |
| | 95 | 33.507 | | | 19235 | 2810 | | | |
| | 96 | 33.829 | | | 5213 | 482 | | | |
| | 97 | 34.700 | | | 4137 | 543 | | | |
| | 98 | 35.272 | | | 2422 | 234 | | | |
| | 99 | 35.498 | | | 861 | 162 | | | |
| | 100 | 35.637 | | | 732 | 125 | | | |
| | 101 | 36.606 | | | 413 | 91 | | | |
| | 102 | 37.065 | | | 700 | 123 | | | |
| | 103 | 39.078 | | | 492 | 81 | | | |

Flags:
A - Peak quantitates above calibration range
a - Peak quantitates below reporting limit
H - User selected alternate compound hit
M - Peak manually integrated or manually identified
R - Peak fails recovery
U - User disabled peak ID: either peak quantitates below reporting limit or peak identification not confirmed on second column

## Target Compounds

| Peak RT | Expected RT | Target Compound |
|---|---|---|
| 4.999 | 5.001 | Tetrachloro-meta-xylene |
| | 5.761 | BZ#8 |
| | 6.701 | BZ#18 |
| 7.951 | 7.925 | BZ#28 |
| | 8.984 | BZ#52 |
| | 9.667 | BZ#44 |
| | 11.243 | BZ#66 |

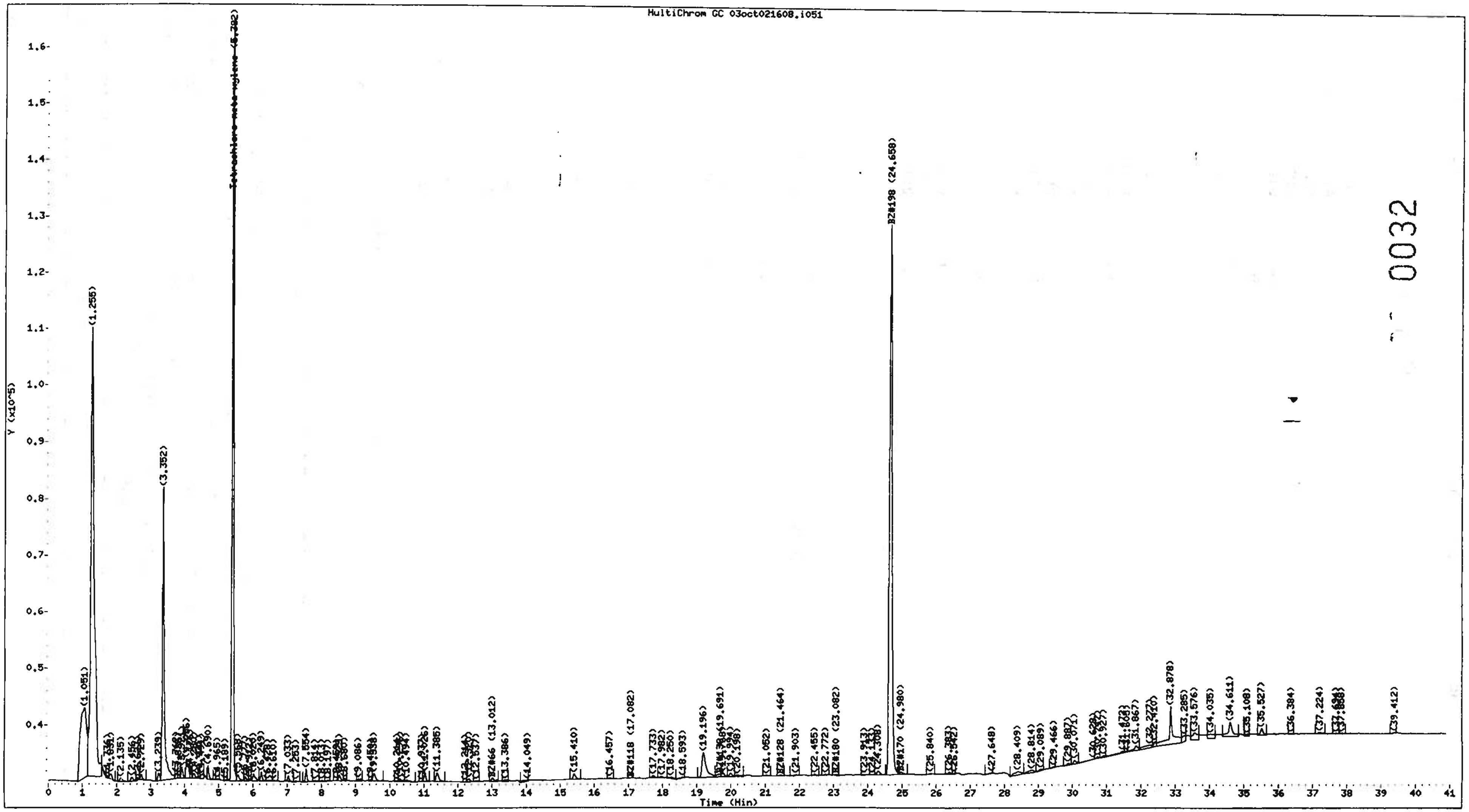
```
  Peak      Expected
   RT          RT                     Target Compound
========    ========    ====================================
              12.207    BZ#101
  13.788      13.752    BZ#77
              14.938    BZ#118
              15.993    BZ#153
              16.155    BZ#105
              17.328    BZ#138
              17.762    BZ#126
              18.647    BZ#128
              20.781    BZ#180
              22.271    BZ#170
  22.550      22.559    BZ#198
              24.552    BZ#195
              27.655    BZ#206
              29.180    BZ#209
```

## STL Burlington - Target GC Chromatogram

| Lab Sample ID: 502105 | Client Sample ID: F01009LS12 |
|---|---|

Matrix : SOIL
Analyst :
Instrument : 3327_2.i
Column : RTX-CLPII
Integrator : Falcon
Method : /var/chem/3327_2.i/100302_1/03OCT021608.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 09:54 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 02:55
Dilution Factor : 1.00
Data File : 03oct021608-r051.d
Compound Sublist: ENVNET



# STL Burlington - Target GC Injection Report

**Lab Sample ID: 502105** **Client Sample ID: F01009LS12**

| | | | |
|---|---|---|---|
| Matrix | : SOIL | Sample Type | : SAMPLE |
| Analyst | : | Injection Date | : 04-OCT-2002 02:55 |
| Instrument | : 3327_2.i | Dilution Factor | : 1.00 |
| Column | : RTX-CLPII | Data File | : 03oct021608-r051.d |
| Integrator | : Falcon | Compound Sublist | : ENVNET |

Method : /var/chem/3327_2.i/100302_1/03OCT021608.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 09:54 rrm

## Peaks

| | Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 1.051 | | | 160442 | 12294 | | | |
| | 2 | 1.255 | | | 574517 | 79139 | | | |
| | 3 | 1.736 | | | 1717 | 384 | | | |
| | 4 | 1.831 | | | 4104 | 918 | | | |
| | 5 | 2.135 | | | 3328 | 559 | | | |
| | 6 | 2.456 | | | 3396 | 711 | | | |
| | 7 | 2.627 | | | 1563 | 478 | | | |
| | 8 | 2.729 | | | 3509 | 939 | | | |
| | 9 | 3.239 | | | 5345 | 1321 | | | |
| | 10 | 3.352 | | | 198996 | 51643 | | | |
| | 11 | 3.762 | | | 3623 | 906 | | | |
| | 12 | 3.835 | | | 2391 | 693 | | | |
| | 13 | 3.921 | | | 6525 | 1883 | | | |
| | 14 | 4.056 | | | 15780 | 3387 | | | |
| | 15 | 4.176 | | | 3946 | 1355 | | | |
| | 16 | 4.280 | | | 4543 | 857 | | | |
| | 17 | 4.431 | | | 1255 | 425 | | | |
| | 18 | 4.491 | | | 4189 | 721 | | | |
| | 19 | 4.690 | | | 6963 | 2382 | | | |
| | 20 | 4.965 | | | 460 | 156 | | | |
| | 21 | 5.189 | | | 479 | 114 | | | |
| $ | 22 | 5.382 | 5.391 | -0.009 | 466043 | 160169 | 42.5008 | | Tetrachloro-meta-xylene |
| | 23 | 5.568 | | | 5533 | 1015 | | | |
| | 24 | 5.777 | | | 2816 | 708 | | | |
| | 25 | 5.912 | | | 915 | 289 | | | |
| | 26 | 6.020 | | | 6288 | 1163 | | | |
| | 27 | 6.249 | | | 5378 | 1550 | | | |
| | 28 | 6.428 | | | 548 | 101 | | | |
| | 29 | 6.610 | | | 523 | 133 | | | |
| | 30 | 7.033 | | | 3210 | 973 | | | |
| | 31 | 7.253 | | | 515 | 107 | | | |
| | 32 | 7.554 | | | 7049 | 2226 | | | |
| | 33 | 7.814 | | | 657 | 126 | | | |
| | 34 | 8.013 | | | 569 | 146 | | | |
| | 35 | 8.197 | | | 523 | 94 | | | |
| | 36 | 8.459 | | | 632 | 178 | | | |
| | 37 | 8.525 | | | 4432 | 1014 | | | |
| | 38 | 8.680 | | | 1536 | 486 | | | |
| | 39 | 9.086 | | | 2319 | 352 | | | |
| | 40 | 9.450 | | | 1122 | 322 | | | |
| | 41 | 9.538 | | | 7753 | 1311 | | | |
| | 42 | 10.214 | | | 791 | 178 | | | |
| | 43 | 10.296 | | | 2813 | 501 | | | |
| | 44 | 10.494 | | | 2493 | 290 | | | |
| | 45 | 10.937 | | | 238 | 86 | | | |
| | 46 | 11.026 | | | 6005 | 1564 | | | |
| | 47 | 11.385 | | | 8961 | 1495 | | | |
| | 48 | 12.214 | | | 363 | 87 | | | |
| | 49 | 12.320 | | | 2520 | 565 | | | |
| | 50 | 12.537 | | | 766 | 166 | | | |
| | 51 | 13.012 | 13.056 | -0.044 | 3639 | 553 | 2.01376 | a | BZ#66 |
| | 52 | 13.386 | | | 2006 | 273 | | | |
| | 53 | 14.049 | | | 2769 | 178 | | | |
| | 54 | 15.410 | | | 5677 | 948 | | | |
| | 55 | 16.457 | | | 812 | 161 | | | |

# STL Burlington - Target GC Injection Report

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| 56 | 17.082 | 17.075 | 0.007 | 327 | 71 | 1.04486 | a | BZ#118 |
| 57 | 17.733 | | | 2247 | 435 | | | |
| 58 | 17.982 | | | 1635 | 239 | | | |
| 59 | 18.250 | | | 2113 | 251 | | | |
| 60 | 18.593 | | | 1217 | 113 | | | |
| 61 | 19.196 | | | 37108 | 4340 | | | |
| 62 | 19.691 | 19.713 | -0.022 | 4199 | 491 | 0.483716 | a | BZ#138 |
| 63 | 19.768 | | | 3633 | 599 | | | |
| 64 | 19.994 | | | 3685 | 613 | | | |
| 65 | 20.198 | | | 2833 | 283 | | | |
| 66 | 21.052 | | | 1125 | 154 | | | |
| 67 | 21.464 | 21.462 | 0.002 | 953 | 143 | 1.04142 | a | BZ#128 |
| 68 | 21.903 | | | 1775 | 238 | | | |
| 69 | 22.455 | | | 1374 | 261 | | | |
| 70 | 22.772 | | | 1591 | 220 | | | |
| 71 | 23.082 | 23.115 | -0.033 | 1189 | 247 | 0.552565 | a | BZ#180 |
| 72 | 23.913 | | | 812 | 146 | | | |
| 73 | 24.133 | | | 391 | 96 | | | |
| 74 | 24.308 | | | 4590 | 669 | | | |
| $ 75 | 24.658 | 24.678 | -0.020 | 521489 | 97727 | 41.0352 | | BZ#198 |
| 76 | 24.980 | 25.004 | -0.024 | 3549 | 423 | 0.944999 | a | BZ#170 |
| 77 | 25.840 | | | 1246 | 184 | | | |
| 78 | 26.383 | | | 1701 | 322 | | | |
| 79 | 26.542 | | | 583 | 125 | | | |
| 80 | 27.648 | | | 998 | 92 | | | |
| 81 | 28.409 | | | 8815 | 569 | | | |
| 82 | 28.814 | | | 6255 | 449 | | | |
| 83 | 29.089 | | | 1688 | 198 | | | |
| 84 | 29.466 | | | 767 | 135 | | | |
| 85 | 29.887 | | | 2193 | 313 | | | |
| 86 | 30.071 | | | 4128 | 689 | | | |
| 87 | 30.628 | | | 2244 | 94 | | | |
| 88 | 30.747 | | | 1413 | 328 | | | |
| 89 | 30.927 | | | 1871 | 285 | | | |
| 90 | 31.472 | | | 4791 | 300 | | | |
| 91 | 31.605 | | | 883 | 142 | | | |
| 92 | 31.867 | | | 7707 | 911 | | | |
| 93 | 32.277 | | | 9165 | 426 | | | |
| 94 | 32.410 | | | 3759 | 903 | | | |
| 95 | 32.878 | | | 59756 | 6730 | | | |
| 96 | 33.285 | | | 8010 | 1059 | | | |
| 97 | 33.576 | | | 13910 | 1230 | | | |
| 98 | 34.035 | | | 9399 | 737 | | | |
| 99 | 34.611 | | | 24329 | 2584 | | | |
| 100 | 35.108 | | | 2155 | 309 | | | |
| 101 | 35.527 | | | 7427 | 1252 | | | |
| 102 | 36.384 | | | 1307 | 188 | | | |
| 103 | 37.224 | | | 2491 | 315 | | | |
| 104 | 37.694 | | | 653 | 125 | | | |
| 105 | 37.858 | | | 904 | 151 | | | |
| 106 | 39.412 | | | 1150 | 174 | | | |

Flags:
A - Peak quantitates above calibration range
a - Peak quantitates below reporting limit
H - User selected alternate compound hit
M - Peak manually integrated or manually identified
R - Peak fails recovery
U - User disabled peak ID: either peak quantitates below reporting limit or peak identification not confirmed on second column

## Target Compounds

| Peak RT | Expected RT | Target Compound |
|---|---|---|
| 5.382 | 5.391 | Tetrachloro-meta-xylene |
| | 6.592 | BZ#8 |
| | 7.698 | BZ#18 |
| | 9.137 | BZ#28 |

# STL Burlington - Target GC Injection Report

| Peak RT | Expected RT | Target Compound |
|---|---|---|
|  | 10.341 | BZ#52 |
|  | 11.312 | BZ#44 |
| 13.012 | 13.056 | BZ#66 |
|  | 13.914 | BZ#101 |
|  | 16.080 | BZ#77 |
| 17.082 | 17.075 | BZ#118 |
|  | 17.995 | BZ#153 |
|  | 18.720 | BZ#105 |
| 19.691 | 19.713 | BZ#138 |
|  | 20.225 | BZ#126 |
| 21.464 | 21.462 | BZ#128 |
| 23.082 | 23.115 | BZ#180 |
| 24.658 | 24.678 | BZ#198 |
| 24.980 | 25.004 | BZ#170 |
|  | 27.203 | BZ#195 |
|  | 29.805 | BZ#206 |
|  | 30.754 | BZ#209 |

FORM 1
OTHER ORGANICS ANALYSIS DATA SHEET

ENVNET SAMPLE NO.

F01009LS13

Lab Name: STL BURLINGTON Contract: 22000

Lab Code: STLVT Case No.: 22000 SAS No.: SDG No.: 89891

Matrix: (soil/water) SOIL Lab Sample ID: 502104

Sample wt/vol: 30.0 (g/mL) G Lab File ID: 03OCT021608-R041

% Moisture: 25 decanted: (Y/N) N Date Received: 09/25/02

Extraction: (SepF/Cont/Sonc) SOXH Date Extracted: 09/26/02

Concentrated Extract Volume: 10(mL) Date Analyzed: 10/04/02

Injection Volume: 1.0(uL) Dilution Factor: 1.0

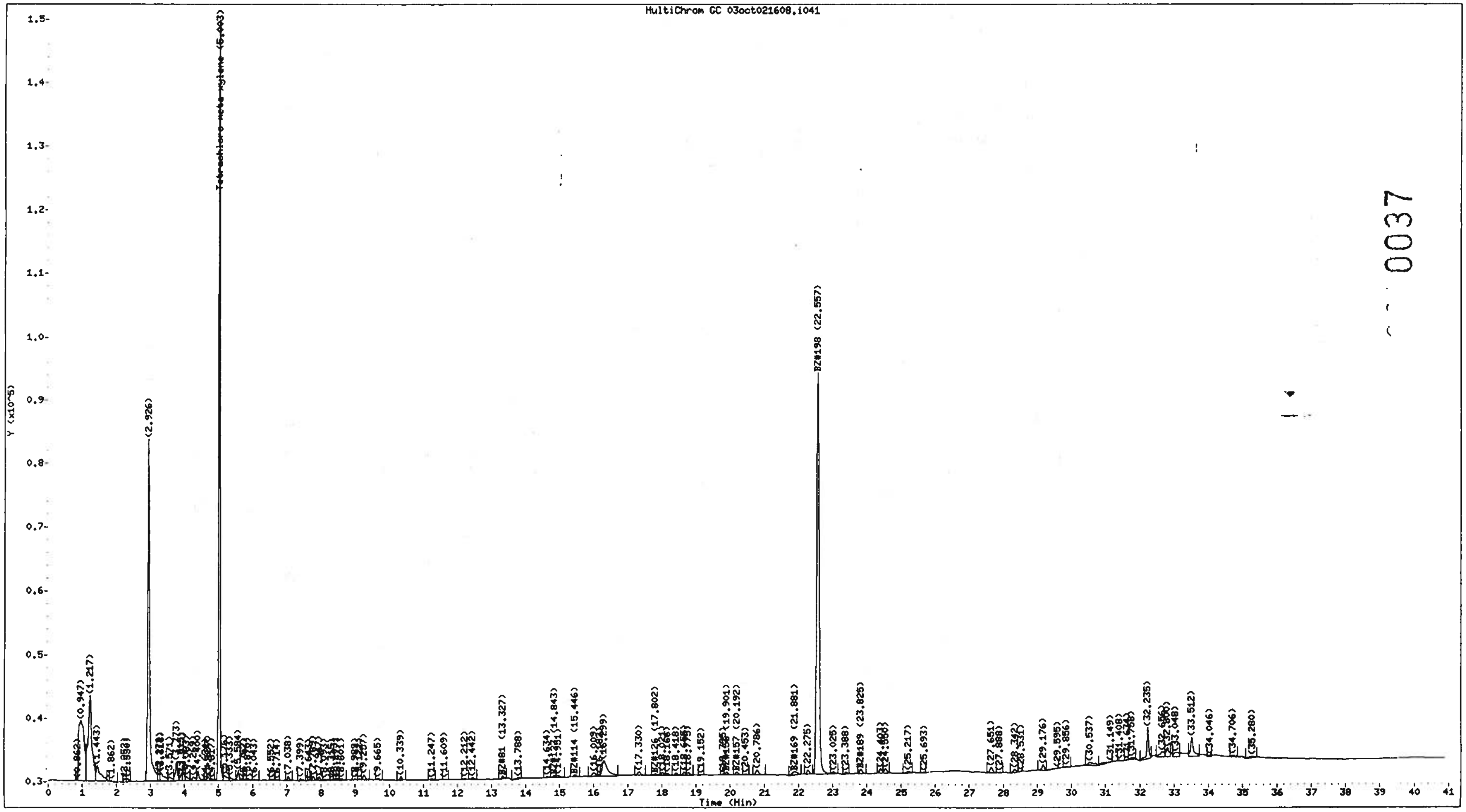
GPC Cleanup: (Y/N) N pH: ___ Sulfur Cleanup: (Y/N) Y

| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG | Q |
|---|---|---|---|
| 34883-43-7 | BZ#8 | 2.2 | U |
| 37680-65-2 | BZ#18 | 2.2 | U |
| 7012-37-5 | BZ#28 | 2.2 | U |
| 41464-39-5 | BZ#44 | 2.2 | U |
| 35693-99-3 | BZ#52 | 2.2 | U |
| 32598-10-0 | BZ#66 | 2.2 | U |
| 32598-13-3 | BZ#77 | 2.2 | U |
| 37680-73-2 | BZ#101 | 2.2 | U |
| 32598-14-4 | BZ#105 | 2.2 | U |
| 31508-00-6 | BZ#118 | 2.2 | U |
| 57465-28-8 | BZ#126 | 2.2 | U |
| 38380-07-3 | BZ#128 | 2.2 | U |
| 35065-28-2 | BZ#138 | 2.2 | U |
| 35065-27-1 | BZ#153 | 2.2 | U |
| 35065-30-6 | BZ#170 | 2.2 | U |
| 35065-29-3 | BZ#180 | 2.2 | U |
| 52663-68-0 | BZ#187 | 2.2 | U |
| 52663-78-2 | BZ#195 | 2.2 | U |
| 40186-72-9 | BZ#206 | 2.2 | U |
| 2051-24-3 | BZ#209 | 2.2 | U |

# STL Burlington - Target GC Chromatogram

| Lab Sample ID: 502104 | Client Sample ID: F01009LS13 |
|---|---|

Matrix : SOIL
Analyst :
Instrument : 3327_1.i
Column : RTX-5
Integrator : Falcon
Method : /var/chem/3327_1.i/100302_1/03OCT021608.b/32CONG_3327RTX5_RAW.m
Reported : 17-Oct-2002 09:43 rrm
Sample Type : SAMPLE
Injection Date : 04-OCT-2002 02:10
Dilution Factor : 1.00
Data File : 03oct021608-r041.d
Compound Sublist: ENVNET



# STL Burlington - Target GC Injection Report

Lab Sample ID: 502104 Client Sample ID: F01009LS13

Matrix : SOIL
Analyst :
Instrument : 3327_1.i
Column : RTX-5
Integrator : Falcon
Method : /var/chem/3327_1.i/100302_1/03OCT021608.b/32CONG_3327RTX5_RAW.m
Reported : 17-Oct-2002 09:43 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 02:10
Dilution Factor : 1.00
Data File : 03oct021608-r041.d
Compound Sublist: ENVNET

## Peaks

| | Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0.862 | | | 224 | 210 | | | |
| | 2 | 0.947 | | | 106629 | 9461 | | | |
| | 3 | 1.217 | | | 108754 | 13505 | | | |
| | 4 | 1.443 | | | 21676 | 2346 | | | |
| | 5 | 1.862 | | | 1304 | 191 | | | |
| | 6 | 2.252 | | | 2098 | 565 | | | |
| | 7 | 2.330 | | | 2327 | 540 | | | |
| | 8 | 2.926 | | | 213788 | 53768 | | | |
| | 9 | 3.272 | | | 4877 | 1193 | | | |
| | 10 | 3.318 | | | 9911 | 1310 | | | |
| | 11 | 3.571 | | | 4366 | 581 | | | |
| | 12 | 3.773 | | | 12698 | 3059 | | | |
| | 13 | 3.915 | | | 4915 | 1251 | | | |
| | 14 | 3.977 | | | 4491 | 1233 | | | |
| | 15 | 4.063 | | | 3774 | 713 | | | |
| | 16 | 4.269 | | | 4101 | 619 | | | |
| | 17 | 4.400 | | | 6359 | 1509 | | | |
| | 18 | 4.624 | | | 871 | 240 | | | |
| | 19 | 4.697 | | | 2477 | 706 | | | |
| | 20 | 4.817 | | | 1348 | 272 | | | |
| $ | 21 | 5.003 | 5.001 | 0.002 | 341039 | 135102 | 42.8678 | | Tetrachloro-meta-xylene |
| | 22 | 5.176 | | | 5486 | 843 | | | |
| | 23 | 5.333 | | | 3606 | 563 | | | |
| | 24 | 5.584 | | | 6733 | 1567 | | | |
| | 25 | 5.752 | | | 1104 | 224 | | | |
| | 26 | 5.870 | | | 1523 | 310 | | | |
| | 27 | 6.043 | | | 1038 | 210 | | | |
| | 28 | 6.552 | | | 751 | 202 | | | |
| | 29 | 6.714 | | | 551 | 102 | | | |
| | 30 | 7.038 | | | 2448 | 696 | | | |
| | 31 | 7.399 | | | 1467 | 329 | | | |
| | 32 | 7.643 | | | 214 | 77 | | | |
| | 33 | 7.769 | | | 2544 | 642 | | | |
| | 34 | 7.947 | | | 2348 | 553 | | | |
| | 35 | 8.093 | | | 1661 | 221 | | | |
| | 36 | 8.315 | | | 513 | 161 | | | |
| | 37 | 8.403 | | | 798 | 249 | | | |
| | 38 | 8.477 | | | 978 | 275 | | | |
| | 39 | 8.601 | | | 1185 | 200 | | | |
| | 40 | 8.989 | | | 885 | 161 | | | |
| | 41 | 9.122 | | | 894 | 192 | | | |
| | 42 | 9.257 | | | 4348 | 842 | | | |
| | 43 | 9.665 | | | 1556 | 280 | | | |
| | 44 | 10.339 | | | 2609 | 566 | | | |
| | 45 | 11.247 | | | 819 | 178 | | | |
| | 46 | 11.609 | | | 470 | 114 | | | |
| | 47 | 12.212 | | | 891 | 198 | | | |
| | 48 | 12.442 | | | 1647 | 328 | | | |
| | 49 | 13.327 | | | 2416 | 407 | | | |
| | 50 | 13.788 | | | 2161 | 213 | | | |
| | 51 | 14.634 | | | 1085 | 233 | | | |
| | 52 | 14.843 | | | 1578 | 287 | | | |
| | 53 | 14.951 | | | 2461 | 338 | | | |
| | 54 | 15.446 | | | 2086 | 357 | | | |
| | 55 | 16.009 | | | 4110 | 365 | | | |

# STL Burlington - Target GC Injection Report

```
                                                            Extract
 Peak     Peak    Expected   Delta                           Conc.
  No.      RT        RT        RT       Area      Height     (ppb)     Flags            Peak Identification
=====  ========  ========  ========  ========  ========  ==========  =====  ====================================
   56    16.182                          1353       327
   57    16.299                         27827      2444
   58    17.330                          3933       562
   59    17.802    17.762     0.040      1893       214     1.97440  a      BZ#126
   60    18.021                          2194       447
   61    18.166                          1599       323
   62    18.418                          1915       402
   63    18.655                          2362       484
   64    18.775                          2496       400
   65    19.152                           460        96
   66    19.795                           827       194
   67    19.901                          3052       456
   68    20.192                          2976       477
   69    20.453                           891       169
   70    20.786                          5267       770
   71    21.881                          5399       542
   72    22.275                          3365       646
$  73    22.557    22.559    -0.002    324358     63211     42.3228         BZ#198
   74    23.025                          2317       343
   75    23.388                          1690       292
   76    23.825                          3496       647
   77    24.403                          3700       715
   78    24.550                          3973       705
   79    25.217                          2228       248
   80    25.693                           919       155
   81    27.651                          4711       843
   82    27.888                           601       109
   83    28.342                          2899       524
   84    28.531                           272        46
   85    29.176                          4429       909
   86    29.595                          1331        20
   87    29.856                          1122       178
   88    30.537                          6246       499
   89    31.149                          3887        85
   90    31.408                           593        79
   91    31.634                           258        65
   92    31.758                          2144       259
   93    32.235                         19617      4901
   94    32.656                          7261       765
   95    32.800                          7990      1390
   96    33.048                          6247       613
   97    33.512                         17980      2972
   98    34.046                          1252       195
   99    34.706                          1902       271
  100    35.280                          2873       241

Flags:  A - Peak quantitates above calibration range
        a - Peak quantitates below reporting limit
        H - User selected alternate compound hit
        M - Peak manually integrated or manually identified
        R - Peak fails recovery
        U - User disabled peak ID: either peak quantitates below reporting limit or
            peak identification not confirmed on second column
```

## Target Compounds

```
  Peak      Expected
   RT          RT                   Target Compound
========    ========    ====================================
   5.003       5.001    Tetrachloro-meta-xylene
               5.761    BZ#8
               6.701    BZ#18
               7.925    BZ#28
               8.984    BZ#52
               9.667    BZ#44
              11.243    BZ#66
              12.207    BZ#101
              13.752    BZ#77
              14.938    BZ#118
```

# STL Burlington - Target GC Injection Report

```
  Peak      Expected
   RT          RT                 Target Compound
========   ========   ====================================
              15.993   BZ#153
              16.155   BZ#105
              17.328   BZ#138
  17.802      17.762   BZ#126
              18.647   BZ#128
              20.781   BZ#180
              22.271   BZ#170
  22.557      22.559   BZ#198
              24.552   BZ#195
              27.655   BZ#206
              29.180   BZ#209
```

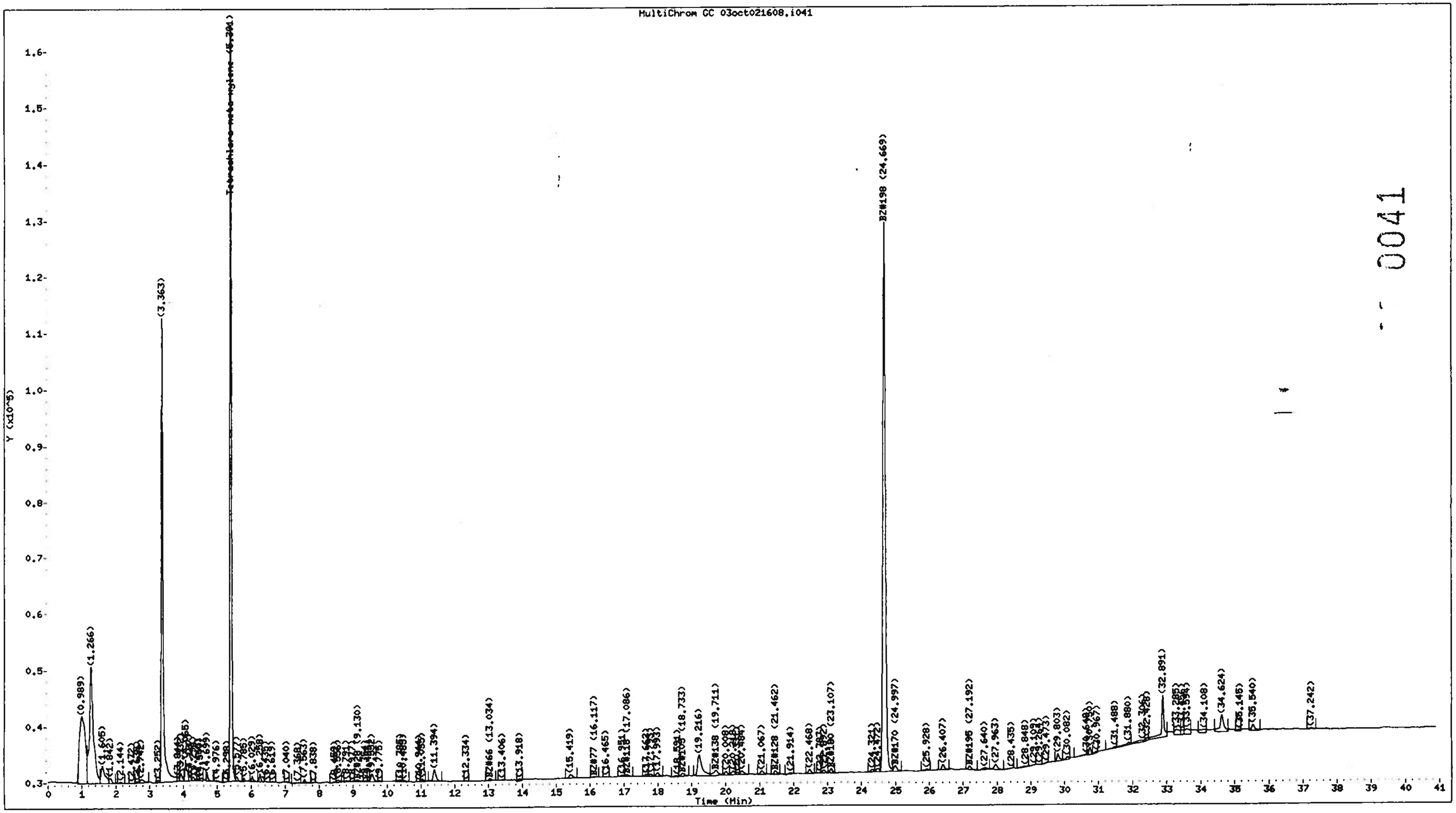
0040

# STL Burlington - Target GC Chromatogram

Lab Sample ID: 502104    Client Sample ID: F01009LS13

Matrix : SOIL
Analyst :
Instrument : 3327_2.i
Column : RTX-CLPII
Integrator : Falcon
Method : /var/chem/3327_2.i/100302_1/03OCT021608.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 09:54 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 02:10
Dilution Factor : 1.00
Data File : 03oct021608-r041.d
Compound Sublist: ENVNET



# STL Burlington - Target GC Injection Report

**Lab Sample ID: 502104** **Client Sample ID: F01009LS13**

Matrix : SOIL
Analyst :
Instrument : 3327_2.i
Column : RTX-CLPII
Integrator : Falcon
Method : /var/chem/3327_2.i/100302_1/03OCT021608.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 09:54 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 02:10
Dilution Factor : 1.00
Data File : 03oct021608-r041.d
Compound Sublist: ENVNET

## Peaks

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.989 | | | 143291 | 11998 | | | |
| 2 | 1.266 | | | 170589 | 20834 | | | |
| 3 | 1.605 | | | 26062 | 3137 | | | |
| 4 | 1.842 | | | 5230 | 975 | | | |
| 5 | 2.144 | | | 1318 | 269 | | | |
| 6 | 2.472 | | | 454 | 108 | | | |
| 7 | 2.638 | | | 1214 | 345 | | | |
| 8 | 2.742 | | | 5380 | 646 | | | |
| 9 | 3.252 | | | 2009 | 490 | | | |
| 10 | 3.363 | | | 310372 | 82593 | | | |
| 11 | 3.844 | | | 3168 | 808 | | | |
| 12 | 3.932 | | | 5754 | 1352 | | | |
| 13 | 4.065 | | | 15360 | 3778 | | | |
| 14 | 4.187 | | | 3728 | 1166 | | | |
| 15 | 4.294 | | | 4202 | 685 | | | |
| 16 | 4.440 | | | 1393 | 418 | | | |
| 17 | 4.500 | | | 2877 | 440 | | | |
| 18 | 4.699 | | | 4803 | 1581 | | | |
| 19 | 4.976 | | | 1600 | 222 | | | |
| 20 | 5.298 | | | 339 | 45 | | | |
| $ 21 | 5.391 | 5.391 | 0.000 | 461657 | 158924 | 42.1753 | | Tetrachloro-meta-xylene |
| 22 | 5.577 | | | 3671 | 856 | | | |
| 23 | 5.785 | | | 2000 | 565 | | | |
| 24 | 6.029 | | | 3518 | 933 | | | |
| 25 | 6.258 | | | 4284 | 1398 | | | |
| 26 | 6.435 | | | 429 | 122 | | | |
| 27 | 6.619 | | | 487 | 145 | | | |
| 28 | 7.040 | | | 714 | 213 | | | |
| 29 | 7.368 | | | 1497 | 172 | | | |
| 30 | 7.563 | | | 3244 | 722 | | | |
| 31 | 7.838 | | | 493 | 107 | | | |
| 32 | 8.459 | | | 1126 | 208 | | | |
| 33 | 8.556 | | | 2373 | 409 | | | |
| 34 | 8.791 | | | 1419 | 246 | | | |
| 35 | 8.977 | | | 921 | 203 | | | |
| 36 | 9.130 | 9.137 | -0.007 | 3055 | 330 | 1.26181 | a | BZ#28 |
| 37 | 9.354 | | | 926 | 201 | | | |
| 38 | 9.456 | | | 1244 | 346 | | | |
| 39 | 9.552 | | | 8221 | 1367 | | | |
| 40 | 9.775 | | | 993 | 197 | | | |
| 41 | 10.385 | | | 2242 | 315 | | | |
| 42 | 10.485 | | | 1514 | 251 | | | |
| 43 | 10.944 | | | 206 | 62 | | | |
| 44 | 11.035 | | | 1966 | 532 | | | |
| 45 | 11.394 | | | 13186 | 2101 | | | |
| 46 | 12.334 | | | 354 | 92 | | | |
| 47 | 13.034 | 13.056 | -0.022 | 2612 | 402 | 1.92238 | a | BZ#66 |
| 48 | 13.406 | | | 1252 | 168 | | | |
| 49 | 13.918 | | | 2350 | 395 | | | |
| 50 | 15.419 | | | 4601 | 631 | | | |
| 51 | 16.117 | 16.080 | 0.038 | 1037 | 148 | 2.66444 | a | BZ#77 |
| 52 | 16.465 | | | 475 | 94 | | | |
| 53 | 16.951 | | | 1735 | 298 | | | |
| 54 | 17.086 | 17.075 | 0.011 | 2651 | 370 | 1.22269 | a | BZ#118 |
| 55 | 17.662 | | | 2210 | 385 | | | |

# STL Burlington - Target GC Injection Report

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| 56 | 17.793 | | | 2732 | 401 | | | |
| 57 | 17.993 | | | 4394 | 621 | | | |
| 58 | 18.591 | | | 1471 | 144 | | | |
| 59 | 18.733 | 18.720 | 0.013 | 4199 | 503 | 3.01551 | a | BZ#105 |
| 60 | 19.216 | | | 33227 | 3663 | | | |
| 61 | 19.711 | 19.713 | -0.002 | 9349 | 922 | 0.697323 | a | BZ#138 |
| 62 | 20.008 | | | 4090 | 645 | | | |
| 63 | 20.218 | | | 4520 | 709 | | | |
| 64 | 20.331 | | | 2636 | 421 | | | |
| 65 | 20.484 | | | 5342 | 679 | | | |
| 66 | 21.067 | | | 4368 | 621 | | | |
| 67 | 21.462 | 21.462 | 0.000 | 3553 | 602 | 1.24309 | a | BZ#128 |
| 68 | 21.914 | | | 1734 | 237 | | | |
| 69 | 22.468 | | | 4120 | 726 | | | |
| 70 | 22.787 | | | 669 | 166 | | | |
| 71 | 22.892 | | | 3875 | 596 | | | |
| 72 | 23.107 | 23.115 | -0.009 | 3920 | 769 | 0.782295 | a | BZ#180 |
| 73 | 24.321 | | | 3133 | 512 | | | |
| 74 | 24.472 | | | 3662 | 617 | | | |
| $ 75 | 24.669 | 24.678 | -0.009 | 522926 | 97958 | 41.1326 | | BZ#198 |
| 76 | 24.997 | 25.004 | -0.007 | 7302 | 1039 | 1.20570 | a | BZ#170 |
| 77 | 25.928 | | | 2265 | 293 | | | |
| 78 | 26.407 | | | 6043 | 982 | | | |
| 79 | 27.192 | 27.203 | -0.011 | 4311 | 711 | 0.688035 | a | BZ#195 |
| 80 | 27.640 | | | 3115 | 320 | | | |
| 81 | 27.963 | | | 7267 | 935 | | | |
| 82 | 28.435 | | | 1303 | 78 | | | |
| 83 | 28.848 | | | 2008 | 153 | | | |
| 84 | 29.109 | | | 557 | 78 | | | |
| 85 | 29.264 | | | 596 | 107 | | | |
| 86 | 29.473 | | | 835 | 138 | | | |
| 87 | 29.803 | | | 6749 | 1272 | | | |
| 88 | 30.082 | | | 4092 | 575 | | | |
| 89 | 30.648 | | | 2039 | 172 | | | |
| 90 | 30.750 | | | 5648 | 1370 | | | |
| 91 | 30.967 | | | 2029 | 260 | | | |
| 92 | 31.488 | | | 2477 | 303 | | | |
| 93 | 31.880 | | | 6099 | 445 | | | |
| 94 | 32.306 | | | 5831 | 301 | | | |
| 95 | 32.428 | | | 2100 | 539 | | | |
| 96 | 32.891 | | | 38684 | 7523 | | | |
| 97 | 33.285 | | | 9365 | 919 | | | |
| 98 | 33.456 | | | 4859 | 806 | | | |
| 99 | 33.594 | | | 9106 | 935 | | | |
| 100 | 34.108 | | | 7809 | 587 | | | |
| 101 | 34.624 | | | 24703 | 3001 | | | |
| 102 | 35.145 | | | 2040 | 296 | | | |
| 103 | 35.540 | | | 8630 | 1170 | | | |
| 104 | 37.242 | | | 1605 | 199 | | | |

Flags:
A - Peak quantitates above calibration range
a - Peak quantitates below reporting limit
H - User selected alternate compound hit
M - Peak manually integrated or manually identified
R - Peak fails recovery
U - User disabled peak ID: either peak quantitates below reporting limit or peak identification not confirmed on second column

## Target Compounds

| Peak RT | Expected RT | Target Compound |
|---|---|---|
| 5.391 | 5.391 | Tetrachloro-meta-xylene |
| | 6.592 | BZ#8 |
| | 7.698 | BZ#18 |
| 9.130 | 9.137 | BZ#28 |
| | 10.341 | BZ#52 |
| | 11.312 | BZ#44 |

# STL Burlington - Target GC Injection Report

```
  Peak       Expected
   RT           RT                  Target Compound
========    ========    ======================================
 13.034       13.056    BZ#66
              13.914    BZ#101
 16.117       16.080    BZ#77
 17.086       17.075    BZ#118
              17.995    BZ#153
 18.733       18.720    BZ#105
 19.711       19.713    BZ#138
              20.225    BZ#126
 21.462       21.462    BZ#128
 23.107       23.115    BZ#180
 24.669       24.678    BZ#198
 24.997       25.004    BZ#170
 27.192       27.203    BZ#195
              29.805    BZ#206
              30.754    BZ#209
```

# FORM 1
# OTHER ORGANICS ANALYSIS DATA SHEET

ENVNET SAMPLE NO.

F01009LS21

Lab Name: STL BURLINGTON Contract: 22000

Lab Code: STLVT Case No.: 22000 SAS No.: SDG No.: 89891

Matrix: (soil/water) SOIL Lab Sample ID: 502109

Sample wt/vol: 30.0 (g/mL) G Lab File ID: 03OCT021608-R091

% Moisture: 26 decanted: (Y/N) N Date Received: 09/25/02

Extraction: (SepF/Cont/Sonc) SOXH Date Extracted: 09/26/02

Concentrated Extract Volume: 10(mL) Date Analyzed: 10/04/02

Injection Volume: 1.0(uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: ___ Sulfur Cleanup: (Y/N) Y

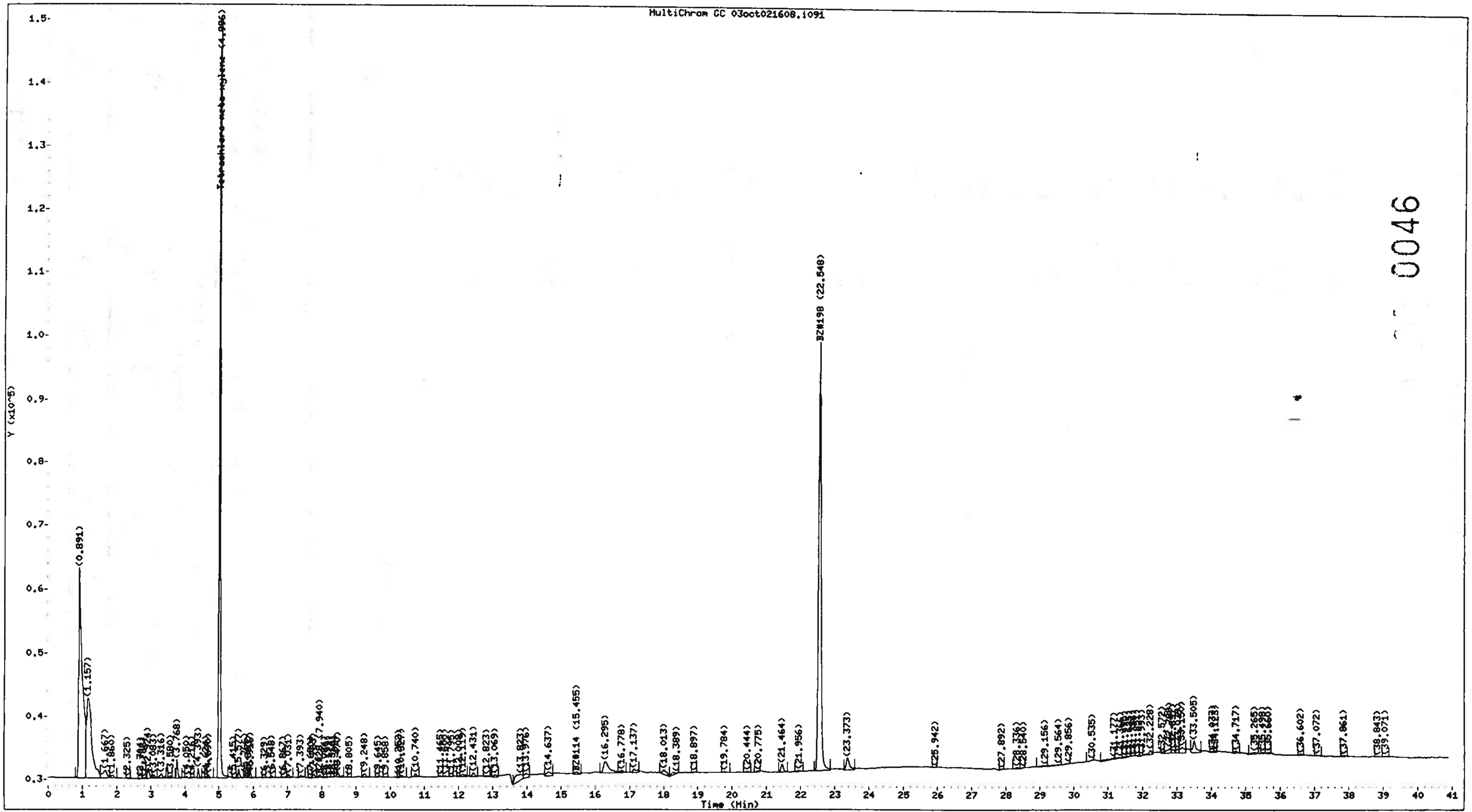
| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG | Q |
|---|---|---|---|
| 34883-43-7 | BZ#8 | 2.2 | U |
| 37680-65-2 | BZ#18 | 2.2 | U |
| 7012-37-5 | BZ#28 | 2.2 | U |
| 41464-39-5 | BZ#44 | 2.2 | U |
| 35693-99-3 | BZ#52 | 2.2 | U |
| 32598-10-0 | BZ#66 | 2.2 | U |
| 32598-13-3 | BZ#77 | 2.2 | U |
| 37680-73-2 | BZ#101 | 2.2 | U |
| 32598-14-4 | BZ#105 | 2.2 | U |
| 31508-00-6 | BZ#118 | 2.2 | U |
| 57465-28-8 | BZ#126 | 2.2 | U |
| 38380-07-3 | BZ#128 | 2.2 | U |
| 35065-28-2 | BZ#138 | 2.2 | U |
| 35065-27-1 | BZ#153 | 2.2 | U |
| 35065-30-6 | BZ#170 | 2.2 | U |
| 35065-29-3 | BZ#180 | 2.2 | U |
| 52663-68-0 | BZ#187 | 2.2 | U |
| 52663-78-2 | BZ#195 | 2.2 | U |
| 40186-72-9 | BZ#206 | 2.2 | U |
| 2051-24-3 | BZ#209 | 2.2 | U |

## STL Burlington - Target GC Chromatogram

Lab Sample ID: 502109 Client Sample ID: F01009LS21

Matrix : SOIL
Analyst :
Instrument : 3327_1.i
Column : RTX-5
Integrator : Falcon
Method : /var/chem/3327_1.i/100302_1/03OCT021608.b/32CONG_3327RTX5_RAW.m
Reported : 17-Oct-2002 09:44 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 05:55
Dilution Factor : 1.00
Data File : 03oct021608-r091.d
Compound Sublist: ENVNET



# STL Burlington - Target GC Injection Report

Lab Sample ID: 502109 Client Sample ID: F01009LS21

| | | | | |
|---|---|---|---|---|
| Matrix | : SOIL | | Sample Type | : SAMPLE |
| Analyst | : | | Injection Date | : 04-OCT-2002 05:55 |
| Instrument | : 3327_1.i | | Dilution Factor | : 1.00 |
| Column | : RTX-5 | | Data File | : 03oct021608-r091.d |
| Integrator | : Falcon | | Compound Sublist | : ENVNET |

Method : /var/chem/3327_1.i/100302_1/03OCT021608.b/32CONG_3327RTX5_RAW.m
Reported : 17-Oct-2002 09:44 rrm

## Peaks

| | Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0.891 | | | 240940 | 33121 | | | |
| | 2 | 1.157 | | | 137599 | 12623 | | | |
| | 3 | 1.667 | | | 11214 | 1233 | | | |
| | 4 | 1.860 | | | 2728 | 427 | | | |
| | 5 | 2.325 | | | 592 | 156 | | | |
| | 6 | 2.704 | | | 196 | 56 | | | |
| | 7 | 2.786 | | | 258 | 58 | | | |
| | 8 | 2.924 | | | 6618 | 1601 | | | |
| | 9 | 3.083 | | | 2076 | 538 | | | |
| | 10 | 3.316 | | | 4379 | 712 | | | |
| | 11 | 3.580 | | | 1398 | 349 | | | |
| | 12 | 3.768 | | | 8517 | 2930 | | | |
| | 13 | 4.050 | | | 1087 | 300 | | | |
| | 14 | 4.216 | | | 479 | 184 | | | |
| | 15 | 4.393 | | | 4565 | 1517 | | | |
| | 16 | 4.624 | | | 483 | 217 | | | |
| | 17 | 4.690 | | | 1422 | 510 | | | |
| $ | 18 | 4.996 | 5.001 | -0.005 | 343412 | 136350 | 43.2627 | | Tetrachloro-meta-xylene |
| | 19 | 5.415 | | | 423 | 90 | | | |
| | 20 | 5.577 | | | 4182 | 1347 | | | |
| | 21 | 5.766 | | | 1745 | 590 | | | |
| | 22 | 5.863 | | | 546 | 233 | | | |
| | 23 | 5.916 | | | 2501 | 719 | | | |
| | 24 | 6.329 | | | 225 | 64 | | | |
| | 25 | 6.548 | | | 910 | 282 | | | |
| | 26 | 6.867 | | | 605 | 91 | | | |
| | 27 | 7.031 | | | 2087 | 519 | | | |
| | 28 | 7.393 | | | 1793 | 361 | | | |
| | 29 | 7.690 | | | 433 | 109 | | | |
| | 30 | 7.763 | | | 2337 | 568 | | | |
| | 31 | 7.940 | 7.925 | 0.016 | 1695 | 402 | 0.439858 | a | BZ#28 |
| | 32 | 8.084 | | | 287 | 94 | | | |
| | 33 | 8.199 | | | 539 | 158 | | | |
| | 34 | 8.310 | | | 453 | 125 | | | |
| | 35 | 8.392 | | | 506 | 175 | | | |
| | 36 | 8.470 | | | 3762 | 737 | | | |
| | 37 | 8.805 | | | 382 | 92 | | | |
| | 38 | 9.248 | | | 3194 | 563 | | | |
| | 39 | 9.645 | | | 720 | 180 | | | |
| | 40 | 9.858 | | | 362 | 86 | | | |
| | 41 | 10.252 | | | 471 | 152 | | | |
| | 42 | 10.327 | | | 1636 | 349 | | | |
| | 43 | 10.740 | | | 2210 | 529 | | | |
| | 44 | 11.465 | | | 492 | 138 | | | |
| | 45 | 11.600 | | | 718 | 175 | | | |
| | 46 | 11.795 | | | 319 | 98 | | | |
| | 47 | 12.008 | | | 378 | 99 | | | |
| | 48 | 12.119 | | | 2704 | 338 | | | |
| | 49 | 12.431 | | | 3400 | 616 | | | |
| | 50 | 12.823 | | | 1654 | 196 | | | |
| | 51 | 13.069 | | | 2644 | 332 | | | |
| | 52 | 13.823 | | | 15389 | 825 | | | |
| | 53 | 13.976 | | | 6216 | 667 | | | |
| | 54 | 14.637 | | | 6668 | 645 | | | |
| | 55 | 15.455 | | | 3110 | 357 | | | |

0047

# STL Burlington - Target GC Injection Report

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| 56 | 16.295 | | | 20055 | 1790 | | | |
| 57 | 16.778 | | | 2589 | 307 | | | |
| 58 | 17.137 | | | 3869 | 524 | | | |
| 59 | 18.013 | | | 6016 | 716 | | | |
| 60 | 18.389 | | | 3343 | 145 | | | |
| 61 | 18.897 | | | 776 | 142 | | | |
| 62 | 19.784 | | | 694 | 140 | | | |
| 63 | 20.444 | | | 835 | 169 | | | |
| 64 | 20.775 | | | 1147 | 207 | | | |
| 65 | 21.464 | | | 6056 | 1229 | | | |
| 66 | 21.956 | | | 884 | 157 | | | |
| $ 67 | 22.548 | 22.559 | -0.011 | 349184 | 68037 | 45.6804 | | BZ#198 |
| 68 | 23.373 | | | 13610 | 1956 | | | |
| 69 | 25.942 | | | 481 | 93 | | | |
| 70 | 27.892 | | | 454 | 89 | | | |
| 71 | 28.336 | | | 1439 | 250 | | | |
| 72 | 28.540 | | | 341 | 33 | | | |
| 73 | 29.156 | | | 2161 | 175 | | | |
| 74 | 29.564 | | | 2444 | 135 | | | |
| 75 | 29.856 | | | 1344 | 103 | | | |
| 76 | 30.535 | | | 580 | 101 | | | |
| 77 | 31.177 | | | 4847 | 208 | | | |
| 78 | 31.366 | | | 1755 | 129 | | | |
| 79 | 31.490 | | | 812 | 139 | | | |
| 80 | 31.625 | | | 517 | 120 | | | |
| 81 | 31.736 | | | 209 | 54 | | | |
| 82 | 31.851 | | | 826 | 185 | | | |
| 83 | 31.993 | | | 230 | 47 | | | |
| 84 | 32.228 | | | 4850 | 720 | | | |
| 85 | 32.572 | | | 1184 | 245 | | | |
| 86 | 32.789 | | | 5893 | 770 | | | |
| 87 | 32.891 | | | 3197 | 562 | | | |
| 88 | 33.039 | | | 3419 | 594 | | | |
| 89 | 33.150 | | | 8112 | 880 | | | |
| 90 | 33.505 | | | 13911 | 1874 | | | |
| 91 | 34.037 | | | 1206 | 206 | | | |
| 92 | 34.123 | | | 1290 | 305 | | | |
| 93 | 34.717 | | | 2123 | 342 | | | |
| 94 | 35.265 | | | 2879 | 275 | | | |
| 95 | 35.498 | | | 832 | 239 | | | |
| 96 | 35.660 | | | 1657 | 231 | | | |
| 97 | 36.602 | | | 1088 | 223 | | | |
| 98 | 37.072 | | | 775 | 133 | | | |
| 99 | 37.861 | | | 798 | 149 | | | |
| 100 | 38.843 | | | 611 | 115 | | | |
| 101 | 39.071 | | | 923 | 173 | | | |

Flags:
- A - Peak quantitates above calibration range
- a - Peak quantitates below reporting limit
- H - User selected alternate compound hit
- M - Peak manually integrated or manually identified
- R - Peak fails recovery
- U - User disabled peak ID: either peak quantitates below reporting limit or peak identification not confirmed on second column

## Target Compounds

| Peak RT | Expected RT | Target Compound |
|---|---|---|
| 4.996 | 5.001 | Tetrachloro-meta-xylene |
| | 5.761 | BZ#8 |
| | 6.701 | BZ#18 |
| 7.940 | 7.925 | BZ#28 |
| | 8.984 | BZ#52 |
| | 9.667 | BZ#44 |
| | 11.243 | BZ#66 |
| | 12.207 | BZ#101 |
| | 13.752 | BZ#77 |

# STL Burlington - Target GC Injection Report

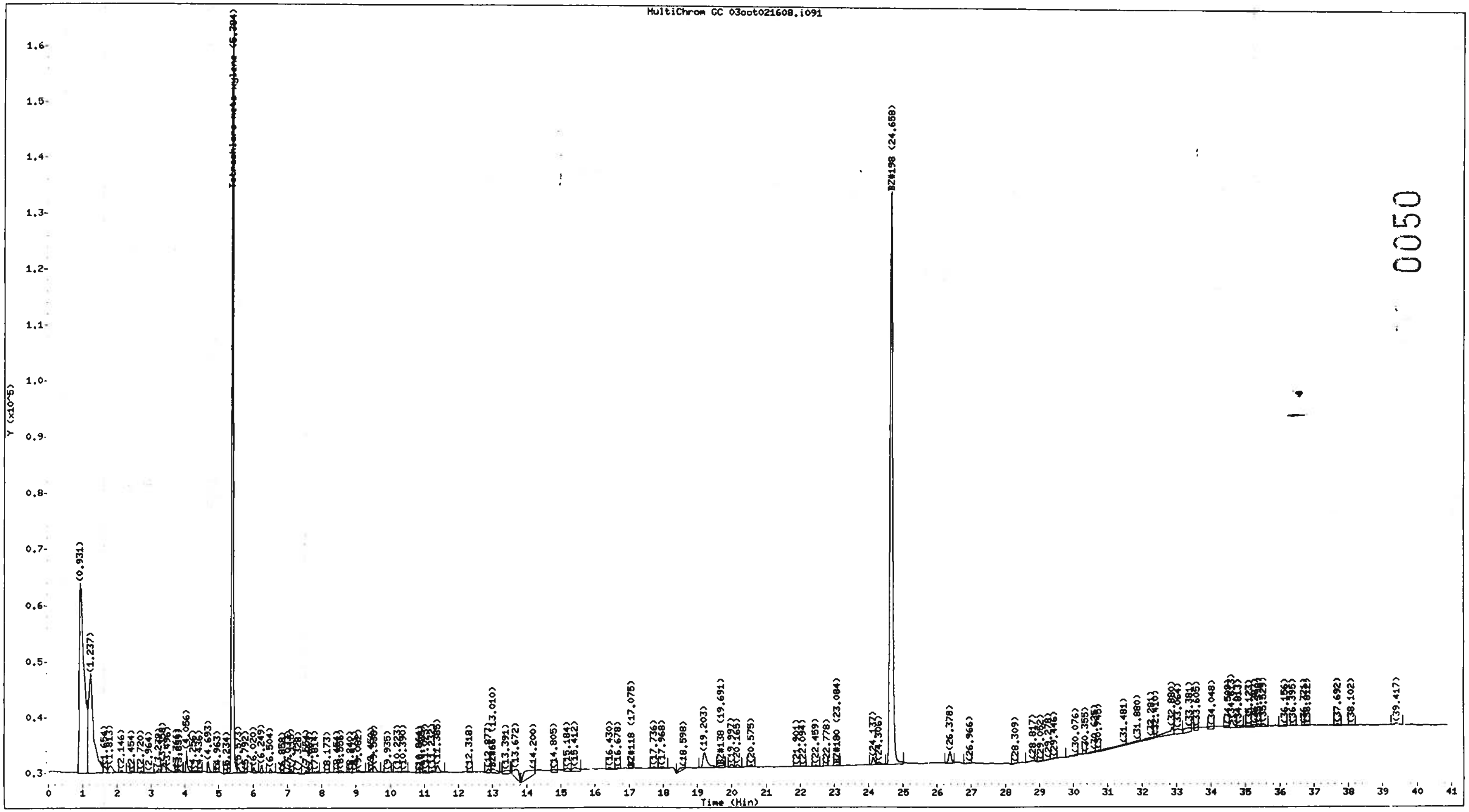
| Peak RT | Expected RT | Target Compound |
|---|---|---|
| | 14.938 | BZ#118 |
| | 15.993 | BZ#153 |
| | 16.155 | BZ#105 |
| | 17.328 | BZ#138 |
| | 17.762 | BZ#126 |
| | 18.647 | BZ#128 |
| | 20.781 | BZ#180 |
| | 22.271 | BZ#170 |
| 22.548 | 22.559 | BZ#198 |
| | 24.552 | BZ#195 |
| | 27.655 | BZ#206 |
| | 29.180 | BZ#209 |

## STL Burlington - Target GC Chromatogram

| | |
|---|---|
| Lab Sample ID: 502109 | Client Sample ID: F01009LS21 |

Matrix : SOIL
Analyst :
Instrument : 3327_2.i
Column : RTX-CLPII
Integrator : Falcon
Method : /var/chem/3327_2.i/100302_1/03OCT021608.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 09:55 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 05:55
Dilution Factor : 1.00
Data File : 03oct021608-r091.d
Compound Sublist: ENVNET



# STL Burlington - Target GC Injection Report

Lab Sample ID: 502109 Client Sample ID: F01009LS21

Matrix : SOIL
Analyst :
Instrument : 3327_2.i
Column : RTX-CLPII
Integrator : Falcon
Method : /var/chem/3327_2.i/100302_1/03OCT021608.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 09:55 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 05:55
Dilution Factor : 1.00
Data File : 03oct021608-r091.d
Compound Sublist: ENVNET

## Peaks

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.931 | | | 331248 | 33886 | | | |
| 2 | 1.237 | | | 192303 | 17874 | | | |
| 3 | 1.654 | | | 6981 | 1140 | | | |
| 4 | 1.813 | | | 11513 | 1244 | | | |
| 5 | 2.146 | | | 2453 | 473 | | | |
| 6 | 2.454 | | | 1182 | 294 | | | |
| 7 | 2.720 | | | 1246 | 338 | | | |
| 8 | 2.964 | | | 1003 | 119 | | | |
| 9 | 3.239 | | | 3161 | 656 | | | |
| 10 | 3.358 | | | 8750 | 1637 | | | |
| 11 | 3.496 | | | 5222 | 906 | | | |
| 12 | 3.766 | | | 1822 | 525 | | | |
| 13 | 3.839 | | | 2098 | 504 | | | |
| 14 | 4.056 | | | 13053 | 3907 | | | |
| 15 | 4.256 | | | 2364 | 292 | | | |
| 16 | 4.436 | | | 1312 | 268 | | | |
| 17 | 4.693 | | | 6031 | 2033 | | | |
| 18 | 4.963 | | | 540 | 163 | | | |
| 19 | 5.234 | | | 790 | 164 | | | |
| $ 20 | 5.384 | 5.391 | -0.007 | 465801 | 159467 | 42.3173 | | Tetrachloro-meta-xylene |
| 21 | 5.573 | | | 5000 | 1045 | | | |
| 22 | 5.792 | | | 791 | 199 | | | |
| 23 | 6.020 | | | 3812 | 925 | | | |
| 24 | 6.249 | | | 5142 | 1436 | | | |
| 25 | 6.504 | | | 3699 | 805 | | | |
| 26 | 6.858 | | | 262 | 96 | | | |
| 27 | 7.033 | | | 1657 | 351 | | | |
| 28 | 7.115 | | | 2254 | 741 | | | |
| 29 | 7.328 | | | 1646 | 227 | | | |
| 30 | 7.554 | | | 2438 | 549 | | | |
| 31 | 7.663 | | | 617 | 155 | | | |
| 32 | 7.814 | | | 1900 | 251 | | | |
| 33 | 8.173 | | | 726 | 119 | | | |
| 34 | 8.454 | | | 1006 | 212 | | | |
| 35 | 8.556 | | | 2945 | 431 | | | |
| 36 | 8.840 | | | 315 | 96 | | | |
| 37 | 8.971 | | | 688 | 144 | | | |
| 38 | 9.082 | | | 2671 | 464 | | | |
| 39 | 9.450 | | | 2901 | 814 | | | |
| 40 | 9.538 | | | 6904 | 1125 | | | |
| 41 | 9.935 | | | 1240 | 237 | | | |
| 42 | 10.223 | | | 1870 | 198 | | | |
| 43 | 10.390 | | | 2040 | 247 | | | |
| 44 | 10.864 | | | 369 | 77 | | | |
| 45 | 10.935 | | | 620 | 141 | | | |
| 46 | 11.023 | | | 1899 | 387 | | | |
| 47 | 11.232 | | | 2139 | 354 | | | |
| 48 | 11.385 | | | 8513 | 1288 | | | |
| 49 | 12.318 | | | 1393 | 236 | | | |
| 50 | 12.877 | | | 4420 | 680 | | | |
| 51 | 13.010 | 13.056 | -0.047 | 7168 | 769 | 2.14447 | a | BZ#66 |
| 52 | 13.391 | | | 6722 | 526 | | | |
| 53 | 13.672 | | | 17093 | 1479 | | | |
| 54 | 14.200 | | | 26690 | 753 | | | |
| 55 | 14.805 | | | 4441 | 490 | | | |

# STL Burlington - Target GC Injection Report

| | Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|---|
| | 56 | 15.184 | | | 6335 | 646 | | | |
| | 57 | 15.412 | | | 8491 | 727 | | | |
| | 58 | 16.430 | | | 2333 | 305 | | | |
| | 59 | 16.678 | | | 1170 | 181 | | | |
| | 60 | 17.075 | 17.075 | 0.000 | 972 | 183 | 1.11147 | a | BZ#118 |
| | 61 | 17.736 | | | 2651 | 340 | | | |
| | 62 | 17.968 | | | 3690 | 346 | | | |
| | 63 | 18.598 | | | 5757 | 328 | | | |
| | 64 | 19.203 | | | 25123 | 2735 | | | |
| | 65 | 19.691 | 19.713 | -0.022 | 5141 | 387 | 0.432173 | a | BZ#138 |
| | 66 | 19.997 | | | 3511 | 625 | | | |
| | 67 | 20.165 | | | 3561 | 529 | | | |
| | 68 | 20.575 | | | 3025 | 442 | | | |
| | 69 | 21.901 | | | 668 | 151 | | | |
| | 70 | 22.094 | | | 469 | 101 | | | |
| | 71 | 22.459 | | | 1343 | 242 | | | |
| | 72 | 22.778 | | | 423 | 91 | | | |
| | 73 | 23.084 | 23.115 | -0.031 | 1006 | 202 | 0.532761 | a | BZ#180 |
| | 74 | 24.137 | | | 6118 | 1290 | | | |
| | 75 | 24.306 | | | 3179 | 444 | | | |
| $ | 76 | 24.658 | 24.678 | -0.020 | 556637 | 102858 | 43.1981 | | BZ#198 |
| | 77 | 26.378 | | | 11385 | 2084 | | | |
| | 78 | 26.966 | | | 919 | 88 | | | |
| | 79 | 28.309 | | | 697 | 89 | | | |
| | 80 | 28.817 | | | 711 | 67 | | | |
| | 81 | 29.052 | | | 1050 | 163 | | | |
| | 82 | 29.278 | | | 520 | 58 | | | |
| | 83 | 29.446 | | | 908 | 153 | | | |
| | 84 | 30.076 | | | 3190 | 282 | | | |
| | 85 | 30.355 | | | 404 | 100 | | | |
| | 86 | 30.625 | | | 3063 | 226 | | | |
| | 87 | 30.745 | | | 2112 | 348 | | | |
| | 88 | 31.481 | | | 10365 | 293 | | | |
| | 89 | 31.880 | | | 5743 | 285 | | | |
| | 90 | 32.281 | | | 5998 | 292 | | | |
| | 91 | 32.410 | | | 893 | 267 | | | |
| | 92 | 32.880 | | | 17290 | 1334 | | | |
| | 93 | 33.064 | | | 11286 | 841 | | | |
| | 94 | 33.381 | | | 10793 | 771 | | | |
| | 95 | 33.605 | | | 3983 | 603 | | | |
| | 96 | 34.048 | | | 4778 | 537 | | | |
| | 97 | 34.509 | | | 2955 | 399 | | | |
| | 98 | 34.613 | | | 9866 | 1431 | | | |
| | 99 | 34.813 | | | 4266 | 412 | | | |
| | 100 | 35.123 | | | 1887 | 279 | | | |
| | 101 | 35.287 | | | 3273 | 384 | | | |
| | 102 | 35.398 | | | 2921 | 506 | | | |
| | 103 | 35.529 | | | 4005 | 604 | | | |
| | 104 | 36.156 | | | 2108 | 201 | | | |
| | 105 | 36.395 | | | 1492 | 210 | | | |
| | 106 | 36.721 | | | 657 | 167 | | | |
| | 107 | 36.812 | | | 1860 | 258 | | | |
| | 108 | 37.692 | | | 1966 | 323 | | | |
| | 109 | 38.102 | | | 971 | 163 | | | |
| | 110 | 39.417 | | | 3444 | 293 | | | |

Flags:
A - Peak quantitates above calibration range
a - Peak quantitates below reporting limit
H - User selected alternate compound hit
M - Peak manually integrated or manually identified
R - Peak fails recovery
U - User disabled peak ID: either peak quantitates below reporting limit or peak identification not confirmed on second column

```
  Peak      Expected
   RT          RT                  Target Compound
========    ========    ======================================
```

## Target Compounds

```
  Peak      Expected
   RT          RT                  Target Compound
========    ========    ======================================
  5.384        5.391    Tetrachloro-meta-xylene
               6.592    BZ#8
               7.698    BZ#18
               9.137    BZ#28
              10.341    BZ#52
              11.312    BZ#44
 13.010       13.056    BZ#66
              13.914    BZ#101
              16.080    BZ#77
 17.075       17.075    BZ#118
              17.995    BZ#153
              18.720    BZ#105
 19.691       19.713    BZ#138
              20.225    BZ#126
              21.462    BZ#128
 23.084       23.115    BZ#180
 24.658       24.678    BZ#198
              25.004    BZ#170
              27.203    BZ#195
              29.805    BZ#206
              30.754    BZ#209
```

FORM 1
OTHER ORGANICS ANALYSIS DATA SHEET

ENVNET SAMPLE NO.

F01009LS22

Lab Name: STL BURLINGTON Contract: 22000

Lab Code: STLVT Case No.: 22000 SAS No.: SDG No.: 89891

Matrix: (soil/water) SOIL Lab Sample ID: 502108

Sample wt/vol: 30.0 (g/mL) G Lab File ID: 03OCT021608-R081

% Moisture: 24 decanted: (Y/N) N Date Received: 09/25/02

Extraction: (SepF/Cont/Sonc) SOXH Date Extracted: 09/26/02

Concentrated Extract Volume: 10(mL) Date Analyzed: 10/04/02

Injection Volume: 1.0(uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: ___ Sulfur Cleanup: (Y/N) Y

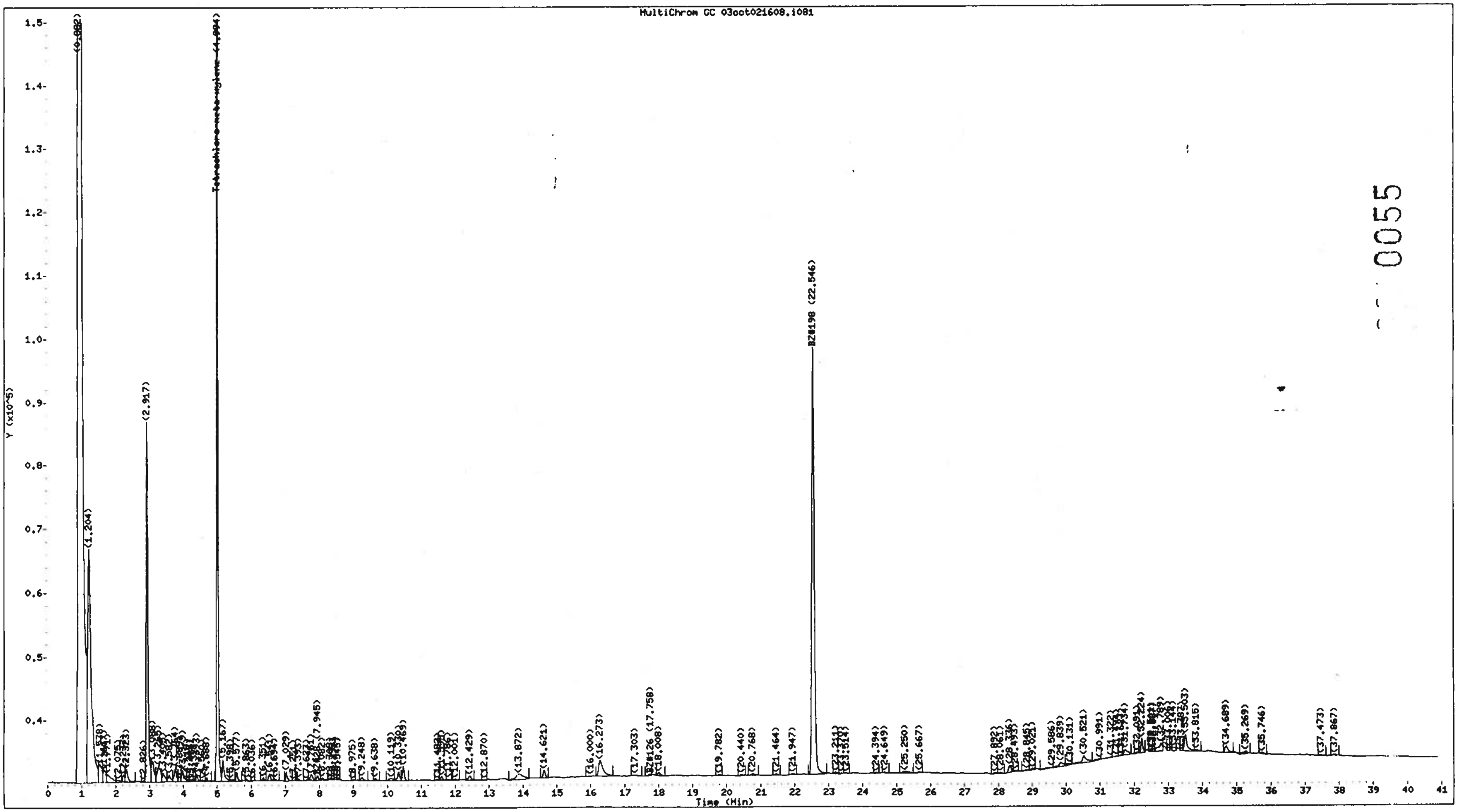
| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG | Q |
|---|---|---|---|
| 34883-43-7 | BZ#8 | 2.2 | U |
| 37680-65-2 | BZ#18 | 2.2 | U |
| 7012-37-5 | BZ#28 | 2.2 | U |
| 41464-39-5 | BZ#44 | 2.2 | U |
| 35693-99-3 | BZ#52 | 2.2 | U |
| 32598-10-0 | BZ#66 | 2.2 | U |
| 32598-13-3 | BZ#77 | 2.2 | U |
| 37680-73-2 | BZ#101 | 2.2 | U |
| 32598-14-4 | BZ#105 | 2.2 | U |
| 31508-00-6 | BZ#118 | 2.2 | U |
| 57465-28-8 | BZ#126 | 2.2 | U |
| 38380-07-3 | BZ#128 | 2.2 | U |
| 35065-28-2 | BZ#138 | 2.2 | U |
| 35065-27-1 | BZ#153 | 2.2 | U |
| 35065-30-6 | BZ#170 | 2.2 | U |
| 35065-29-3 | BZ#180 | 2.2 | U |
| 52663-68-0 | BZ#187 | 2.2 | U |
| 52663-78-2 | BZ#195 | 2.2 | U |
| 40186-72-9 | BZ#206 | 2.2 | U |
| 2051-24-3 | BZ#209 | 2.2 | U |

STL Burlington - Target GC Chromatogram

| Lab Sample ID: 502108 | Client Sample ID: F01009LS22 |
|---|---|

Matrix : SOIL
Analyst :
Instrument : 3327_1.i
Column : RTX-5
Integrator : Falcon
Method : /var/chem/3327_1.i/100302_1/03OCT021608.b/32CONG_3327RTX5_RAW.m
Reported : 17-Oct-2002 09:44 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 05:10
Dilution Factor : 1.00
Data File : 03oct021608-r081.d
Compound Sublist: ENVNET



# STL Burlington - Target GC Injection Report

**Lab Sample ID: 502108** **Client Sample ID: F01009LS22**

Matrix : SOIL
Analyst :
Instrument : 3327_1.i
Column : RTX-5
Integrator : Falcon
Method : /var/chem/3327_1.i/100302_1/03OCT021608.b/32CONG_3327RTX5_RAW.m
Reported : 17-Oct-2002 09:44 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 05:10
Dilution Factor : 1.00
Data File : 03oct021608-r081.d
Compound Sublist: ENVNET

## Peaks

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.882 | | | 2351684 | 400639 | | | |
| 2 | 1.204 | | | 283543 | 36654 | | | |
| 3 | 1.538 | | | 19542 | 2906 | | | |
| 4 | 1.667 | | | 10139 | 1926 | | | |
| 5 | 1.771 | | | 11938 | 1258 | | | |
| 6 | 2.075 | | | 2612 | 325 | | | |
| 7 | 2.237 | | | 4432 | 1179 | | | |
| 8 | 2.323 | | | 10788 | 1991 | | | |
| 9 | 2.826 | | | 823 | 261 | | | |
| 10 | 2.917 | | | 194736 | 56717 | | | |
| 11 | 3.088 | | | 19817 | 3356 | | | |
| 12 | 3.265 | | | 17417 | 2547 | | | |
| 13 | 3.405 | | | 7631 | 1427 | | | |
| 14 | 3.582 | | | 6094 | 1131 | | | |
| 15 | 3.764 | | | 9970 | 2334 | | | |
| 16 | 3.899 | | | 3977 | 849 | | | |
| 17 | 3.979 | | | 7476 | 1731 | | | |
| 18 | 4.119 | | | 1013 | 325 | | | |
| 19 | 4.205 | | | 1798 | 252 | | | |
| 20 | 4.327 | | | 1319 | 412 | | | |
| 21 | 4.393 | | | 4279 | 1243 | | | |
| 22 | 4.560 | | | 1310 | 250 | | | |
| 23 | 4.688 | | | 2253 | 657 | | | |
| $ 24 | 4.994 | 5.001 | -0.007 | 348115 | 137953 | 43.7700 | | Tetrachloro-meta-xylene |
| 25 | 5.167 | | | 15207 | 3411 | | | |
| 26 | 5.398 | | | 2133 | 253 | | | |
| 27 | 5.577 | | | 4930 | 1464 | | | |
| 28 | 5.863 | | | 1208 | 373 | | | |
| 29 | 6.036 | | | 476 | 153 | | | |
| 30 | 6.351 | | | 1494 | 521 | | | |
| 31 | 6.541 | | | 4835 | 1063 | | | |
| 32 | 6.694 | | | 902 | 289 | | | |
| 33 | 7.029 | | | 5039 | 1467 | | | |
| 34 | 7.251 | | | 227 | 85 | | | |
| 35 | 7.393 | | | 1186 | 322 | | | |
| 36 | 7.623 | | | 594 | 145 | | | |
| 37 | 7.761 | | | 4849 | 971 | | | |
| 38 | 7.945 | 7.925 | 0.020 | 2951 | 803 | 0.743877 | a | BZ#28 |
| 39 | 8.082 | | | 1947 | 364 | | | |
| 40 | 8.308 | | | 1150 | 357 | | | |
| 41 | 8.395 | | | 777 | 274 | | | |
| 42 | 8.470 | | | 1406 | 477 | | | |
| 43 | 8.545 | | | 1425 | 326 | | | |
| 44 | 8.975 | | | 416 | 144 | | | |
| 45 | 9.248 | | | 2633 | 503 | | | |
| 46 | 9.638 | | | 1822 | 413 | | | |
| 47 | 10.119 | | | 3350 | 398 | | | |
| 48 | 10.330 | | | 6775 | 1425 | | | |
| 49 | 10.469 | | | 8174 | 2281 | | | |
| 50 | 11.482 | | | 851 | 192 | | | |
| 51 | 11.595 | | | 2687 | 610 | | | |
| 52 | 11.786 | | | 879 | 207 | | | |
| 53 | 12.001 | | | 1104 | 220 | | | |
| 54 | 12.429 | | | 3882 | 687 | | | |
| 55 | 12.870 | | | 478 | 101 | | | |

# STL Burlington - Target GC Injection Report

| | Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|---|
| | 56 | 13.872 | | | 15870 | 915 | | | |
| | 57 | 14.621 | | | 6041 | 1229 | | | |
| | 58 | 16.000 | | | 1718 | 170 | | | |
| | 59 | 16.273 | | | 23327 | 2461 | | | |
| | 60 | 17.303 | | | 1570 | 177 | | | |
| | 61 | 17.758 | 17.762 | -0.004 | 1242 | 211 | 1.97003 | a | BZ#126 |
| | 62 | 18.008 | | | 3189 | 519 | | | |
| | 63 | 19.782 | | | 913 | 180 | | | |
| | 64 | 20.440 | | | 836 | 174 | | | |
| | 65 | 20.768 | | | 2059 | 250 | | | |
| | 66 | 21.464 | | | 1275 | 265 | | | |
| | 67 | 21.947 | | | 888 | 164 | | | |
| $ | 68 | 22.546 | 22.559 | -0.013 | 344694 | 67186 | 45.0883 | | BZ#198 |
| | 69 | 23.211 | | | 1209 | 254 | | | |
| | 70 | 23.370 | | | 446 | 95 | | | |
| | 71 | 23.514 | | | 533 | 99 | | | |
| | 72 | 24.394 | | | 684 | 119 | | | |
| | 73 | 24.649 | | | 958 | 163 | | | |
| | 74 | 25.250 | | | 3194 | 267 | | | |
| | 75 | 25.667 | | | 1305 | 191 | | | |
| | 76 | 27.892 | | | 1263 | 215 | | | |
| | 77 | 28.061 | | | 1049 | 187 | | | |
| | 78 | 28.336 | | | 5926 | 1120 | | | |
| | 79 | 28.493 | | | 957 | 163 | | | |
| | 80 | 28.845 | | | 910 | 125 | | | |
| | 81 | 29.021 | | | 1662 | 280 | | | |
| | 82 | 29.586 | | | 3228 | 150 | | | |
| | 83 | 29.839 | | | 7009 | 698 | | | |
| | 84 | 30.131 | | | 2787 | 199 | | | |
| | 85 | 30.521 | | | 11852 | 1098 | | | |
| | 86 | 30.991 | | | 1771 | 102 | | | |
| | 87 | 31.322 | | | 647 | 63 | | | |
| | 88 | 31.494 | | | 600 | 98 | | | |
| | 89 | 31.627 | | | 571 | 134 | | | |
| | 90 | 31.734 | | | 6864 | 841 | | | |
| | 91 | 32.091 | | | 908 | 189 | | | |
| | 92 | 32.224 | | | 8518 | 2224 | | | |
| | 93 | 32.501 | | | 1985 | 352 | | | |
| | 94 | 32.567 | | | 1625 | 403 | | | |
| | 95 | 32.789 | | | 10297 | 1294 | | | |
| | 96 | 33.006 | | | 2843 | 551 | | | |
| | 97 | 33.144 | | | 3941 | 586 | | | |
| | 98 | 33.387 | | | 2264 | 474 | | | |
| | 99 | 33.503 | | | 14869 | 2563 | | | |
| | 100 | 33.815 | | | 1991 | 263 | | | |
| | 101 | 34.689 | | | 6354 | 1022 | | | |
| | 102 | 35.269 | | | 3534 | 401 | | | |
| | 103 | 35.746 | | | 1362 | 218 | | | |
| | 104 | 37.473 | | | 760 | 122 | | | |
| | 105 | 37.867 | | | 1387 | 189 | | | |

Flags:
- A - Peak quantitates above calibration range
- a - Peak quantitates below reporting limit
- H - User selected alternate compound hit
- M - Peak manually integrated or manually identified
- R - Peak fails recovery
- U - User disabled peak ID: either peak quantitates below reporting limit or peak identification not confirmed on second column

## Target Compounds

| Peak RT | Expected RT | Target Compound |
|---|---|---|
| 4.994 | 5.001 | Tetrachloro-meta-xylene |
| | 5.761 | BZ#8 |
| | 6.701 | BZ#18 |
| 7.945 | 7.925 | BZ#28 |
| | 8.984 | BZ#52 |

## STL Burlington - Target GC Injection Report

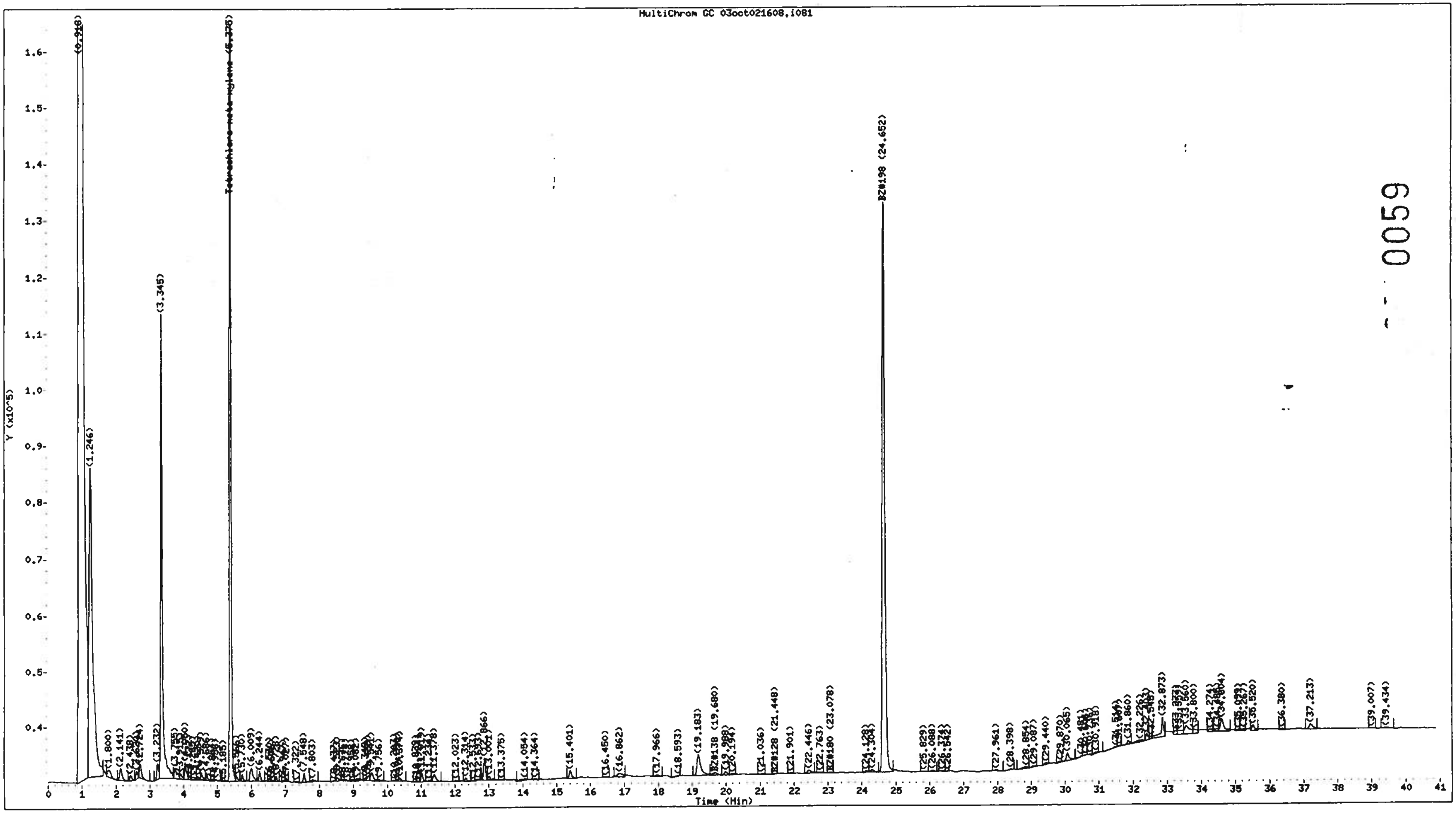
| Peak RT | Expected RT | Target Compound |
|---|---|---|
| | 9.667 | BZ#44 |
| | 11.243 | BZ#66 |
| | 12.207 | BZ#101 |
| | 13.752 | BZ#77 |
| | 14.938 | BZ#118 |
| | 15.993 | BZ#153 |
| | 16.155 | BZ#105 |
| | 17.328 | BZ#138 |
| 17.758 | 17.762 | BZ#126 |
| | 18.647 | BZ#128 |
| | 20.781 | BZ#180 |
| | 22.271 | BZ#170 |
| 22.546 | 22.559 | BZ#198 |
| | 24.552 | BZ#195 |
| | 27.655 | BZ#206 |
| | 29.180 | BZ#209 |

# STL Burlington - Target GC Chromatogram

**Lab Sample ID: 502108** **Client Sample ID: F01009LS22**

Matrix : SOIL
Analyst :
Instrument : 3327_2.i
Column : RTX-CLPII
Integrator : Falcon
Method : /var/chem/3327_2.i/100302_1/03OCT021608.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 09:55 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 05:10
Dilution Factor : 1.00
Data File : 03oct021608-r081.d
Compound Sublist: ENVNET



# STL Burlington - Target GC Injection Report

**Lab Sample ID: 502108** **Client Sample ID: F01009LS22**

| | | | |
|---|---|---|---|
| Matrix | : SOIL | Sample Type | : SAMPLE |
| Analyst | : | Injection Date | : 04-OCT-2002 05:10 |
| Instrument | : 3327_2.i | Dilution Factor | : 1.00 |
| Column | : RTX-CLPII | Data File | : 03oct021608-r081.d |
| Integrator | : Falcon | Compound Sublist | : ENVNET |

Method : /var/chem/3327_2.i/100302_1/03OCT021608.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 09:55 rrm

## Peaks

| | Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0.918 | | | 3063497 | 405875 | | | |
| | 2 | 1.246 | | | 437423 | 54981 | | | |
| | 3 | 1.800 | | | 9026 | 1264 | | | |
| | 4 | 2.141 | | | 11035 | 2060 | | | |
| | 5 | 2.438 | | | 4067 | 943 | | | |
| | 6 | 2.620 | | | 4206 | 1295 | | | |
| | 7 | 2.724 | | | 9983 | 2474 | | | |
| | 8 | 3.232 | | | 10666 | 2742 | | | |
| | 9 | 3.345 | | | 295643 | 82564 | | | |
| | 10 | 3.755 | | | 10187 | 1818 | | | |
| | 11 | 3.915 | | | 4120 | 946 | | | |
| | 12 | 4.050 | | | 10692 | 2877 | | | |
| | 13 | 4.172 | | | 2312 | 748 | | | |
| | 14 | 4.285 | | | 3116 | 485 | | | |
| | 15 | 4.420 | | | 2308 | 567 | | | |
| | 16 | 4.529 | | | 4884 | 1290 | | | |
| | 17 | 4.686 | | | 3705 | 1275 | | | |
| | 18 | 4.854 | | | 1129 | 284 | | | |
| | 19 | 4.956 | | | 1289 | 212 | | | |
| | 20 | 5.185 | | | 439 | 138 | | | |
| $ | 21 | 5.375 | 5.391 | -0.016 | 476750 | 162961 | 43.2306 | | Tetrachloro-meta-xylene |
| | 22 | 5.566 | | | 3835 | 968 | | | |
| | 23 | 5.730 | | | 4935 | 1210 | | | |
| | 24 | 6.009 | | | 14616 | 2242 | | | |
| | 25 | 6.244 | | | 6431 | 1675 | | | |
| | 26 | 6.530 | | | 1640 | 577 | | | |
| | 27 | 6.606 | | | 995 | 260 | | | |
| | 28 | 6.728 | | | 2488 | 883 | | | |
| | 29 | 6.947 | | | 907 | 315 | | | |
| | 30 | 7.027 | | | 1708 | 636 | | | |
| | 31 | 7.322 | | | 731 | 156 | | | |
| | 32 | 7.548 | | | 5404 | 1550 | | | |
| | 33 | 7.803 | | | 2058 | 310 | | | |
| | 34 | 8.437 | | | 872 | 162 | | | |
| | 35 | 8.523 | | | 3239 | 640 | | | |
| | 36 | 8.676 | | | 580 | 219 | | | |
| | 37 | 8.774 | | | 1338 | 290 | | | |
| | 38 | 8.958 | | | 946 | 254 | | | |
| | 39 | 9.082 | | | 2834 | 414 | | | |
| | 40 | 9.348 | | | 2131 | 501 | | | |
| | 41 | 9.439 | | | 3691 | 898 | | | |
| | 42 | 9.541 | | | 8304 | 1386 | | | |
| | 43 | 9.756 | | | 1746 | 273 | | | |
| | 44 | 10.203 | | | 864 | 208 | | | |
| | 45 | 10.290 | | | 1201 | 363 | | | |
| | 46 | 10.374 | | | 2894 | 583 | | | |
| | 47 | 10.839 | | | 389 | 91 | | | |
| | 48 | 10.924 | | | 712 | 162 | | | |
| | 49 | 11.019 | | | 5885 | 1415 | | | |
| | 50 | 11.234 | | | 1858 | 314 | | | |
| | 51 | 11.378 | | | 7863 | 1239 | | | |
| | 52 | 12.023 | | | 789 | 206 | | | |
| | 53 | 12.314 | | | 2312 | 604 | | | |
| | 54 | 12.533 | | | 331 | 110 | | | |
| | 55 | 12.693 | | | 1288 | 193 | | | |

# STL Burlington - Target GC Injection Report

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| 56 | 12.866 | | | 15549 | 4012 | | | |
| 57 | 13.001 | | | 4228 | 679 | | | |
| 58 | 13.375 | | | 911 | 149 | | | |
| 59 | 14.054 | | | 3580 | 257 | | | |
| 60 | 14.364 | | | 1600 | 194 | | | |
| 61 | 15.401 | | | 6897 | 1306 | | | |
| 62 | 16.450 | | | 656 | 116 | | | |
| 63 | 16.862 | | | 6989 | 575 | | | |
| 64 | 17.966 | | | 2045 | 250 | | | |
| 65 | 18.593 | | | 1603 | 140 | | | |
| 66 | 19.183 | | | 29318 | 3663 | | | |
| 67 | 19.680 | 19.713 | -0.033 | 4562 | 406 | 0.441590 | a | BZ#138 |
| 68 | 19.988 | | | 3262 | 584 | | | |
| 69 | 20.194 | | | 1710 | 229 | | | |
| 70 | 21.036 | | | 727 | 107 | | | |
| 71 | 21.448 | 21.462 | -0.013 | 404 | 78 | 1.01286 | a | BZ#128 |
| 72 | 21.901 | | | 827 | 170 | | | |
| 73 | 22.446 | | | 4125 | 548 | | | |
| 74 | 22.763 | | | 1281 | 169 | | | |
| 75 | 23.078 | 23.115 | -0.038 | 1034 | 221 | 0.541123 | a | BZ#180 |
| 76 | 24.128 | | | 1269 | 288 | | | |
| 77 | 24.304 | | | 2831 | 442 | | | |
| $ 78 | 24.652 | 24.678 | -0.027 | 544902 | 101366 | 42.5692 | | BZ#198 |
| 79 | 25.829 | | | 689 | 107 | | | |
| 80 | 26.088 | | | 1462 | 272 | | | |
| 81 | 26.374 | | | 573 | 125 | | | |
| 82 | 26.542 | | | 367 | 84 | | | |
| 83 | 27.961 | | | 2152 | 203 | | | |
| 84 | 28.398 | | | 1796 | 186 | | | |
| 85 | 28.854 | | | 3780 | 334 | | | |
| 86 | 29.087 | | | 1654 | 201 | | | |
| 87 | 29.440 | | | 1731 | 329 | | | |
| 88 | 29.870 | | | 1588 | 204 | | | |
| 89 | 30.065 | | | 8909 | 1399 | | | |
| 90 | 30.481 | | | 746 | 149 | | | |
| 91 | 30.606 | | | 518 | 112 | | | |
| 92 | 30.736 | | | 961 | 243 | | | |
| 93 | 30.918 | | | 1929 | 291 | | | |
| 94 | 31.514 | | | 2239 | 76 | | | |
| 95 | 31.607 | | | 590 | 208 | | | |
| 96 | 31.860 | | | 3507 | 705 | | | |
| 97 | 32.226 | | | 4731 | 269 | | | |
| 98 | 32.403 | | | 4655 | 1158 | | | |
| 99 | 32.545 | | | 2130 | 397 | | | |
| 100 | 32.873 | | | 20264 | 3424 | | | |
| 101 | 33.277 | | | 4424 | 730 | | | |
| 102 | 33.359 | | | 8259 | 763 | | | |
| 103 | 33.560 | | | 15680 | 1528 | | | |
| 104 | 33.800 | | | 6031 | 731 | | | |
| 105 | 34.274 | | | 3687 | 459 | | | |
| 106 | 34.485 | | | 3587 | 515 | | | |
| 107 | 34.604 | | | 17533 | 2280 | | | |
| 108 | 35.099 | | | 1396 | 252 | | | |
| 109 | 35.267 | | | 2797 | 318 | | | |
| 110 | 35.520 | | | 5760 | 948 | | | |
| 111 | 36.380 | | | 1549 | 204 | | | |
| 112 | 37.213 | | | 7172 | 898 | | | |
| 113 | 39.007 | | | 663 | 130 | | | |
| 114 | 39.434 | | | 2314 | 193 | | | |

Flags: A - Peak quantitates above calibration range
a - Peak quantitates below reporting limit
H - User selected alternate compound hit
M - Peak manually integrated or manually identified
R - Peak fails recovery
U - User disabled peak ID: either peak quantitates below reporting limit or peak identification not confirmed on second column

```
  Peak      Expected
   RT          RT                   Target Compound
========    ========    ======================================
```

## Target Compounds

```
  Peak      Expected
   RT          RT                   Target Compound
========    ========    ======================================
   5.375       5.391    Tetrachloro-meta-xylene
               6.592    BZ#8
               7.698    BZ#18
               9.137    BZ#28
              10.341    BZ#52
              11.312    BZ#44
              13.056    BZ#66
              13.914    BZ#101
              16.080    BZ#77
              17.075    BZ#118
              17.995    BZ#153
              18.720    BZ#105
  19.680      19.713    BZ#138
              20.225    BZ#126
  21.448      21.462    BZ#128
  23.078      23.115    BZ#180
  24.652      24.678    BZ#198
              25.004    BZ#170
              27.203    BZ#195
              29.805    BZ#206
              30.754    BZ#209
```

FORM 1
OTHER ORGANICS ANALYSIS DATA SHEET

ENVNET SAMPLE NO.

F01009LS23

Lab Name: STL BURLINGTON        Contract: 22000

Lab Code: STLVT    Case No.: 22000    SAS No.:        SDG No.: 89891

Matrix: (soil/water) SOIL        Lab Sample ID: 502107

Sample wt/vol: 30.0 (g/mL) G        Lab File ID: 03OCT021608-R071

% Moisture: 25    decanted: (Y/N) N        Date Received: 09/25/02

Extraction: (SepF/Cont/Sonc) SOXH        Date Extracted: 09/26/02

Concentrated Extract Volume: 10(mL)        Date Analyzed: 10/04/02

Injection Volume: 1.0(uL)        Dilution Factor: 1.0

GPC Cleanup: (Y/N) N    pH: ___        Sulfur Cleanup: (Y/N) Y

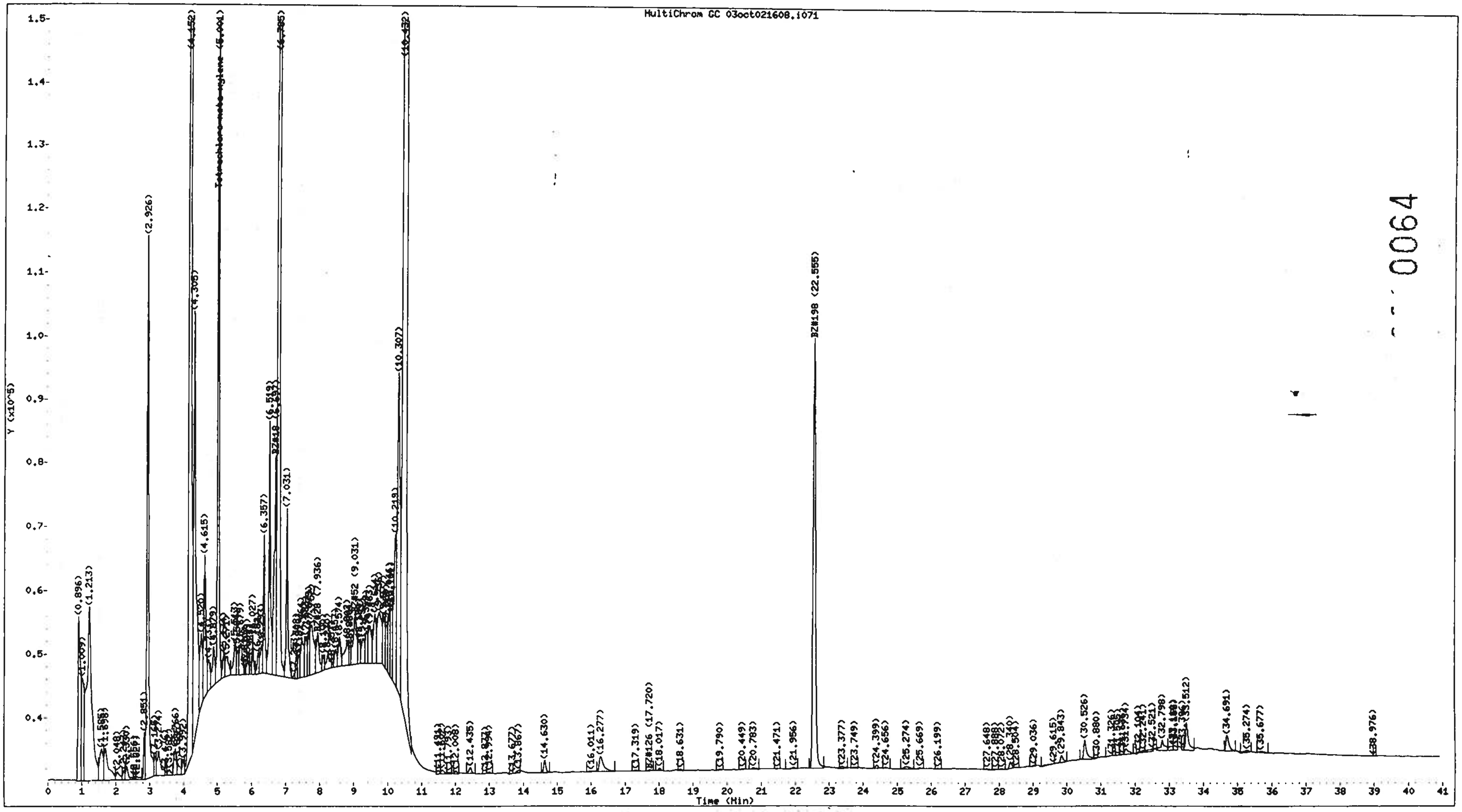
| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG | Q |
|---|---|---|---|
| 34883-43-7 | ------BZ#8 | 2.2 | U |
| 37680-65-2 | ------BZ#18 | 2.2 | U |
| 7012-37-5 | -------BZ#28 | 2.2 | U |
| 41464-39-5 | ------BZ#44 | 2.2 | U |
| 35693-99-3 | ------BZ#52 | 2.2 | U |
| 32598-10-0 | ------BZ#66 | 2.2 | U |
| 32598-13-3 | ------BZ#77 | 2.2 | U |
| 37680-73-2 | ------BZ#101 | 2.2 | U |
| 32598-14-4 | ------BZ#105 | 2.2 | U |
| 31508-00-6 | ------BZ#118 | 2.2 | U |
| 57465-28-8 | ------BZ#126 | 2.2 | U |
| 38380-07-3 | ------BZ#128 | 2.2 | U |
| 35065-28-2 | ------BZ#138 | 2.2 | U |
| 35065-27-1 | ------BZ#153 | 2.2 | U |
| 35065-30-6 | ------BZ#170 | 2.2 | U |
| 35065-29-3 | ------BZ#180 | 2.2 | U |
| 52663-68-0 | ------BZ#187 | 2.2 | U |
| 52663-78-2 | ------BZ#195 | 2.2 | U |
| 40186-72-9 | ------BZ#206 | 2.2 | U |
| 2051-24-3 | -------BZ#209 | 2.2 | U |

STL Burlington - Target GC Chromatogram

|  |  |
|---|---|
| Lab Sample ID: 502107 | Client Sample ID: F01009LS23 |

Matrix : SOIL
Analyst :
Instrument : 3327_1.i
Column : RTX-5
Integrator : Falcon
Method : /var/chem/3327_1.i/100302_1/03OCT021608.b/32CONG_3327RTX5_RAW.m
Reported : 17-Oct-2002 09:43 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 04:25
Dilution Factor : 1.00
Data File : 03oct021608-r071.d
Compound Sublist: ENVNET



# STL Burlington - Target GC Injection Report

Lab Sample ID: 502107 Client Sample ID: F01009LS23

Matrix : SOIL
Analyst :
Instrument : 3327_1.i
Column : RTX-5
Integrator : Falcon
Method : /var/chem/3327_1.i/100302_1/03OCT021608.b/32CONG_3327RTX5_RAW.m
Reported : 17-Oct-2002 09:43 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 04:25
Dilution Factor : 1.00
Data File : 03oct021608-r071.d
Compound Sublist: ENVNET

## Peaks

| | Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0.896 | | | 128940 | 25777 | | | |
| | 2 | 1.009 | | | 81142 | 16121 | | | |
| | 3 | 1.213 | | | 303044 | 27284 | | | |
| | 4 | 1.585 | | | 35422 | 4886 | | | |
| | 5 | 1.698 | | | 47107 | 4974 | | | |
| | 6 | 2.048 | | | 9466 | 1244 | | | |
| | 7 | 2.243 | | | 6220 | 1438 | | | |
| | 8 | 2.330 | | | 12179 | 2085 | | | |
| | 9 | 2.556 | | | 1510 | 459 | | | |
| | 10 | 2.627 | | | 4142 | 486 | | | |
| | 11 | 2.851 | | | 21775 | 7352 | | | |
| | 12 | 2.926 | | | 318004 | 85200 | | | |
| | 13 | 3.165 | | | 12157 | 3080 | | | |
| | 14 | 3.274 | | | 27803 | 3844 | | | |
| | 15 | 3.476 | | | 2301 | 686 | | | |
| | 16 | 3.582 | | | 5152 | 860 | | | |
| | 17 | 3.766 | | | 18535 | 4091 | | | |
| | 18 | 3.835 | | | 10524 | 1758 | | | |
| | 19 | 3.992 | | | 9529 | 2335 | | | |
| | 20 | 4.152 | | | 2219299 | 888063 | | | |
| | 21 | 4.305 | | | 353152 | 68304 | | | |
| | 22 | 4.520 | | | 62150 | 11424 | | | |
| | 23 | 4.615 | | | 101505 | 22398 | | | |
| | 24 | 4.733 | | | 24858 | 4913 | | | |
| | 25 | 4.879 | | | 32931 | 6106 | | | |
| $ | 26 | 5.001 | 5.001 | 0.000 | 376936 | 143078 | 45.3919 | | Tetrachloro-meta-xylene |
| | 27 | 5.174 | | | 14119 | 3830 | | | |
| | 28 | 5.271 | | | 23480 | 3168 | | | |
| | 29 | 5.513 | | | 27769 | 5110 | | | |
| | 30 | 5.584 | | | 14211 | 3864 | | | |
| | 31 | 5.679 | | | 30861 | 4972 | | | |
| | 32 | 5.810 | | | 2689 | 993 | | | |
| | 33 | 5.879 | | | 11063 | 2357 | | | |
| | 34 | 5.963 | | | 4678 | 1493 | | | |
| | 35 | 6.027 | | | 18773 | 6205 | | | |
| | 36 | 6.182 | | | 12760 | 3305 | | | |
| | 37 | 6.293 | | | 21525 | 4537 | | | |
| | 38 | 6.357 | | | 65941 | 21684 | | | |
| | 39 | 6.519 | | | 133202 | 39713 | | | |
| | 40 | 6.697 | 6.701 | -0.004 | 144454 | 34501 | 42.5438 | | BZ#18 |
| | 41 | 6.785 | | | 2998839 | 953297 | | | |
| | 42 | 7.031 | | | 91821 | 26513 | | | |
| | 43 | 7.253 | | | 2220 | 787 | | | |
| | 44 | 7.308 | | | 12066 | 3858 | | | |
| | 45 | 7.390 | | | 14996 | 3815 | | | |
| | 46 | 7.464 | | | 39048 | 6258 | | | |
| | 47 | 7.583 | | | 29589 | 6355 | | | |
| | 48 | 7.679 | | | 31297 | 7748 | | | |
| | 49 | 7.752 | | | 63689 | 7902 | | | |
| | 50 | 7.936 | 7.925 | 0.011 | 36846 | 6308 | 4.91751 | a | BZ#28 |
| | 51 | 8.100 | | | 9829 | 2463 | | | |
| | 52 | 8.230 | | | 15424 | 2331 | | | |
| | 53 | 8.357 | | | 2150 | 896 | | | |
| | 54 | 8.457 | | | 12489 | 2733 | | | |
| | 55 | 8.574 | | | 22766 | 4565 | | | |

# STL Burlington - Target GC Injection Report

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| 56 | 8.802 | | | 31548 | 3963 | | | |
| 57 | 8.880 | | | 11591 | 3048 | | | |
| 58 | 9.031 | 8.984 | 0.047 | 58563 | 8042 | 6.09794 | | BZ#52 |
| 59 | 9.150 | | | 17503 | 3921 | | | |
| 60 | 9.257 | | | 23783 | 3959 | | | |
| 61 | 9.359 | | | 23806 | 5146 | | | |
| 62 | 9.463 | | | 41943 | 5982 | | | |
| 63 | 9.614 | | | 45394 | 7778 | | | |
| 64 | 9.736 | | | 72305 | 8026 | | | |
| 65 | 9.877 | | | 40869 | 7831 | | | |
| 66 | 9.959 | | | 24693 | 7118 | | | |
| 67 | 10.046 | | | 47055 | 10421 | | | |
| 68 | 10.101 | | | 41900 | 11076 | | | |
| 69 | 10.219 | | | 121920 | 23761 | | | |
| 70 | 10.307 | | | 289783 | 50310 | | | |
| 71 | 10.432 | | | 6251072 | 958434 | | M | |
| 72 | 11.491 | | | 3228 | 545 | | | |
| 73 | 11.602 | | | 3719 | 580 | | | |
| 74 | 11.793 | | | 1541 | 243 | | | |
| 75 | 12.008 | | | 2163 | 446 | | | |
| 76 | 12.435 | | | 5217 | 960 | | | |
| 77 | 12.877 | | | 291 | 71 | | | |
| 78 | 12.994 | | | 1186 | 277 | | | |
| 79 | 13.677 | | | 200 | 30 | | | |
| 80 | 13.867 | | | 2836 | 404 | | | |
| 81 | 14.630 | | | 9039 | 1922 | | | |
| 82 | 16.011 | | | 1614 | 149 | | | |
| 83 | 16.277 | | | 21563 | 2372 | | | |
| 84 | 17.319 | | | 1036 | 148 | | | |
| 85 | 17.720 | 17.762 | -0.042 | 1022 | 201 | 1.95545 | a | BZ#126 |
| 86 | 18.017 | | | 1972 | 431 | | | |
| 87 | 18.631 | | | 1251 | 232 | | | |
| 88 | 19.790 | | | 711 | 156 | | | |
| 89 | 20.449 | | | 934 | 183 | | | |
| 90 | 20.783 | | | 2016 | 229 | | | |
| 91 | 21.471 | | | 430 | 94 | | | |
| 92 | 21.956 | | | 2206 | 240 | | | |
| $ 93 | 22.555 | 22.559 | -0.004 | 347259 | 67959 | 45.6261 | | BZ#198 |
| 94 | 23.377 | | | 2562 | 344 | | | |
| 95 | 23.749 | | | 1660 | 162 | | | |
| 96 | 24.399 | | | 3131 | 508 | | | |
| 97 | 24.656 | | | 1286 | 215 | | | |
| 98 | 25.274 | | | 3703 | 341 | | | |
| 99 | 25.669 | | | 1130 | 153 | | | |
| 100 | 26.199 | | | 504 | 99 | | | |
| 101 | 27.648 | | | 1075 | 158 | | | |
| 102 | 27.888 | | | 1142 | 202 | | | |
| 103 | 28.072 | | | 988 | 180 | | | |
| 104 | 28.340 | | | 5500 | 1032 | | | |
| 105 | 28.504 | | | 471 | 92 | | | |
| 106 | 29.036 | | | 846 | 149 | | | |
| 107 | 29.615 | | | 2649 | 47 | | | |
| 108 | 29.843 | | | 7716 | 1189 | | | |
| 109 | 30.526 | | | 18992 | 3046 | | | |
| 110 | 30.880 | | | 464 | 75 | | | |
| 111 | 31.326 | | | 271 | 23 | | | |
| 112 | 31.505 | | | 309 | 72 | | | |
| 113 | 31.636 | | | 391 | 96 | | | |
| 114 | 31.734 | | | 6813 | 879 | | | |
| 115 | 32.104 | | | 1061 | 231 | | | |
| 116 | 32.241 | | | 2277 | 316 | | | |
| 117 | 32.521 | | | 4366 | 378 | | | |
| 118 | 32.798 | | | 13876 | 1648 | | | |
| 119 | 33.110 | | | 4975 | 571 | | | |
| 120 | 33.155 | | | 4908 | 709 | | | |
| 121 | 33.396 | | | 2325 | 541 | | | |
| 122 | 33.512 | | | 25194 | 4328 | | | |
| 123 | 34.691 | | | 16272 | 2508 | | | |
| 124 | 35.274 | | | 2982 | 337 | | | |
| 125 | 35.677 | | | 1907 | 226 | | | |
| 126 | 38.976 | | | 306 | 111 | | | |

# STL Burlington - Target GC Injection Report

Flags:
A - Peak quantitates above calibration range
a - Peak quantitates below reporting limit
H - User selected alternate compound hit
M - Peak manually integrated or manually identified
R - Peak fails recovery
U - User disabled peak ID: either peak quantitates below reporting limit or peak identification not confirmed on second column

## Target Compounds

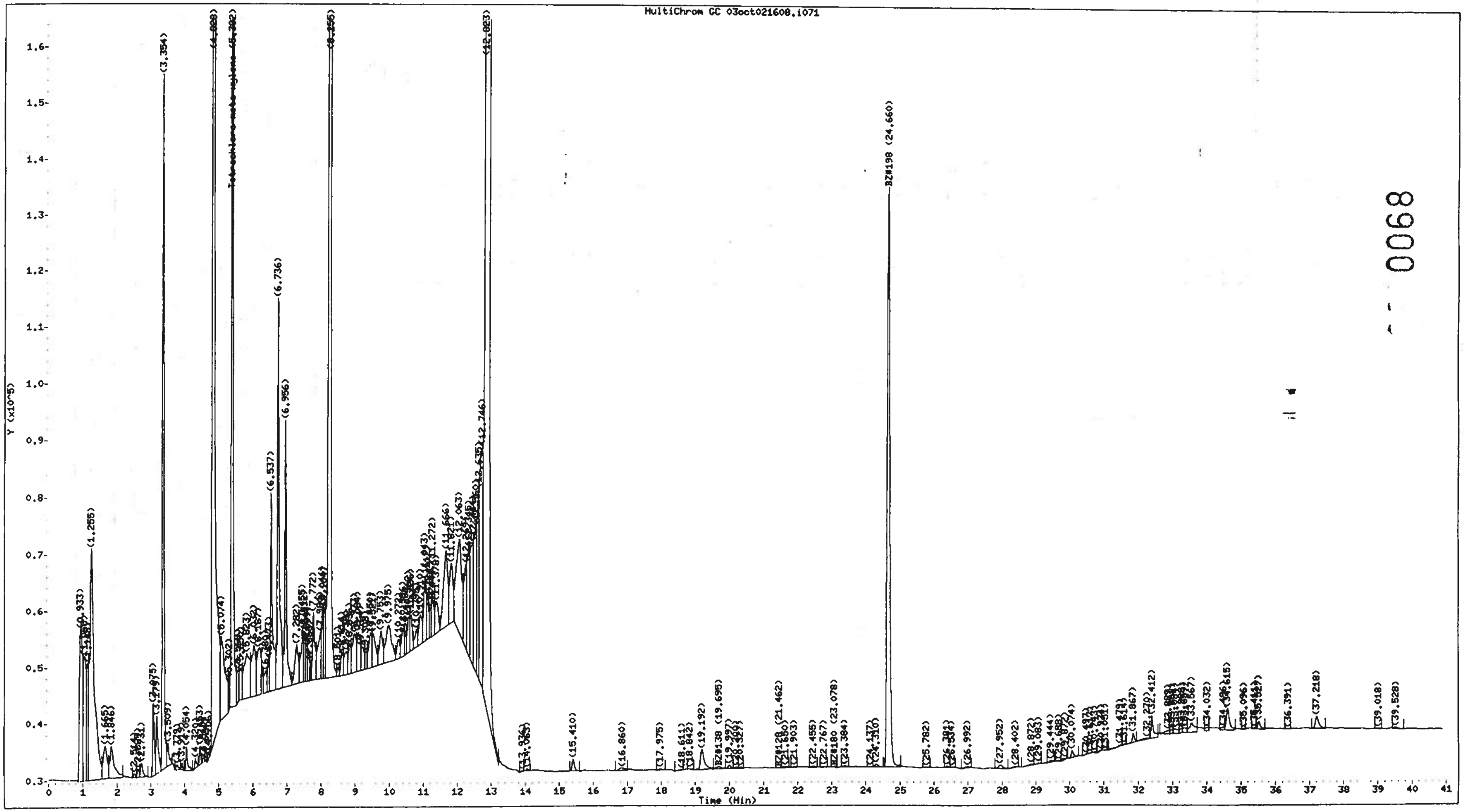
| Peak RT | Expected RT | Target Compound |
|---|---|---|
| 5.001 | 5.001 | Tetrachloro-meta-xylene |
|  | 5.761 | BZ#8 |
| 6.697 | 6.701 | BZ#18 |
| 7.936 | 7.925 | BZ#28 |
| 9.031 | 8.984 | BZ#52 |
|  | 9.667 | BZ#44 |
|  | 11.243 | BZ#66 |
|  | 12.207 | BZ#101 |
|  | 13.752 | BZ#77 |
|  | 14.938 | BZ#118 |
|  | 15.993 | BZ#153 |
|  | 16.155 | BZ#105 |
|  | 17.328 | BZ#138 |
| 17.720 | 17.762 | BZ#126 |
|  | 18.647 | BZ#128 |
|  | 20.781 | BZ#180 |
|  | 22.271 | BZ#170 |
| 22.555 | 22.559 | BZ#198 |
|  | 24.552 | BZ#195 |
|  | 27.655 | BZ#206 |
|  | 29.180 | BZ#209 |

# STL Burlington - Target GC Chromatogram

Lab Sample ID: 502107 Client Sample ID: F01009LS23

Matrix : SOIL
Analyst :
Instrument : 3327_2.i
Column : RTX-CLPII
Integrator : Falcon
Method : /var/chem/3327_2.i/100302_1/03OCT021608.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 09:54 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 04:25
Dilution Factor : 1.00
Data File : 03oct021608-r071.d
Compound Sublist: ENVNET



# STL Burlington - Target GC Injection Report

Lab Sample ID: 502107 Client Sample ID: F01009LS23

Matrix : SOIL
Analyst :
Instrument : 3327_2.i
Column : RTX-CLPII
Integrator : Falcon
Method : /var/chem/3327_2.i/100302_1/03OCT021608.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 09:54 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 04:25
Dilution Factor : 1.00
Data File : 03oct021608-r071.d
Compound Sublist: ENVNET

## Peaks

| | Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0.933 | | | 169882 | 26865 | | | |
| | 2 | 1.055 | | | 117147 | 21974 | | | |
| | 3 | 1.148 | | | 74761 | 20685 | | | |
| | 4 | 1.255 | | | 390860 | 40861 | | | |
| | 5 | 1.665 | | | 45428 | 5679 | | | |
| | 6 | 1.846 | | | 50955 | 5536 | | | |
| | 7 | 2.514 | | | 2317 | 719 | | | |
| | 8 | 2.629 | | | 5393 | 1426 | | | |
| | 9 | 2.731 | | | 11453 | 2408 | | | |
| | 10 | 3.075 | | | 43731 | 12624 | | | |
| | 11 | 3.179 | | | 44417 | 10034 | | | |
| | 12 | 3.354 | | | 402073 | 123053 | | | |
| | 13 | 3.509 | | | 16085 | 4001 | | | |
| | 14 | 3.779 | | | 3953 | 865 | | | |
| | 15 | 3.919 | | | 3119 | 1194 | | | |
| | 16 | 4.054 | | | 14565 | 4170 | | | |
| | 17 | 4.320 | | | 5979 | 1658 | | | |
| | 18 | 4.453 | | | 9082 | 3303 | | | |
| | 19 | 4.560 | | | 2485 | 803 | | | |
| | 20 | 4.624 | | | 728 | 365 | | | |
| | 21 | 4.706 | | | 3013 | 1276 | | | |
| | 22 | 4.828 | | | 2915386 | 963747 | | | |
| | 23 | 5.074 | | | 140981 | 14767 | | | |
| | 24 | 5.302 | | | 16168 | 5570 | | | |
| $ | 25 | 5.382 | 5.391 | -0.009 | 556035 | 173787 | 46.0604. | | Tetrachloro-meta-xylene |
| | 26 | 5.568 | | | 25089 | 5750 | | | |
| | 27 | 5.650 | | | 32342 | 5730 | | | |
| | 28 | 5.823 | | | 97264 | 7945 | | | |
| | 29 | 6.032 | | | 72204 | 9003 | | | |
| | 30 | 6.167 | | | 68757 | 8317 | | | |
| | 31 | 6.380 | | | 22920 | 3899 | | | |
| | 32 | 6.473 | | | 22040 | 6072 | | | |
| | 33 | 6.537 | | | 150456 | 35040 | | | |
| | 34 | 6.736 | | | 265009 | 68904 | | | |
| | 35 | 6.956 | | | 175085 | 46968 | | | |
| | 36 | 7.282 | | | 48678 | 6889 | | | |
| | 37 | 7.455 | | | 48605 | 10107 | | | |
| | 38 | 7.512 | | | 29169 | 8998 | | M | |
| | 39 | 7.543 | | | 22386 | 6927 | | M | |
| | 40 | 7.599 | | | 19976 | 6027 | | M | |
| | 41 | 7.665 | | | 9748 | 3437 | | M | |
| | 42 | 7.772 | | | 59160 | 11941 | | | |
| | 43 | 7.980 | | | 55136 | 8267 | | | |
| | 44 | 8.046 | | | 50405 | 12788 | | | |
| | 45 | 8.104 | | | 45307 | 12584 | | | |
| | 46 | 8.255 | | | 3731890 | 951719 | | | |
| | 47 | 8.501 | | | 6680 | 1710 | | | |
| | 48 | 8.614 | | | 20204 | 4147 | | | |
| | 49 | 8.738 | | | 27823 | 4163 | | | |
| | 50 | 8.836 | | | 28126 | 5403 | | | |
| | 51 | 8.977 | | | 56224 | 6916 | | | |
| | 52 | 9.084 | | | 45231 | 6920 | | M | |
| | 53 | 9.164 | | | 25409 | 4264 | | M | |
| | 54 | 9.308 | | | 14252 | 3083 | | | |
| | 55 | 9.450 | | | 38287 | 6159 | | | |

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| 56 | 9.521 | | | 44349 | 5926 | | | |
| 57 | 9.753 | | | 41140 | 5844 | | | |
| 58 | 9.975 | | | 80585 | 6528 | | | |
| 59 | 10.272 | | | 21063 | 3487 | | | |
| 60 | 10.396 | | | 27165 | 5041 | | | |
| 61 | 10.478 | | | 12643 | 3603 | | | |
| 62 | 10.562 | | | 32354 | 6274 | | | |
| 63 | 10.636 | | | 28054 | 6329 | | | |
| 64 | 10.795 | | | 17659 | 3151 | | | |
| 65 | 10.910 | | | 34965 | 5154 | | | |
| 66 | 11.043 | | | 52638 | 10926 | | | |
| 67 | 11.112 | | | 35622 | 8401 | | | |
| 68 | 11.201 | | | 16421 | 5212 | | | |
| 69 | 11.272 | 11.312 | -0.040 | 34818 | 6444 | 3.28002 | a | BZ#44 |
| 70 | 11.378 | | | 38308 | 5591 | | | |
| 71 | 11.666 | | | 119266 | 13455 | | | |
| 72 | 11.821 | | | 77309 | 10522 | | | |
| 73 | 12.063 | | | 188439 | 16711 | | M | |
| 74 | 12.269 | | | 83909 | 15340 | | M | |
| 75 | 12.345 | | | 106158 | 19322 | | M | |
| 76 | 12.464 | | | 122994 | 21917 | | M | |
| 77 | 12.560 | | | 141531 | 26145 | | M | |
| 78 | 12.635 | | | 141117 | 33822 | | M | |
| 79 | 12.746 | | | 269044 | 43011 | | M | |
| 80 | 12.823 | | | 7401147 | 956303 | | M | |
| 81 | 13.936 | | | 520 | 62 | | | |
| 82 | 14.063 | | | 1217 | 304 | | | |
| 83 | 15.410 | | | 9824 | 2091 | | | |
| 84 | 16.860 | | | 4966 | 395 | | | |
| 85 | 17.975 | | | 1270 | 190 | | | |
| 86 | 18.611 | | | 886 | 36 | | | |
| 87 | 18.842 | | | 617 | 136 | | | |
| 88 | 19.192 | | | 27341 | 3466 | | | |
| 89 | 19.695 | 19.713 | -0.018 | 4143 | 356 | 0.416810 | a | BZ#138 |
| 90 | 19.997 | | | 3394 | 615 | | | |
| 91 | 20.200 | | | 1533 | 219 | | | |
| 92 | 20.327 | | | 1295 | 230 | | | |
| 93 | 21.462 | 21.462 | 0.000 | 507 | 91 | 1.01858 | a | BZ#128 |
| 94 | 21.650 | | | 1777 | 236 | | | |
| 95 | 21.903 | | | 1155 | 204 | | | |
| 96 | 22.455 | | | 1492 | 265 | | | |
| 97 | 22.767 | | | 1179 | 161 | | | |
| 98 | 23.078 | 23.115 | -0.038 | 1064 | 210 | 0.536282 | a | BZ#180 |
| 99 | 23.384 | | | 1221 | 183 | | | |
| 100 | 24.137 | | | 426 | 101 | | | |
| 101 | 24.310 | | | 3372 | 522 | | | |
| $ 102 | 24.660 | 24.678 | -0.018 | 552387 | 103250 | 43.3633 | | BZ#198 |
| 103 | 25.782 | | | 608 | 71 | | | |
| 104 | 26.381 | | | 1160 | 257 | | | |
| 105 | 26.534 | | | 708 | 130 | | | |
| 106 | 26.992 | | | 2066 | 227 | | | |
| 107 | 27.952 | | | 5493 | 665 | | | |
| 108 | 28.402 | | | 1670 | 203 | | | |
| 109 | 28.872 | | | 2586 | 258 | | | |
| 110 | 29.083 | | | 1211 | 193 | | | |
| 111 | 29.444 | | | 1595 | 288 | | | |
| 112 | 29.688 | | | 813 | 173 | | | |
| 113 | 29.872 | | | 1799 | 177 | | | |
| 114 | 30.074 | | | 6335 | 1286 | | | |
| 115 | 30.497 | | | 400 | 32 | | | |
| 116 | 30.617 | | | 412 | 101 | | | |
| 117 | 30.743 | | | 1091 | 264 | | | |
| 118 | 30.934 | | | 841 | 39 | | | |
| 119 | 31.051 | | | 248 | 74 | | | |
| 120 | 31.479 | | | 2173 | 174 | | | |
| 121 | 31.614 | | | 441 | 139 | | | |
| 122 | 31.867 | | | 7072 | 1610 | | | |
| 123 | 32.270 | | | 3971 | 222 | | | |
| 124 | 32.412 | | | 19691 | 3968 | | | |
| 125 | 32.889 | | | 5974 | 648 | | | |
| 126 | 33.008 | | | 3763 | 687 | | | |

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| 127 | 33.084 | | | 6689 | 740 | | | |
| 128 | 33.288 | | | 4640 | 754 | | | |
| 129 | 33.359 | | | 6160 | 802 | | | |
| 130 | 33.567 | | | 18086 | 1684 | | | |
| 131 | 34.032 | | | 4193 | 619 | | | |
| 132 | 34.496 | | | 3759 | 529 | | | |
| 133 | 34.615 | | | 26405 | 3951 | | | |
| 134 | 35.096 | | | 959 | 197 | | | |
| 135 | 35.411 | | | 1754 | 290 | | | |
| 136 | 35.527 | | | 8024 | 1445 | | | |
| 137 | 36.391 | | | 795 | 113 | | | |
| 138 | 37.218 | | | 15914 | 2154 | | | |
| 139 | 39.018 | | | 566 | 105 | | | |
| 140 | 39.528 | | | 2639 | 277 | | | |

Flags:
A - Peak quantitates above calibration range
a - Peak quantitates below reporting limit
H - User selected alternate compound hit
M - Peak manually integrated or manually identified
R - Peak fails recovery
U - User disabled peak ID: either peak quantitates below reporting limit or peak identification not confirmed on second column

## Target Compounds

| Peak RT | Expected RT | Target Compound |
|---|---|---|
| 5.382 | 5.391 | Tetrachloro-meta-xylene |
| | 6.592 | BZ#8 |
| | 7.698 | BZ#18 |
| | 9.137 | BZ#28 |
| | 10.341 | BZ#52 |
| 11.272 | 11.312 | BZ#44 |
| | 13.056 | BZ#66 |
| | 13.914 | BZ#101 |
| | 16.080 | BZ#77 |
| | 17.075 | BZ#118 |
| | 17.995 | BZ#153 |
| | 18.720 | BZ#105 |
| 19.695 | 19.713 | BZ#138 |
| | 20.225 | BZ#126 |
| 21.462 | 21.462 | BZ#128 |
| 23.078 | 23.115 | BZ#180 |
| 24.660 | 24.678 | BZ#198 |
| | 25.004 | BZ#170 |
| | 27.203 | BZ#195 |
| | 29.805 | BZ#206 |
| | 30.754 | BZ#209 |

FORM 1
OTHER ORGANICS ANALYSIS DATA SHEET

ENVNET SAMPLE NO.

F01009LS31

Lab Name: STL BURLINGTON Contract: 22000

Lab Code: STLVT Case No.: 22000 SAS No.: SDG No.: 89891

Matrix: (soil/water) SOIL Lab Sample ID: 502112

Sample wt/vol: 30.0 (g/mL) G Lab File ID: 03OCT021608-R151

% Moisture: 25 decanted: (Y/N) N Date Received: 09/25/02

Extraction: (SepF/Cont/Sonc) SOXH Date Extracted: 09/26/02

Concentrated Extract Volume: 10(mL) Date Analyzed: 10/04/02

Injection Volume: 1.0(uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: ___ Sulfur Cleanup: (Y/N) Y

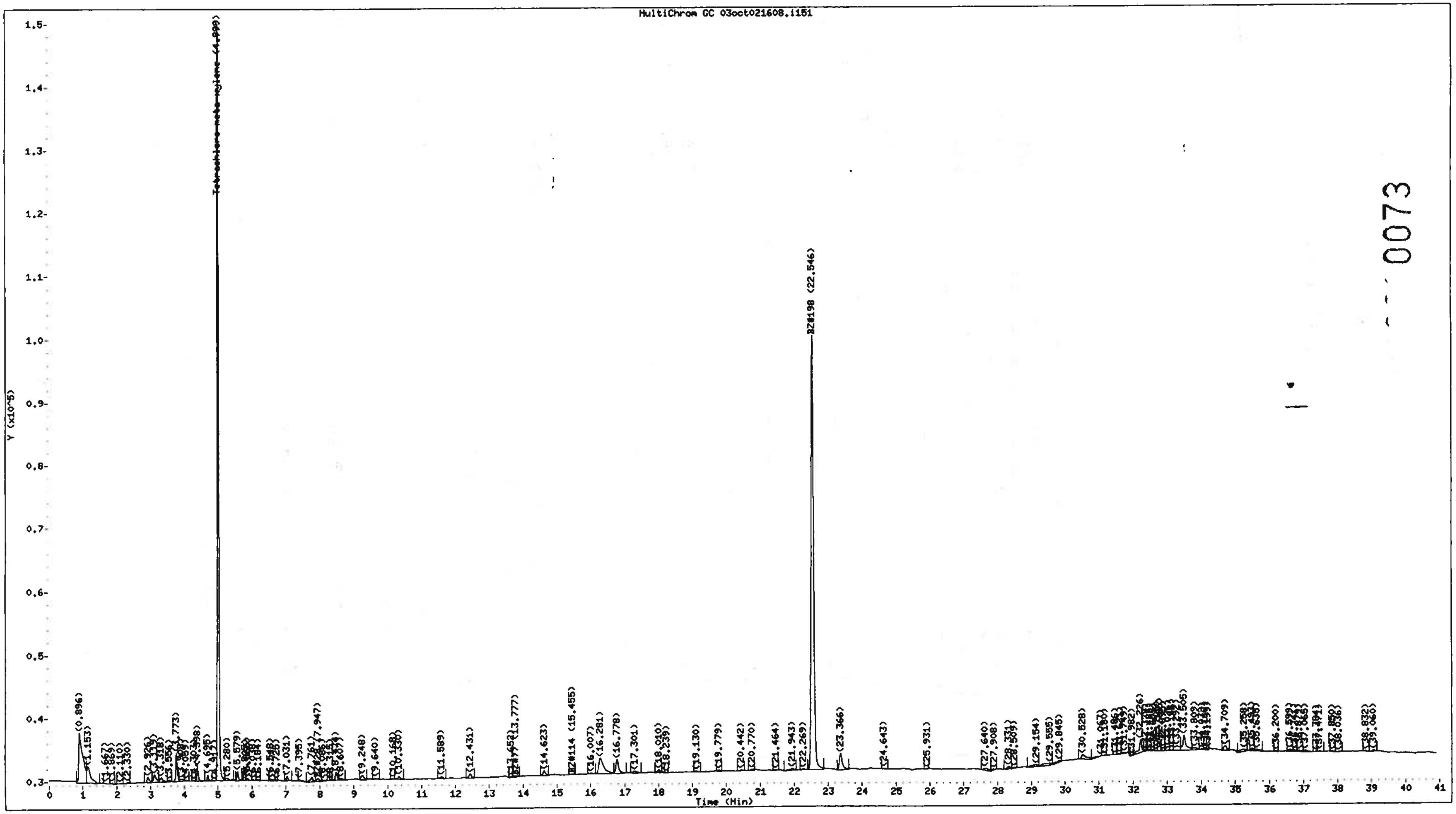
| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG | Q |
|---|---|---|---|
| 34883-43-7 | ------BZ#8 | 2.2 | U |
| 37680-65-2 | ------BZ#18 | 2.2 | U |
| 7012-37-5 | -------BZ#28 | 2.2 | U |
| 41464-39-5 | ------BZ#44 | 2.2 | U |
| 35693-99-3 | ------BZ#52 | 2.2 | U |
| 32598-10-0 | ------BZ#66 | 2.2 | U |
| 32598-13-3 | ------BZ#77 | 2.2 | U |
| 37680-73-2 | ------BZ#101 | 2.2 | U |
| 32598-14-4 | ------BZ#105 | 2.2 | U |
| 31508-00-6 | ------BZ#118 | 2.2 | U |
| 57465-28-8 | ------BZ#126 | 2.2 | U |
| 38380-07-3 | ------BZ#128 | 2.2 | U |
| 35065-28-2 | ------BZ#138 | 2.2 | U |
| 35065-27-1 | ------BZ#153 | 2.2 | U |
| 35065-30-6 | ------BZ#170 | 2.2 | U |
| 35065-29-3 | ------BZ#180 | 2.2 | U |
| 52663-68-0 | ------BZ#187 | 2.2 | U |
| 52663-78-2 | ------BZ#195 | 2.2 | U |
| 40186-72-9 | ------BZ#206 | 2.2 | U |
| 2051-24-3 | -------BZ#209 | 2.2 | U |

## STL Burlington - Target GC Chromatogram

| Lab Sample ID: 502112 | Client Sample ID: F01009LS31 |
|---|---|

Matrix : SOIL
Analyst :
Instrument : 3327_1.i
Column : RTX-5
Integrator : Falcon
Method : /var/chem/3327_1.i/100302_1/03OCT021608.b/32CONG_3327RTX5_RAW.m
Reported : 17-Oct-2002 09:44 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 10:25
Dilution Factor : 1.00
Data File : 03oct021608-r151.d
Compound Sublist: ENVNET



# STL Burlington - Target GC Injection Report

**Lab Sample ID: 502112** **Client Sample ID: F01009LS31**

Matrix : SOIL
Analyst :
Instrument : 3327_1.i
Column : RTX-5
Integrator : Falcon
Method : /var/chem/3327_1.i/100302_1/03OCT021608.b/32CONG_3327RTX5_RAW.m
Reported : 17-Oct-2002 09:44 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 10:25
Dilution Factor : 1.00
Data File : 03oct021608-r151.d
Compound Sublist: ENVNET

## Peaks

| | Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0.896 | | | 65548 | 7928 | | | |
| | 2 | 1.153 | | | 21051 | 2614 | | | |
| | 3 | 1.667 | | | 451 | 97 | | | |
| | 4 | 1.869 | | | 1107 | 246 | | | |
| | 5 | 2.110 | | | 673 | 142 | | | |
| | 6 | 2.330 | | | 1048 | 193 | | | |
| | 7 | 2.926 | | | 3716 | 792 | | | |
| | 8 | 3.119 | | | 6460 | 1159 | | | |
| | 9 | 3.318 | | | 4648 | 723 | | | |
| | 10 | 3.556 | | | 1226 | 296 | | | |
| | 11 | 3.773 | | | 13395 | 4493 | | | |
| | 12 | 3.908 | | | 2787 | 333 | | | |
| | 13 | 4.059 | | | 631 | 153 | | | |
| | 14 | 4.303 | | | 765 | 153 | | | |
| | 15 | 4.398 | | | 6782 | 2384 | | | |
| | 16 | 4.695 | | | 3128 | 974 | | | |
| | 17 | 4.917 | | | 373 | 79 | | | |
| $ | 18 | 4.999 | 5.001 | -0.002 | 362771 | 144422 | 45.8173 | | Tetrachloro-meta-xylene |
| | 19 | 5.280 | | | 3587 | 406 | | | |
| | 20 | 5.579 | | | 4837 | 1531 | | | |
| | 21 | 5.805 | | | 408 | 122 | | | |
| | 22 | 5.865 | | | 1577 | 387 | | | |
| | 23 | 6.038 | | | 662 | 202 | | | |
| | 24 | 6.184 | | | 627 | 164 | | | |
| | 25 | 6.548 | | | 1234 | 313 | | | |
| | 26 | 6.725 | | | 384 | 89 | | | |
| | 27 | 7.031 | | | 2746 | 698 | | | |
| | 28 | 7.395 | | | 1901 | 260 | | | |
| | 29 | 7.761 | | | 4494 | 782 | | | |
| | 30 | 7.947 | 7.925 | 0.022 | 2280 | 549 | 0.551306 | a | BZ#28 |
| | 31 | 8.086 | | | 1138 | 196 | | | |
| | 32 | 8.315 | | | 282 | 117 | | | |
| | 33 | 8.474 | | | 5383 | 1299 | | | |
| | 34 | 8.607 | | | 2210 | 359 | | | |
| | 35 | 9.248 | | | 4342 | 759 | | | |
| | 36 | 9.640 | | | 1798 | 230 | | | |
| | 37 | 10.168 | | | 639 | 136 | | | |
| | 38 | 10.330 | | | 2718 | 510 | | | |
| | 39 | 11.589 | | | 1738 | 324 | | | |
| | 40 | 12.431 | | | 3651 | 691 | | | |
| | 41 | 13.652 | | | 906 | 205 | | | |
| | 42 | 13.777 | 13.752 | 0.024 | 2260 | 234 | 2.57236 | a | BZ#77 |
| | 43 | 14.623 | | | 3935 | 740 | | | |
| | 44 | 15.455 | | | 532 | 112 | | | |
| | 45 | 16.007 | | | 996 | 130 | | | |
| | 46 | 16.281 | | | 25235 | 2441 | | | |
| | 47 | 16.778 | | | 12916 | 2179 | | | |
| | 48 | 17.301 | | | 2743 | 294 | | | |
| | 49 | 18.010 | | | 2348 | 444 | | | |
| | 50 | 18.239 | | | 202 | 54 | | | |
| | 51 | 19.130 | | | 984 | 176 | | | |
| | 52 | 19.779 | | | 1174 | 235 | | | |
| | 53 | 20.442 | | | 932 | 179 | | | |
| | 54 | 20.770 | | | 1611 | 248 | | | |
| | 55 | 21.464 | | | 507 | 104 | | | |

| | Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|---|
| | 56 | 21.943 | | | 2695 | 267 | | | |
| | 57 | 22.269 | | | 818 | 121 | | | |
| $ | 58 | 22.546 | 22.559 | -0.013 | 350221 | 68780 | 46.1973 | | BZ#198 |
| | 59 | 23.366 | | | 15746 | 2532 | | | |
| | 60 | 24.643 | | | 935 | 158 | | | |
| | 61 | 25.931 | | | 609 | 117 | | | |
| | 62 | 27.640 | | | 3293 | 329 | | | |
| | 63 | 27.908 | | | 1147 | 173 | | | |
| | 64 | 28.331 | | | 2276 | 409 | | | |
| | 65 | 28.509 | | | 755 | 140 | | | |
| | 66 | 29.154 | | | 4138 | 331 | | | |
| | 67 | 29.555 | | | 6454 | 341 | | | |
| | 68 | 29.845 | | | 3567 | 317 | | | |
| | 69 | 30.528 | | | 7365 | 733 | | | |
| | 70 | 31.067 | | | 2351 | 40 | | | |
| | 71 | 31.180 | | | 287 | 56 | | | |
| | 72 | 31.486 | | | 511 | 112 | | | |
| | 73 | 31.621 | | | 590 | 145 | | | |
| | 74 | 31.749 | | | 1512 | 193 | | | |
| | 75 | 31.982 | | | 376 | 105 | | | |
| | 76 | 32.226 | | | 10923 | 2051 | | | |
| | 77 | 32.379 | | | 1011 | 245 | | | |
| | 78 | 32.485 | | | 1196 | 269 | | | |
| | 79 | 32.605 | | | 1109 | 233 | | | |
| | 80 | 32.705 | | | 2413 | 529 | | | |
| | 81 | 32.785 | | | 3968 | 966 | | | |
| | 82 | 32.895 | | | 2489 | 526 | | | |
| | 83 | 33.026 | | | 3717 | 610 | | | |
| | 84 | 33.146 | | | 4467 | 778 | | | |
| | 85 | 33.292 | | | 7680 | 697 | | | |
| | 86 | 33.505 | | | 15740 | 2352 | | | |
| | 87 | 33.809 | | | 3206 | 346 | | | |
| | 88 | 34.032 | | | 987 | 205 | | | |
| | 89 | 34.117 | | | 1333 | 322 | | | |
| | 90 | 34.199 | | | 1249 | 320 | | | |
| | 91 | 34.709 | | | 4603 | 721 | | | |
| | 92 | 35.258 | | | 4150 | 359 | | | |
| | 93 | 35.493 | | | 2003 | 473 | | | |
| | 94 | 35.635 | | | 2132 | 290 | | | |
| | 95 | 36.200 | | | 644 | 125 | | | |
| | 96 | 36.599 | | | 2293 | 400 | | | |
| | 97 | 36.741 | | | 1332 | 250 | | | |
| | 98 | 36.879 | | | 1195 | 165 | | | |
| | 99 | 37.065 | | | 1803 | 262 | | | |
| | 100 | 37.384 | | | 282 | 84 | | | |
| | 101 | 37.471 | | | 1022 | 175 | | | |
| | 102 | 37.850 | | | 758 | 155 | | | |
| | 103 | 38.036 | | | 554 | 73 | | | |
| | 104 | 38.832 | | | 892 | 177 | | | |
| | 105 | 39.060 | | | 1724 | 302 | | | |

Flags:
- A - Peak quantitates above calibration range
- a - Peak quantitates below reporting limit
- H - User selected alternate compound hit
- M - Peak manually integrated or manually identified
- R - Peak fails recovery
- U - User disabled peak ID: either peak quantitates below reporting limit or peak identification not confirmed on second column

## Target Compounds

| Peak RT | Expected RT | Target Compound |
|---|---|---|
| 4.999 | 5.001 | Tetrachloro-meta-xylene |
| | 5.761 | BZ#8 |
| | 6.701 | BZ#18 |
| 7.947 | 7.925 | BZ#28 |
| | 8.984 | BZ#52 |

## STL Burlington - Target GC Injection Report

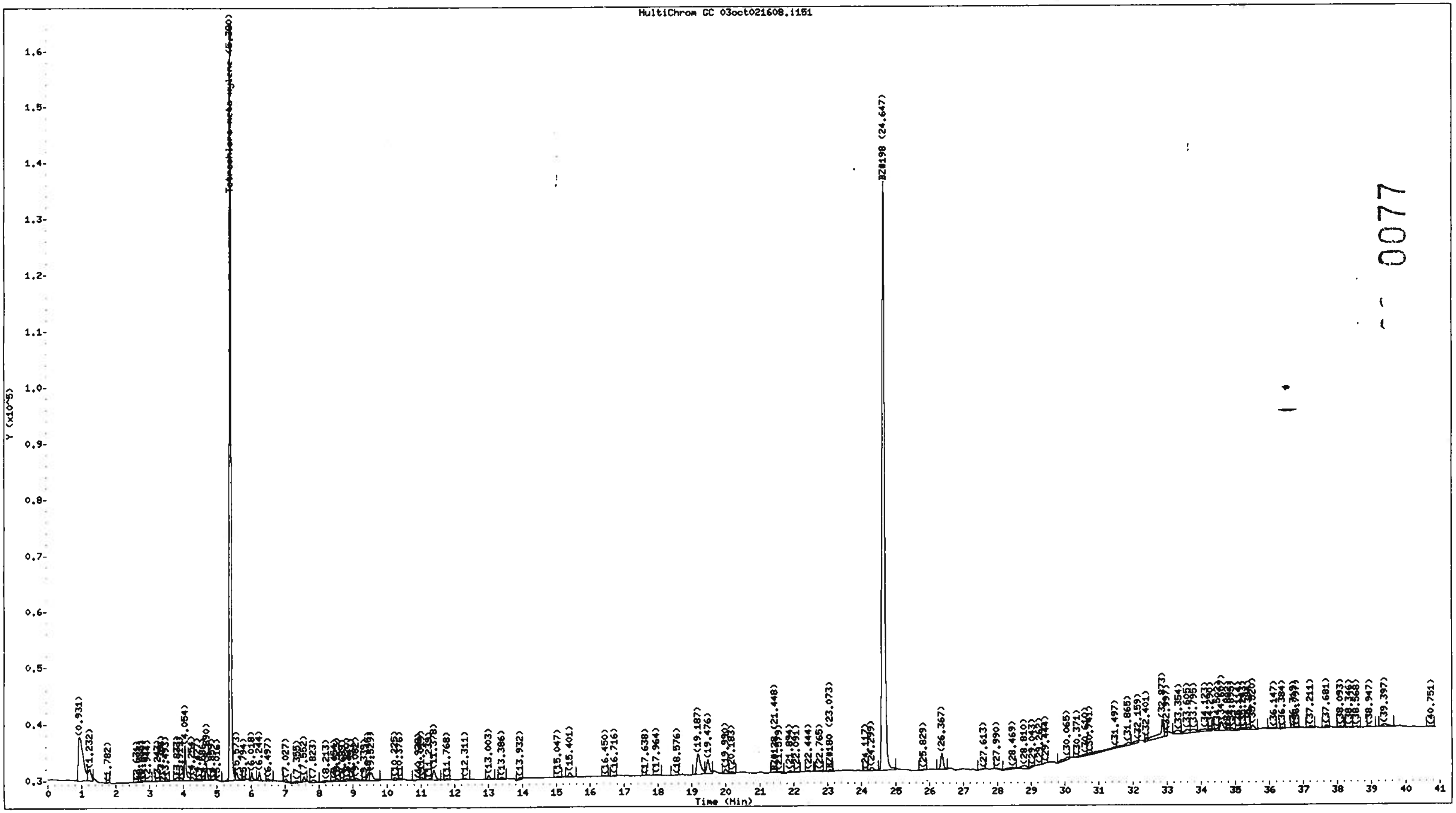
```
  Peak      Expected
   RT          RT                    Target Compound
========    ========    ====================================
               9.667    BZ#44
              11.243    BZ#66
              12.207    BZ#101
  13.777      13.752    BZ#77
              14.938    BZ#118
              15.993    BZ#153
              16.155    BZ#105
              17.328    BZ#138
              17.762    BZ#126
              18.647    BZ#128
              20.781    BZ#180
              22.271    BZ#170
  22.546      22.559    BZ#198
              24.552    BZ#195
              27.655    BZ#206
              29.180    BZ#209
```

# STL Burlington - Target GC Chromatogram

| Lab Sample ID: 502112 | Client Sample ID: F01009LS31 |
|---|---|

Matrix : SOIL
Analyst :
Instrument : 3327_2.i
Column : RTX-CLPII
Integrator : Falcon
Method : /var/chem/3327_2.i/100302_1/03OCT021608.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 09:56 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 10:25
Dilution Factor : 1.00
Data File : 03oct021608-r151.d
Compound Sublist: ENVNET



# STL Burlington - Target GC Injection Report

Lab Sample ID: 502112 Client Sample ID: F01009LS31

Matrix : SOIL
Analyst :
Instrument : 3327_2.i
Column : RTX-CLPII
Integrator : Falcon
Method : /var/chem/3327_2.i/100302_1/03OCT021608.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 09:56 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 10:25
Dilution Factor : 1.00
Data File : 03oct021608-r151.d
Compound Sublist: ENVNET

## Peaks

| | Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0.931 | | | 77102 | 7832 | | | |
| | 2 | 1.232 | | | 13487 | 2050 | | | |
| | 3 | 1.782 | | | 216 | 59 | | | |
| | 4 | 2.631 | | | 354 | 102 | | | |
| | 5 | 2.733 | | | 491 | 178 | | | |
| | 6 | 2.800 | | | 1270 | 244 | | | |
| | 7 | 2.944 | | | 1290 | 164 | | | |
| | 8 | 3.243 | | | 535 | 131 | | | |
| | 9 | 3.356 | | | 4489 | 908 | | | |
| | 10 | 3.493 | | | 2365 | 656 | | | |
| | 11 | 3.833 | | | 4018 | 676 | | | |
| | 12 | 3.919 | | | 3058 | 596 | | | |
| | 13 | 4.054 | | | 22229 | 6198 | | | |
| | 14 | 4.254 | | | 4200 | 681 | | | |
| | 15 | 4.427 | | | 2063 | 278 | | | |
| | 16 | 4.586 | | | 1174 | 238 | | | |
| | 17 | 4.690 | | | 8315 | 2883 | | | |
| | 18 | 4.859 | | | 1066 | 227 | | | |
| | 19 | 5.016 | | | 677 | 153 | | | |
| $ | 20 | 5.380 | 5.391 | -0.011 | 496561 | 169156 | 44.8499 | | Tetrachloro-meta-xylene |
| | 21 | 5.573 | | | 6519 | 1415 | | | |
| | 22 | 5.794 | | | 1049 | 232 | | | |
| | 23 | 6.018 | | | 5084 | 1477 | | | |
| | 24 | 6.244 | | | 5259 | 1565 | | | |
| | 25 | 6.497 | | | 2387 | 384 | | | |
| | 26 | 7.027 | | | 3310 | 551 | | | |
| | 27 | 7.355 | | | 3192 | 335 | | | |
| | 28 | 7.552 | | | 4306 | 1007 | | | |
| | 29 | 7.823 | | | 3420 | 450 | | | |
| | 30 | 8.213 | | | 3264 | 311 | | | |
| | 31 | 8.454 | | | 1777 | 345 | | | |
| | 32 | 8.523 | | | 2754 | 521 | | | |
| | 33 | 8.689 | | | 637 | 180 | | | |
| | 34 | 8.820 | | | 3127 | 448 | | | |
| | 35 | 8.953 | | | 1773 | 285 | | | |
| | 36 | 9.082 | | | 4265 | 512 | | | |
| | 37 | 9.339 | | | 1216 | 211 | | | |
| | 38 | 9.445 | | | 5182 | 1424 | | | |
| | 39 | 9.529 | | | 10809 | 1494 | | | |
| | 40 | 10.225 | | | 3368 | 471 | | | |
| | 41 | 10.376 | | | 1778 | 366 | | | |
| | 42 | 10.928 | | | 1053 | 141 | | | |
| | 43 | 11.019 | | | 2130 | 538 | | | |
| | 44 | 11.239 | | | 1298 | 216 | | | |
| | 45 | 11.378 | | | 10448 | 1701 | | | |
| | 46 | 11.768 | | | 1440 | 257 | | | |
| | 47 | 12.311 | | | 1347 | 258 | | | |
| | 48 | 13.003 | | | 4014 | 723 | | | |
| | 49 | 13.386 | | | 2885 | 404 | | | |
| | 50 | 13.932 | | | 2642 | 388 | | | |
| | 51 | 15.047 | | | 1906 | 274 | | | |
| | 52 | 15.401 | | | 5289 | 815 | | | |
| | 53 | 16.450 | | | 800 | 149 | | | |
| | 54 | 16.716 | | | 1236 | 194 | | | |
| | 55 | 17.638 | | | 349 | 67 | | | |

# STL Burlington - Target GC Injection Report

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| 56 | 17.964 | | | 1338 | 204 | | | |
| 57 | 18.576 | | | 710 | 45 | | | |
| 58 | 19.187 | | | 28020 | 3670 | | | |
| 59 | 19.476 | | | 14658 | 2526 | | | |
| 60 | 19.990 | | | 4577 | 759 | | | |
| 61 | 20.183 | | | 2392 | 290 | | | |
| 62 | 21.448 | 21.462 | -0.013 | 972 | 157 | 1.04758 | a | BZ#128 |
| 63 | 21.579 | | | 1959 | 241 | | | |
| 64 | 21.894 | | | 2440 | 319 | | | |
| 65 | 22.091 | | | 785 | 131 | | | |
| 66 | 22.444 | | | 1387 | 250 | | | |
| 67 | 22.765 | | | 1796 | 225 | | | |
| 68 | 23.073 | 23.115 | -0.042 | 1536 | 296 | 0.574130 | a | BZ#180 |
| 69 | 24.117 | | | 415 | 96 | | | |
| 70 | 24.299 | | | 3923 | 551 | | | |
| $ 71 | 24.647 | 24.678 | -0.031 | 563825 | 104784 | 44.0100 | | BZ#198 |
| 72 | 25.829 | | | 1113 | 146 | | | |
| 73 | 26.367 | | | 15683 | 2911 | | | |
| 74 | 27.613 | | | 648 | 64 | | | |
| 75 | 27.990 | | | 1907 | 184 | | | |
| 76 | 28.469 | | | 4435 | 233 | | | |
| 77 | 28.810 | | | 6910 | 570 | | | |
| 78 | 29.043 | | | 1733 | 280 | | | |
| 79 | 29.262 | | | 711 | 126 | | | |
| 80 | 29.444 | | | 782 | 127 | | | |
| 81 | 30.065 | | | 6598 | 526 | | | |
| 82 | 30.371 | | | 703 | 152 | | | |
| 83 | 30.610 | | | 3354 | 313 | | | |
| 84 | 30.741 | | | 2725 | 459 | | | |
| 85 | 31.497 | | | 12131 | 287 | | | |
| 86 | 31.865 | | | 7906 | 557 | | | |
| 87 | 32.159 | | | 4208 | 317 | | | |
| 88 | 32.401 | | | 2323 | 753 | | | |
| 89 | 32.873 | | | 24224 | 3149 | | | |
| 90 | 32.997 | | | 3588 | 738 | | | |
| 91 | 33.354 | | | 7060 | 603 | | | |
| 92 | 33.605 | | | 7207 | 609 | | | |
| 93 | 33.795 | | | 5831 | 532 | | | |
| 94 | 34.123 | | | 6643 | 417 | | | |
| 95 | 34.290 | | | 1961 | 321 | | | |
| 96 | 34.502 | | | 2974 | 408 | | | |
| 97 | 34.607 | | | 10297 | 1596 | | | |
| 98 | 34.802 | | | 2047 | 393 | | | |
| 99 | 34.895 | | | 2491 | 385 | | | |
| 100 | 35.114 | | | 1867 | 294 | | | |
| 101 | 35.243 | | | 2521 | 353 | | | |
| 102 | 35.394 | | | 2415 | 398 | | | |
| 103 | 35.520 | | | 5050 | 833 | | | |
| 104 | 36.147 | | | 2079 | 199 | | | |
| 105 | 36.384 | | | 1274 | 255 | | | |
| 106 | 36.719 | | | 594 | 155 | | | |
| 107 | 36.797 | | | 1916 | 280 | | | |
| 108 | 37.211 | | | 3011 | 376 | | | |
| 109 | 37.681 | | | 2516 | 463 | | | |
| 110 | 38.093 | | | 1314 | 237 | | | |
| 111 | 38.346 | | | 1201 | 169 | | | |
| 112 | 38.568 | | | 1128 | 146 | | | |
| 113 | 38.947 | | | 1081 | 140 | | | |
| 114 | 39.397 | | | 6917 | 487 | | | |
| 115 | 40.751 | | | 1064 | 139 | | | |

Flags:
A - Peak quantitates above calibration range
a - Peak quantitates below reporting limit
H - User selected alternate compound hit
M - Peak manually integrated or manually identified
R - Peak fails recovery
U - User disabled peak ID: either peak quantitates below reporting limit or peak identification not confirmed on second column

```
  Peak      Expected
   RT          RT                 Target Compound
========    ========    ====================================
                     Target Compounds

  Peak      Expected
   RT          RT                 Target Compound
========    ========    ====================================
   5.380       5.391    Tetrachloro-meta-xylene
               6.592    BZ#8
               7.698    BZ#18
               9.137    BZ#28
              10.341    BZ#52
              11.312    BZ#44
              13.056    BZ#66
              13.914    BZ#101
              16.080    BZ#77
              17.075    BZ#118
              17.995    BZ#153
              18.720    BZ#105
              19.713    BZ#138
              20.225    BZ#126
  21.448      21.462    BZ#128
  23.073      23.115    BZ#180
  24.647      24.678    BZ#198
              25.004    BZ#170
              27.203    BZ#195
              29.805    BZ#206
              30.754    BZ#209
```

FORM 1
OTHER ORGANICS ANALYSIS DATA SHEET

ENVNET SAMPLE NO.

F01009LS32

Lab Name: STL BURLINGTON　　Contract: 22000

Lab Code: STLVT　　Case No.: 22000　　SAS No.:　　SDG No.: 89891

Matrix: (soil/water) SOIL　　Lab Sample ID: 502111

Sample wt/vol: 30.0 (g/mL) G　　Lab File ID: 03OCT021608-R111

% Moisture: 36　　decanted: (Y/N) N　　Date Received: 09/25/02

Extraction: (SepF/Cont/Sonc) SOXH　　Date Extracted: 09/26/02

Concentrated Extract Volume: 10(mL)　　Date Analyzed: 10/04/02

Injection Volume: 1.0(uL)　　Dilution Factor: 1.0

GPC Cleanup: (Y/N) N　　pH: ___　　Sulfur Cleanup: (Y/N) Y

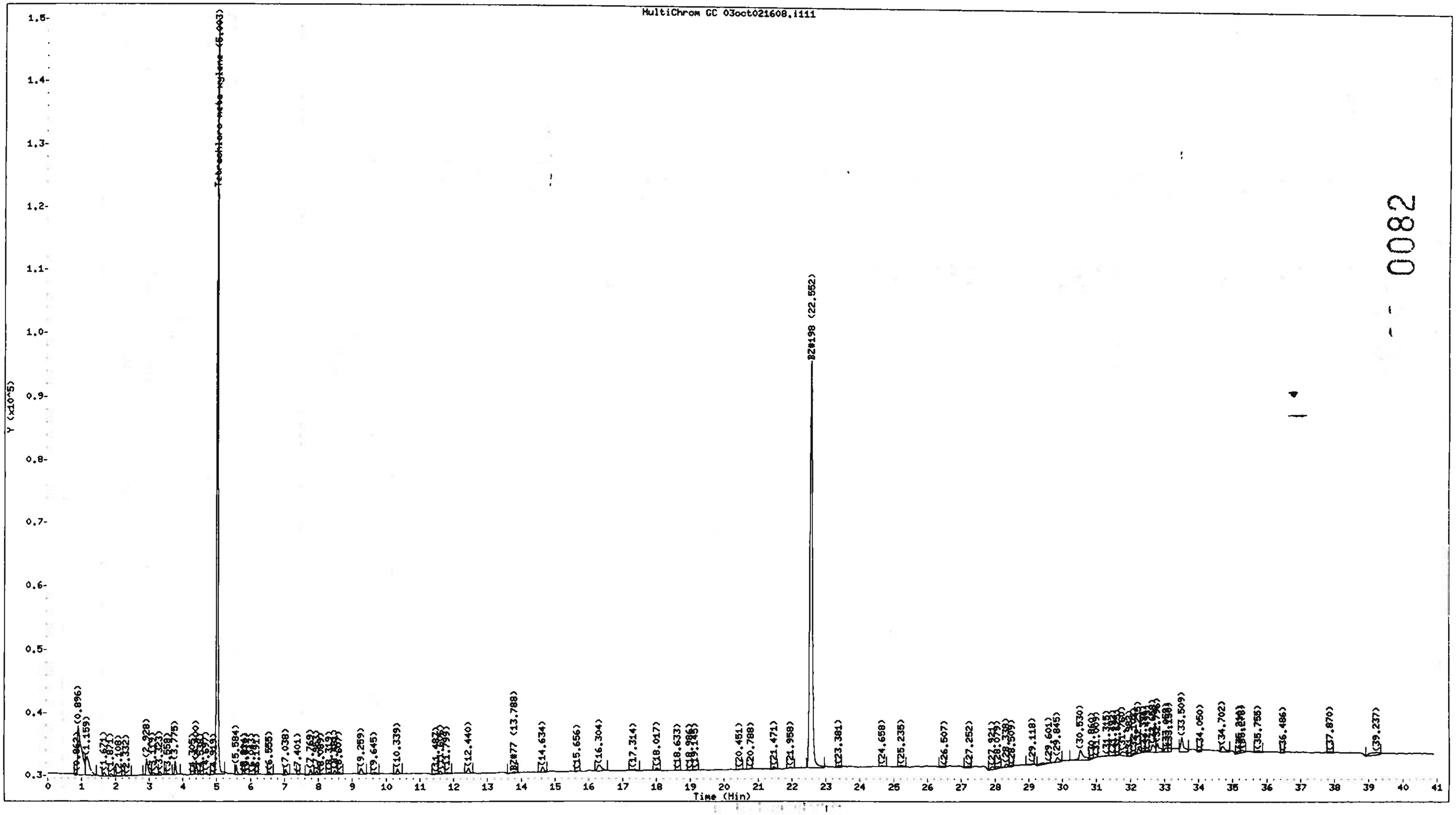
| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG | Q |
|---|---|---|---|
| 34883-43-7 | BZ#8 | 2.6 | U |
| 37680-65-2 | BZ#18 | 2.6 | U |
| 7012-37-5 | BZ#28 | 2.6 | U |
| 41464-39-5 | BZ#44 | 2.6 | U |
| 35693-99-3 | BZ#52 | 2.6 | U |
| 32598-10-0 | BZ#66 | 2.6 | U |
| 32598-13-3 | BZ#77 | 2.6 | U |
| 37680-73-2 | BZ#101 | 2.6 | U |
| 32598-14-4 | BZ#105 | 2.6 | U |
| 31508-00-6 | BZ#118 | 2.6 | U |
| 57465-28-8 | BZ#126 | 2.6 | U |
| 38380-07-3 | BZ#128 | 2.6 | U |
| 35065-28-2 | BZ#138 | 2.6 | U |
| 35065-27-1 | BZ#153 | 2.6 | U |
| 35065-30-6 | BZ#170 | 2.6 | U |
| 35065-29-3 | BZ#180 | 2.6 | U |
| 52663-68-0 | BZ#187 | 2.6 | U |
| 52663-78-2 | BZ#195 | 2.6 | U |
| 40186-72-9 | BZ#206 | 2.6 | U |
| 2051-24-3 | BZ#209 | 2.6 | U |

STL Burlington - Target GC Chromatogram

| | |
|---|---|
| Lab Sample ID: 502111 | Client Sample ID: F01009LS32 |

Matrix : SOIL
Analyst :
Instrument : 3327_1.i
Column : RTX-5
Integrator : Falcon
Method : /var/chem/3327_1.i/100302_1/03OCT021608.b/32CONG_3327RTX5_RAW.m
Reported : 17-Oct-2002 09:44 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 07:25
Dilution Factor : 1.00
Data File : 03oct021608-r111.d
Compound Sublist: ENVNET



# STL Burlington - Target GC Injection Report

| | |
|---|---|
| Lab Sample ID: 502111 | Client Sample ID: F01009LS32 |

Matrix : SOIL
Analyst :
Instrument : 3327_1.i
Column : RTX-5
Integrator : Falcon
Method : /var/chem/3327_1.i/100302_1/03OCT021608.b/32CONG_3327RTX5_RAW.m
Reported : 17-Oct-2002 09:44 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 07:25
Dilution Factor : 1.00
Data File : 03oct021608-r111.d
Compound Sublist: ENVNET

## Peaks

| | Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0.862 | | | 1280 | 392 | | | |
| | 2 | 0.896 | | | 62194 | 7804 | | | |
| | 3 | 1.159 | | | 24436 | 2931 | | | |
| | 4 | 1.671 | | | 2706 | 637 | | | |
| | 5 | 1.871 | | | 2012 | 457 | | | |
| | 6 | 2.108 | | | 447 | 99 | | | |
| | 7 | 2.332 | | | 689 | 129 | | | |
| | 8 | 2.928 | | | 11791 | 2543 | | | |
| | 9 | 3.119 | | | 2806 | 400 | | | |
| | 10 | 3.323 | | | 2345 | 556 | | | |
| | 11 | 3.558 | | | 781 | 235 | | | |
| | 12 | 3.775 | | | 6592 | 2128 | | | |
| | 13 | 4.305 | | | 347 | 87 | | | |
| | 14 | 4.400 | | | 5490 | 2136 | | | |
| | 15 | 4.538 | | | 275 | 86 | | | |
| | 16 | 4.697 | | | 1740 | 433 | | | |
| | 17 | 4.919 | | | 256 | 31 | | | |
| $ | 18 | 5.003 | 5.001 | 0.002 | 342401 | 135445 | 42.9763 | | Tetrachloro-meta-xylene |
| | 19 | 5.584 | | | 4499 | 1434 | | | |
| | 20 | 5.814 | | | 232 | 83 | | | |
| | 21 | 5.870 | | | 707 | 195 | | | |
| | 22 | 6.043 | | | 469 | 161 | | | |
| | 23 | 6.191 | | | 194 | 59 | | | |
| | 24 | 6.555 | | | 1562 | 443 | | | |
| | 25 | 7.038 | | | 3353 | 911 | | | |
| | 26 | 7.401 | | | 335 | 96 | | | |
| | 27 | 7.769 | | | 4152 | 842 | | | |
| | 28 | 7.953 | | | 2632 | 603 | | | |
| | 29 | 8.089 | | | 1402 | 238 | | | |
| | 30 | 8.319 | | | 1710 | 433 | | | |
| | 31 | 8.481 | | | 3091 | 602 | | | |
| | 32 | 8.607 | | | 1828 | 378 | | | |
| | 33 | 9.259 | | | 5097 | 903 | | | |
| | 34 | 9.645 | | | 2351 | 312 | | | |
| | 35 | 10.339 | | | 4116 | 830 | | | |
| | 36 | 11.487 | | | 1285 | 187 | | | |
| | 37 | 11.606 | | | 2750 | 502 | | | |
| | 38 | 11.799 | | | 1624 | 240 | | | |
| | 39 | 12.440 | | | 4937 | 876 | | | |
| | 40 | 13.788 | 13.752 | 0.035 | 2373 | 209 | 2.53182 | a | BZ#77 |
| | 41 | 14.634 | | | 3967 | 770 | | | |
| | 42 | 15.656 | | | 775 | 173 | | | |
| | 43 | 16.304 | | | 8781 | 922 | | | |
| | 44 | 17.314 | | | 2269 | 222 | | | |
| | 45 | 18.017 | | | 1934 | 410 | | | |
| | 46 | 18.633 | | | 324 | 76 | | | |
| | 47 | 18.986 | | | 393 | 86 | | | |
| | 48 | 19.145 | | | 623 | 129 | | | |
| | 49 | 20.451 | | | 729 | 151 | | | |
| | 50 | 20.788 | | | 987 | 159 | | | |
| | 51 | 21.471 | | | 1616 | 338 | | | |
| | 52 | 21.958 | | | 1157 | 189 | | | |
| $ | 53 | 22.552 | 22.559 | -0.007 | 334510 | 64850 | 43.4631 | | BZ#198 |
| | 54 | 23.381 | | | 1770 | 302 | | | |
| | 55 | 24.658 | | | 1281 | 191 | | | |

# STL Burlington - Target GC Injection Report

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| 56 | 25.235 | | | 1367 | 188 | | | |
| 57 | 26.507 | | | 1608 | 166 | | | |
| 58 | 27.252 | | | 1840 | 182 | | | |
| 59 | 27.921 | | | 3234 | 422 | | | |
| 60 | 28.079 | | | 2744 | 318 | | | |
| 61 | 28.338 | | | 3412 | 514 | | | |
| 62 | 28.509 | | | 1117 | 208 | | | |
| 63 | 29.118 | | | 2268 | 228 | | | |
| 64 | 29.601 | | | 4678 | 137 | | | |
| 65 | 29.845 | | | 6183 | 785 | | | |
| 66 | 30.530 | | | 15589 | 1663 | | | |
| 67 | 30.860 | | | 761 | 179 | | | |
| 68 | 31.009 | | | 410 | 77 | | | |
| 69 | 31.315 | | | 1272 | 90 | | | |
| 70 | 31.492 | | | 732 | 144 | | | |
| 71 | 31.625 | | | 565 | 130 | | | |
| 72 | 31.760 | | | 5931 | 572 | | | |
| 73 | 31.982 | | | 399 | 125 | | | |
| 74 | 32.102 | | | 1462 | 329 | | | |
| 75 | 32.235 | | | 4652 | 1150 | | | |
| 76 | 32.394 | | | 1609 | 268 | | | |
| 77 | 32.499 | | | 1728 | 305 | | | |
| 78 | 32.658 | | | 8687 | 1187 | | | |
| 79 | 32.796 | | | 9353 | 1389 | | | |
| 80 | 33.059 | | | 4304 | 610 | | | |
| 81 | 33.150 | | | 3454 | 670 | | | |
| 82 | 33.509 | | | 14570 | 2315 | | | |
| 83 | 34.050 | | | 1982 | 326 | | | |
| 84 | 34.702 | | | 7708 | 903 | | | |
| 85 | 35.210 | | | 2439 | 376 | | | |
| 86 | 35.278 | | | 2975 | 448 | | | |
| 87 | 35.755 | | | 3041 | 338 | | | |
| 88 | 36.486 | | | 476 | 94 | | | |
| 89 | 37.870 | | | 1680 | 231 | | | |
| 90 | 39.237 | | | 8283 | 394 | | | |

Flags:
A - Peak quantitates above calibration range
a - Peak quantitates below reporting limit
H - User selected alternate compound hit
M - Peak manually integrated or manually identified
R - Peak fails recovery
U - User disabled peak ID: either peak quantitates below reporting limit or peak identification not confirmed on second column

## Target Compounds

| Peak RT | Expected RT | Target Compound |
|---|---|---|
| 5.003 | 5.001 | Tetrachloro-meta-xylene |
| | 5.761 | BZ#8 |
| | 6.701 | BZ#18 |
| | 7.925 | BZ#28 |
| | 8.984 | BZ#52 |
| | 9.667 | BZ#44 |
| | 11.243 | BZ#66 |
| | 12.207 | BZ#101 |
| 13.788 | 13.752 | BZ#77 |
| | 14.938 | BZ#118 |
| | 15.993 | BZ#153 |
| | 16.155 | BZ#105 |
| | 17.328 | BZ#138 |
| | 17.762 | BZ#126 |
| | 18.647 | BZ#128 |
| | 20.781 | BZ#180 |
| | 22.271 | BZ#170 |
| 22.552 | 22.559 | BZ#198 |
| | 24.552 | BZ#195 |
| | 27.655 | BZ#206 |

## STL Burlington - Target GC Injection Report

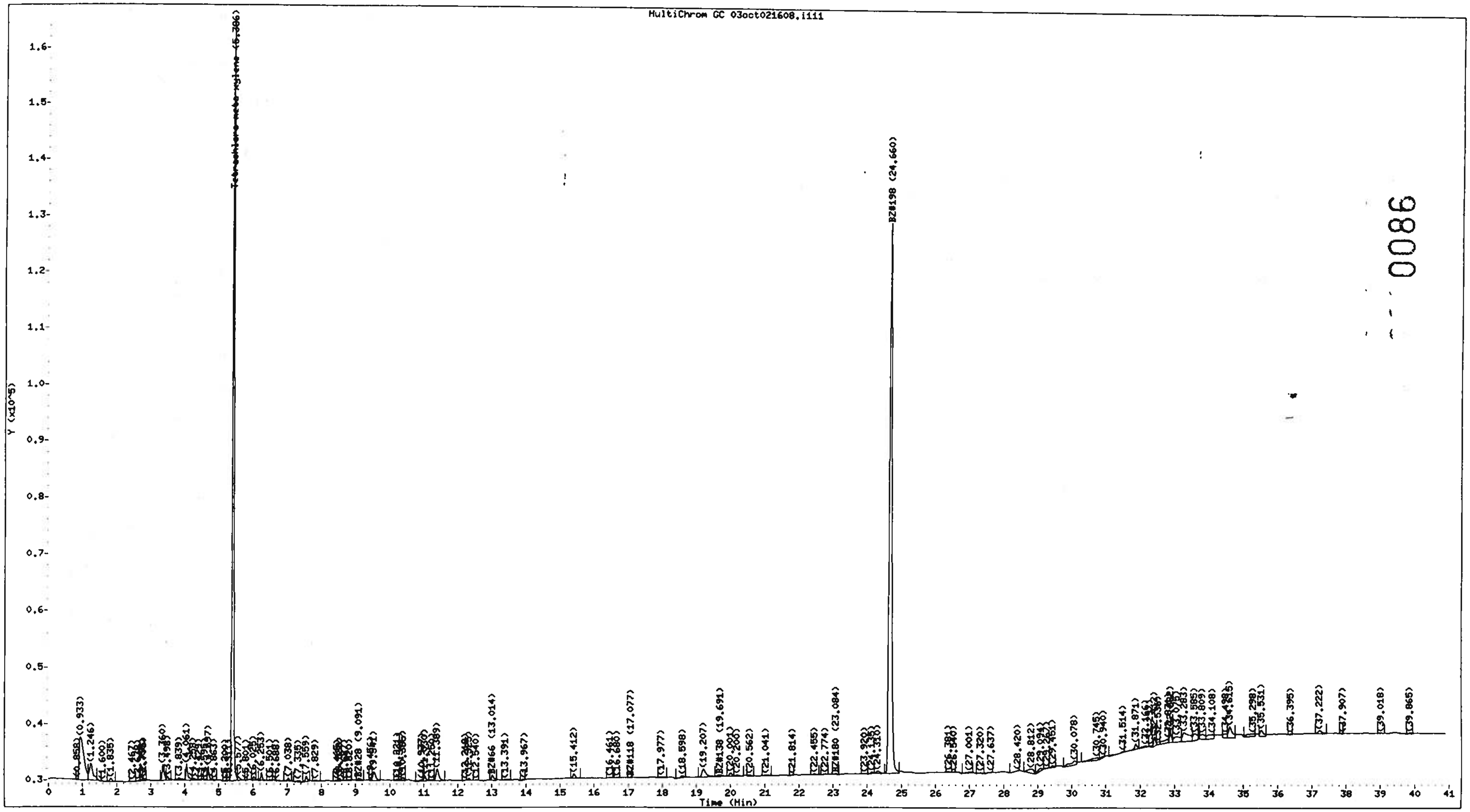
```
  Peak      Expected
   RT          RT                     Target Compound
========    ========    ====================================
              29.180    BZ#209
```

STL Burlington - Target GC Chromatogram

Lab Sample ID: 502111  Client Sample ID: F01009LS32

Matrix : SOIL
Analyst :
Instrument : 3327_2.i
Column : RTX-CLPII
Integrator : Falcon
Method : /var/chem/3327_2.i/100302_1/03OCT021608.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 09:55 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 07:25
Dilution Factor : 1.00
Data File : 03oct021608-r111.d
Compound Sublist: ENVNET



# STL Burlington - Target GC Injection Report

| Lab Sample ID: 502111 | Client Sample ID: F01009LS32 |
|---|---|

Matrix : SOIL
Analyst :
Instrument : 3327_2.i
Column : RTX-CLPII
Integrator : Falcon
Method : /var/chem/3327_2.i/100302_1/03OCT021608.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 09:55 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 07:25
Dilution Factor : 1.00
Data File : 03oct021608-r111.d
Compound Sublist: ENVNET

## Peaks

| | Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0.858 | | | 527 | 225 | | | |
| | 2 | 0.933 | | | 74989 | 7637 | | | |
| | 3 | 1.246 | | | 21914 | 3015 | | | |
| | 4 | 1.600 | | | 629 | 123 | | | |
| | 5 | 1.835 | | | 3035 | 606 | | | |
| | 6 | 2.467 | | | 398 | 93 | | | |
| | 7 | 2.638 | | | 247 | 69 | | | |
| | 8 | 2.755 | | | 449 | 165 | | | |
| | 9 | 2.795 | | | 1808 | 435 | | | |
| | 10 | 3.360 | | | 11770 | 2819 | | | |
| | 11 | 3.498 | | | 2784 | 705 | | | |
| | 12 | 3.839 | | | 3412 | 404 | | | |
| | 13 | 4.061 | | | 10591 | 2867 | | | |
| | 14 | 4.258 | | | 2260 | 351 | | | |
| | 15 | 4.429 | | | 1022 | 185 | | | |
| | 16 | 4.595 | | | 948 | 200 | | | |
| | 17 | 4.697 | | | 7365 | 2510 | | | |
| | 18 | 4.863 | | | 728 | 131 | | | |
| | 19 | 5.200 | | | 699 | 188 | | | |
| | 20 | 5.311 | | | 717 | 185 | | | |
| $ | 21 | 5.386 | 5.391 | -0.004 | 464689 | 159224 | 42.2538 | | Tetrachloro-meta-xylene |
| | 22 | 5.577 | | | 3895 | 726 | | | |
| | 23 | 5.801 | | | 324 | 118 | | | |
| | 24 | 6.025 | | | 2607 | 719 | | | |
| | 25 | 6.253 | | | 5094 | 1449 | | | |
| | 26 | 6.501 | | | 989 | 174 | | | |
| | 27 | 6.688 | | | 871 | 128 | | | |
| | 28 | 7.038 | | | 1939 | 492 | | | |
| | 29 | 7.335 | | | 2453 | 274 | | | |
| | 30 | 7.559 | | | 3773 | 1005 | | | |
| | 31 | 7.829 | | | 891 | 152 | | | |
| | 32 | 8.465 | | | 794 | 157 | | | |
| | 33 | 8.528 | | | 1888 | 477 | | | |
| | 34 | 8.687 | | | 313 | 116 | | | |
| | 35 | 8.820 | | | 995 | 193 | | | |
| | 36 | 9.091 | 9.137 | -0.047 | 2222 | 383 | 1.29241 | a | BZ#28 |
| | 37 | 9.456 | | | 2013 | 611 | | | |
| | 38 | 9.541 | | | 8898 | 1536 | | | |
| | 39 | 10.221 | | | 1244 | 238 | | | |
| | 40 | 10.301 | | | 953 | 269 | | | |
| | 41 | 10.385 | | | 2250 | 553 | | | |
| | 42 | 10.937 | | | 1734 | 232 | | | |
| | 43 | 11.030 | | | 4070 | 889 | | | |
| | 44 | 11.250 | | | 1550 | 214 | | | |
| | 45 | 11.389 | | | 12809 | 2061 | | | |
| | 46 | 12.218 | | | 409 | 92 | | | |
| | 47 | 12.325 | | | 1956 | 420 | | | |
| | 48 | 12.540 | | | 548 | 126 | | | |
| | 49 | 13.014 | 13.056 | -0.042 | 4560 | 874 | 2.20801 | a | BZ#66 |
| | 50 | 13.391 | | | 1717 | 178 | | | |
| | 51 | 13.967 | | | 1171 | 151 | | | |
| | 52 | 15.412 | | | 4070 | 774 | | | |
| | 53 | 16.461 | | | 504 | 98 | | | |
| | 54 | 16.680 | | | 314 | 78 | | | |
| | 55 | 17.077 | 17.075 | 0.002 | 499 | 101 | [illegible].06270 | a | BZ#118 |

# STL Burlington - Target GC Injection Report

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| 56 | 17.977 | | | 1668 | 208 | | | |
| 57 | 18.598 | | | 2639 | 371 | | | |
| 58 | 19.207 | | | 12082 | 1386 | | | |
| 59 | 19.691 | 19.713 | -0.022 | 3529 | 334 | 0.405906 | a | BZ#138 |
| 60 | 20.001 | | | 3349 | 608 | | | |
| 61 | 20.200 | | | 2332 | 220 | | | |
| 62 | 20.562 | | | 1455 | 223 | | | |
| 63 | 21.041 | | | 1714 | 208 | | | |
| 64 | 21.814 | | | 609 | 124 | | | |
| 65 | 22.455 | | | 1227 | 220 | | | |
| 66 | 22.774 | | | 1021 | 155 | | | |
| 67 | 23.084 | 23.115 | -0.031 | 908 | 193 | 0.528800 | a | BZ#180 |
| 68 | 23.920 | | | 482 | 92 | | | |
| 69 | 24.135 | | | 1366 | 313 | | | |
| 70 | 24.310 | | | 3164 | 466 | | | |
| $ 71 | 24.660 | 24.678 | -0.018 | 525337 | 98027 | 41.1617 | | BZ#198 |
| 72 | 26.381 | | | 1018 | 227 | | | |
| 73 | 26.540 | | | 643 | 143 | | | |
| 74 | 27.001 | | | 2008 | 196 | | | |
| 75 | 27.320 | | | 857 | 126 | | | |
| 76 | 27.637 | | | 584 | 43 | | | |
| 77 | 28.420 | | | 1004 | 97 | | | |
| 78 | 28.812 | | | 9095 | 736 | | | |
| 79 | 29.094 | | | 4248 | 465 | | | |
| 80 | 29.267 | | | 701 | 150 | | | |
| 81 | 29.451 | | | 2580 | 362 | | | |
| 82 | 30.078 | | | 9338 | 704 | | | |
| 83 | 30.745 | | | 7369 | 471 | | | |
| 84 | 30.940 | | | 1737 | 199 | | | |
| 85 | 31.514 | | | 3278 | 149 | | | |
| 86 | 31.871 | | | 6229 | 1025 | | | |
| 87 | 32.166 | | | 2930 | 223 | | | |
| 88 | 32.297 | | | 1133 | 273 | | | |
| 89 | 32.412 | | | 5612 | 1615 | | | |
| 90 | 32.536 | | | 2802 | 485 | | | |
| 91 | 32.831 | | | 7939 | 614 | | | |
| 92 | 32.882 | | | 7485 | 1880 | | | |
| 93 | 33.075 | | | 12338 | 910 | | | |
| 94 | 33.283 | | | 21253 | 1510 | | | |
| 95 | 33.585 | | | 10411 | 1218 | | | |
| 96 | 33.809 | | | 8724 | 899 | | | |
| 97 | 34.108 | | | 10344 | 742 | | | |
| 98 | 34.498 | | | 4955 | 650 | | | |
| 99 | 34.615 | | | 14967 | 1964 | | | |
| 100 | 35.298 | | | 7322 | 467 | | | |
| 101 | 35.531 | | | 7262 | 1063 | | | |
| 102 | 36.395 | | | 1154 | 202 | | | |
| 103 | 37.222 | | | 5953 | 627 | | | |
| 104 | 37.907 | | | 282 | 79 | | | |
| 105 | 39.018 | | | 1075 | 142 | | | |
| 106 | 39.865 | | | 968 | 152 | | | |

Flags:
A - Peak quantitates above calibration range
a - Peak quantitates below reporting limit
H - User selected alternate compound hit
M - Peak manually integrated or manually identified
R - Peak fails recovery
U - User disabled peak ID: either peak quantitates below reporting limit or peak identification not confirmed on second column

## Target Compounds

| Peak RT | Expected RT | Target Compound |
|---|---|---|
| 5.386 | 5.391 | Tetrachloro-meta-xylene |
| | 6.592 | BZ#8 |
| | 7.698 | BZ#18 |
| 9.091 | 9.137 | BZ#28 |

## STL Burlington - Target GC Injection Report

```
  Peak     Expected
   RT         RT               Target Compound
========   ========   ====================================
             10.341   BZ#52
             11.312   BZ#44
  13.014     13.056   BZ#66
             13.914   BZ#101
             16.080   BZ#77
  17.077     17.075   BZ#118
             17.995   BZ#153
             18.720   BZ#105
  19.691     19.713   BZ#138
             20.225   BZ#126
             21.462   BZ#128
  23.084     23.115   BZ#180
  24.660     24.678   BZ#198
             25.004   BZ#170
             27.203   BZ#195
             29.805   BZ#206
             30.754   BZ#209
```

FORM 1
OTHER ORGANICS ANALYSIS DATA SHEET

ENVNET SAMPLE NO.

F01009LS33

Lab Name: STL BURLINGTON Contract: 22000

Lab Code: STLVT Case No.: 22000 SAS No.: SDG No.: 89891

Matrix: (soil/water) SOIL Lab Sample ID: 502110

Sample wt/vol: 30.0 (g/mL) G Lab File ID: 03OCT021608-R101

% Moisture: 25 decanted: (Y/N) N Date Received: 09/25/02

Extraction: (SepF/Cont/Sonc) SOXH Date Extracted: 09/26/02

Concentrated Extract Volume: 10(mL) Date Analyzed: 10/04/02

Injection Volume: 1.0(uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: ___ Sulfur Cleanup: (Y/N) Y

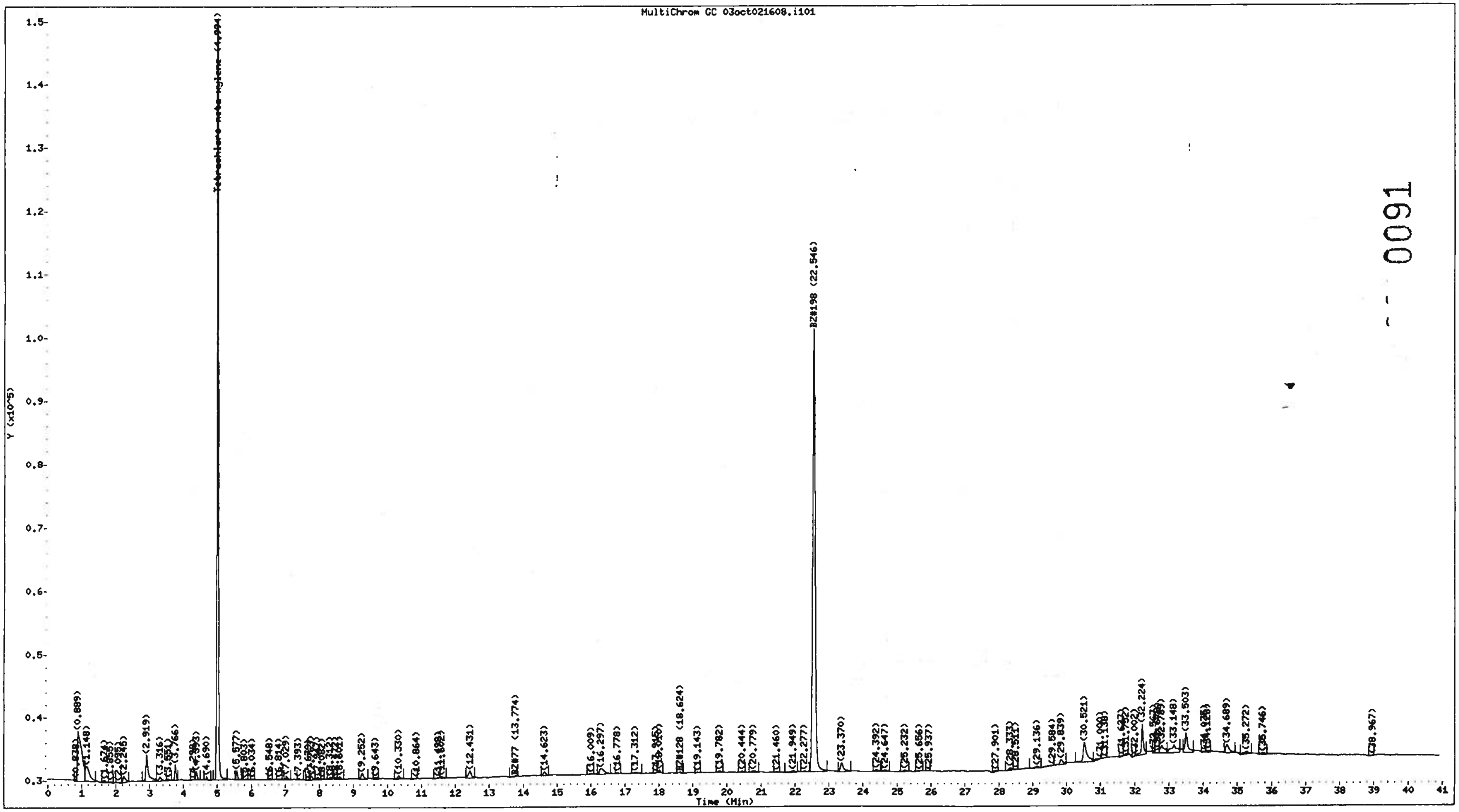
| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG | Q |
|---|---|---|---|
| 34883-43-7 | BZ#8 | 2.2 | U |
| 37680-65-2 | BZ#18 | 2.2 | U |
| 7012-37-5 | BZ#28 | 2.2 | U |
| 41464-39-5 | BZ#44 | 2.2 | U |
| 35693-99-3 | BZ#52 | 2.2 | U |
| 32598-10-0 | BZ#66 | 2.2 | U |
| 32598-13-3 | BZ#77 | 2.2 | U |
| 37680-73-2 | BZ#101 | 2.2 | U |
| 32598-14-4 | BZ#105 | 2.2 | U |
| 31508-00-6 | BZ#118 | 2.2 | U |
| 57465-28-8 | BZ#126 | 2.2 | U |
| 38380-07-3 | BZ#128 | 2.2 | U |
| 35065-28-2 | BZ#138 | 2.2 | U |
| 35065-27-1 | BZ#153 | 2.2 | U |
| 35065-30-6 | BZ#170 | 2.2 | U |
| 35065-29-3 | BZ#180 | 2.2 | U |
| 52663-68-0 | BZ#187 | 2.2 | U |
| 52663-78-2 | BZ#195 | 2.2 | U |
| 40186-72-9 | BZ#206 | 2.2 | U |
| 2051-24-3 | BZ#209 | 2.2 | U |

# STL Burlington - Target GC Chromatogram

**Lab Sample ID: 502110** **Client Sample ID: F01009LS33**

Matrix : SOIL
Analyst :
Instrument : 3327_1.i
Column : RTX-5
Integrator : Falcon
Method : /var/chem/3327_1.i/100302_1/03OCT021608.b/32CONG_3327RTX5_RAW.m
Reported : 17-Oct-2002 09:44 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 06:40
Dilution Factor : 1.00
Data File : 03oct021608-r101.d
Compound Sublist: ENVNET



# STL Burlington - Target GC Injection Report

**Lab Sample ID: 502110** **Client Sample ID: F01009LS33**

Matrix : SOIL
Analyst :
Instrument : 3327_1.i
Column : RTX-5
Integrator : Falcon
Method : /var/chem/3327_1.i/100302_1/03OCT021608.b/32CONG_3327RTX5_RAW.m
Reported : 17-Oct-2002 09:44 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 06:40
Dilution Factor : 1.00
Data File : 03oct021608-r101.d
Compound Sublist: ENVNET

## Peaks

| | Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0.838 | | | 1080 | 300 | | | |
| | 2 | 0.889 | | | 70623 | 7928 | | | |
| | 3 | 1.148 | | | 20823 | 2432 | | | |
| | 4 | 1.674 | | | 1450 | 311 | | | |
| | 5 | 1.855 | | | 954 | 201 | | | |
| | 6 | 2.095 | | | 683 | 131 | | | |
| | 7 | 2.245 | | | 5427 | 974 | | | |
| | 8 | 2.919 | | | 22672 | 4151 | | | |
| | 9 | 3.316 | | | 4140 | 657 | | | |
| | 10 | 3.551 | | | 1120 | 287 | | | |
| | 11 | 3.766 | | | 7206 | 2470 | | | |
| | 12 | 4.298 | | | 632 | 147 | | | |
| | 13 | 4.393 | | | 3884 | 1367 | | | |
| | 14 | 4.690 | | | 1651 | 538 | | | |
| $ | 15 | 4.994 | 5.001 | -0.007 | 366202 | 144229 | 45.7562 | | Tetrachloro-meta-xylene |
| | 16 | 5.577 | | | 4399 | 1463 | | | |
| | 17 | 5.803 | | | 816 | 95 | | | |
| | 18 | 6.034 | | | 484 | 178 | | | |
| | 19 | 6.548 | | | 765 | 251 | | | |
| | 20 | 6.814 | | | 663 | 161 | | | |
| | 21 | 7.029 | | | 2046 | 578 | | | |
| | 22 | 7.393 | | | 617 | 194 | | | |
| | 23 | 7.679 | | | 438 | 102 | | | |
| | 24 | 7.763 | | | 2774 | 620 | | | |
| | 25 | 7.947 | | | 1709 | 401 | | | |
| | 26 | 8.082 | | | 464 | 113 | | | |
| | 27 | 8.312 | | | 1358 | 361 | | | |
| | 28 | 8.472 | | | 1250 | 348 | | | |
| | 29 | 8.601 | | | 1922 | 381 | | | |
| | 30 | 9.252 | | | 5201 | 935 | | | |
| | 31 | 9.643 | | | 1629 | 199 | | | |
| | 32 | 10.330 | | | 3037 | 535 | | | |
| | 33 | 10.864 | | | 524 | 49 | | | |
| | 34 | 11.498 | | | 1013 | 149 | | | |
| | 35 | 11.602 | | | 1799 | 229 | | | |
| | 36 | 12.431 | | | 7007 | 1120 | | | |
| | 37 | 13.774 | 13.752 | 0.022 | 1340 | 144 | 2.42643 | a | BZ#77 |
| | 38 | 14.623 | | | 3064 | 613 | | | |
| | 39 | 16.009 | | | 736 | 110 | | | |
| | 40 | 16.297 | | | 9010 | 903 | | | |
| | 41 | 16.778 | | | 720 | 164 | | | |
| | 42 | 17.312 | | | 1570 | 179 | | | |
| | 43 | 17.915 | | | 335 | 93 | | | |
| | 44 | 18.010 | | | 2364 | 469 | | | |
| | 45 | 18.624 | 18.647 | -0.022 | 823 | 173 | 0.0154182 | a | BZ#128 |
| | 46 | 19.143 | | | 709 | 132 | | | |
| | 47 | 19.782 | | | 1580 | 268 | | | |
| | 48 | 20.444 | | | 1062 | 187 | | | |
| | 49 | 20.779 | | | 2062 | 222 | | | |
| | 50 | 21.460 | | | 628 | 133 | | | |
| | 51 | 21.949 | | | 2322 | 227 | | | |
| | 52 | 22.277 | | | 621 | 98 | | | |
| $ | 53 | 22.546 | 22.559 | -0.013 | 360486 | 70027 | 47.0648 | | BZ#198 |
| | 54 | 23.370 | | | 9948 | 1406 | | | |
| | 55 | 24.392 | | | 1540 | 271 | | | |

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| 56 | 24.647 | | | 1430 | 232 | | | |
| 57 | 25.232 | | | 1558 | 204 | | | |
| 58 | 25.656 | | | 864 | 130 | | | |
| 59 | 25.937 | | | 544 | 107 | | | |
| 60 | 27.901 | | | 1223 | 201 | | | |
| 61 | 28.333 | | | 2221 | 412 | | | |
| 62 | 28.511 | | | 364 | 62 | | | |
| 63 | 29.136 | | | 2839 | 302 | | | |
| 64 | 29.584 | | | 2131 | 58 | | | |
| 65 | 29.839 | | | 5854 | 796 | | | |
| 66 | 30.521 | | | 24506 | 3138 | | | |
| 67 | 31.000 | | | 1870 | 45 | | | |
| 68 | 31.138 | | | 224 | 67 | | | |
| 69 | 31.627 | | | 368 | 84 | | | |
| 70 | 31.752 | | | 1591 | 276 | | | |
| 71 | 32.002 | | | 437 | 139 | | | |
| 72 | 32.224 | | | 19842 | 4798 | | | |
| 73 | 32.567 | | | 1046 | 334 | | | |
| 74 | 32.678 | | | 4281 | 607 | | | |
| 75 | 32.789 | | | 9339 | 1262 | | | |
| 76 | 33.148 | | | 13877 | 1178 | | | |
| 77 | 33.503 | | | 18630 | 3118 | | | |
| 78 | 34.035 | | | 1158 | 197 | | | |
| 79 | 34.128 | | | 2256 | 299 | | | |
| 80 | 34.689 | | | 9822 | 1332 | | | |
| 81 | 35.272 | | | 4126 | 415 | | | |
| 82 | 35.746 | | | 1515 | 192 | | | |
| 83 | 38.967 | | | 787 | 117 | | | |

Flags:
A - Peak quantitates above calibration range
a - Peak quantitates below reporting limit
H - User selected alternate compound hit
M - Peak manually integrated or manually identified
R - Peak fails recovery
U - User disabled peak ID: either peak quantitates below reporting limit or peak identification not confirmed on second column

## Target Compounds

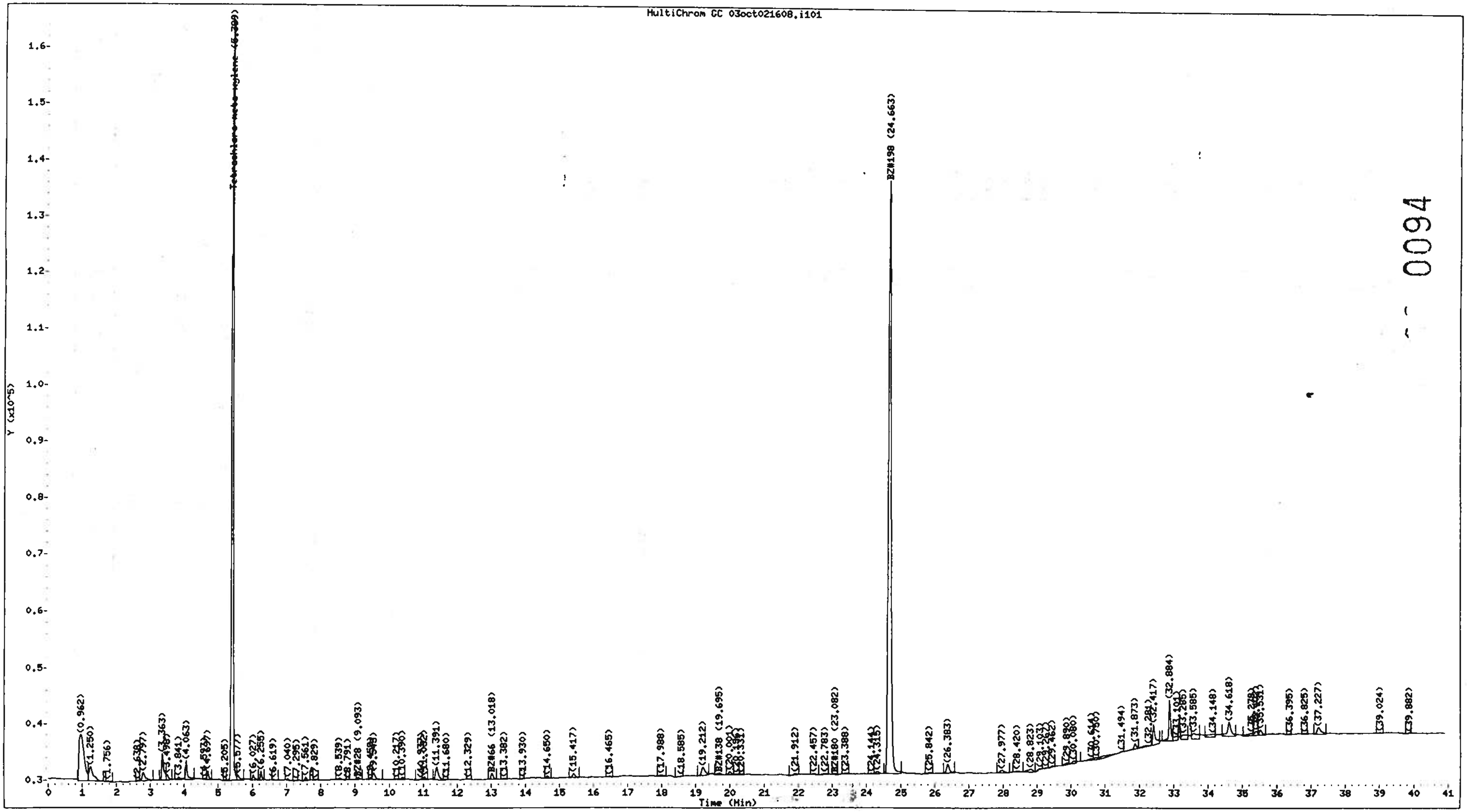
| Peak RT | Expected RT | Target Compound |
|---|---|---|
| 4.994 | 5.001 | Tetrachloro-meta-xylene |
| | 5.761 | BZ#8 |
| | 6.701 | BZ#18 |
| | 7.925 | BZ#28 |
| | 8.984 | BZ#52 |
| | 9.667 | BZ#44 |
| | 11.243 | BZ#66 |
| | 12.207 | BZ#101 |
| 13.774 | 13.752 | BZ#77 |
| | 14.938 | BZ#118 |
| | 15.993 | BZ#153 |
| | 16.155 | BZ#105 |
| | 17.328 | BZ#138 |
| | 17.762 | BZ#126 |
| 18.624 | 18.647 | BZ#128 |
| | 20.781 | BZ#180 |
| | 22.271 | BZ#170 |
| 22.546 | 22.559 | BZ#198 |
| | 24.552 | BZ#195 |
| | 27.655 | BZ#206 |
| | 29.180 | BZ#209 |

## STL Burlington - Target GC Chromatogram

| | |
|---|---|
| Lab Sample ID: 502110 | Client Sample ID: F01009LS33 |

Matrix : SOIL
Analyst :
Instrument : 3327_2.i
Column : RTX-CLPII
Integrator : Falcon
Method : /var/chem/3327_2.i/100302_1/03OCT021608.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 09:55 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 06:40
Dilution Factor : 1.00
Data File : 03oct021608-r101.d
Compound Sublist: ENVNET



STL Burlington - Target GC Injection Report

Lab Sample ID: 502110 Client Sample ID: F01009LS33

| | | | |
|---|---|---|---|
| Matrix | : SOIL | Sample Type | : SAMPLE |
| Analyst | : | Injection Date | : 04-OCT-2002 06:40 |
| Instrument | : 3327_2.i | Dilution Factor | : 1.00 |
| Column | : RTX-CLPII | Data File | : 03oct021608-r101.d |
| Integrator | : Falcon | Compound Sublist | : ENVNET |

Method : /var/chem/3327_2.i/100302_1/03OCT021608.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 09:55 rrm

## Peaks

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.962 | | | 85720 | 8235 | | | |
| 2 | 1.250 | | | 22067 | 2505 | | | |
| 3 | 1.756 | | | 1325 | 186 | | | |
| 4 | 2.638 | | | 350 | 102 | | | |
| 5 | 2.797 | | | 10410 | 1470 | | | |
| 6 | 3.363 | | | 20220 | 4658 | | | |
| 7 | 3.498 | | | 4279 | 977 | | | |
| 8 | 3.841 | | | 3629 | 441 | | | |
| 9 | 4.063 | | | 13623 | 3335 | | | |
| 10 | 4.597 | | | 1519 | 293 | | | |
| 11 | 4.697 | | | 5042 | 1625 | | | |
| 12 | 5.205 | | | 498 | 142 | | | |
| $ 13 | 5.389 | 5.391 | -0.002 | 501396 | 170450 | 45.1881 | | Tetrachloro-meta-xylene |
| 14 | 5.577 | | | 4518 | 909 | | | |
| 15 | 6.027 | | | 3592 | 880 | | | |
| 16 | 6.255 | | | 4882 | 1512 | | | |
| 17 | 6.619 | | | 614 | 157 | | | |
| 18 | 7.040 | | | 1752 | 315 | | | |
| 19 | 7.295 | | | 309 | 42 | | | |
| 20 | 7.561 | | | 2335 | 612 | | | |
| 21 | 7.829 | | | 947 | 135 | | | |
| 22 | 8.539 | | | 2356 | 322 | | | |
| 23 | 8.791 | | | 191 | 57 | | | |
| 24 | 9.093 | 9.137 | -0.044 | 1887 | 391 | 1.29703 | a | BZ#28 |
| 25 | 9.459 | | | 1003 | 323 | | | |
| 26 | 9.545 | | | 6345 | 1088 | | | |
| 27 | 10.217 | | | 700 | 195 | | | |
| 28 | 10.390 | | | 1979 | 450 | | | |
| 29 | 10.937 | | | 863 | 139 | | | |
| 30 | 11.032 | | | 1931 | 499 | | | |
| 31 | 11.391 | | | 13129 | 2194 | | | |
| 32 | 11.680 | | | 447 | 79 | | | |
| 33 | 12.329 | | | 454 | 127 | | | |
| 34 | 13.018 | 13.056 | -0.038 | 4844 | 1067 | 2.32480 | a | BZ#66 |
| 35 | 13.382 | | | 888 | 138 | | | |
| 36 | 13.930 | | | 1000 | 182 | | | |
| 37 | 14.650 | | | 1811 | 378 | | | |
| 38 | 15.417 | | | 4371 | 688 | | | |
| 39 | 16.465 | | | 1073 | 168 | | | |
| 40 | 17.988 | | | 1523 | 207 | | | |
| 41 | 18.585 | | | 835 | 51 | | | |
| 42 | 19.212 | | | 10703 | 1392 | | | |
| 43 | 19.695 | 19.713 | -0.018 | 3191 | 322 | 0.399959 | a | BZ#138 |
| 44 | 20.001 | | | 3131 | 591 | | | |
| 45 | 20.196 | | | 1493 | 202 | | | |
| 46 | 20.331 | | | 1120 | 196 | | | |
| 47 | 21.912 | | | 2223 | 300 | | | |
| 48 | 22.457 | | | 1356 | 237 | | | |
| 49 | 22.783 | | | 1455 | 196 | | | |
| 50 | 23.082 | 23.115 | -0.033 | 815 | 184 | 0.524839 | a | BZ#180 |
| 51 | 23.388 | | | 962 | 163 | | | |
| 52 | 24.144 | | | 506 | 114 | | | |
| 53 | 24.315 | | | 2850 | 430 | | | |
| $ 54 | 24.663 | 24.678 | -0.016 | 575972 | 105891 | 44.4766 | | BZ#198 |
| 55 | 25.842 | | | 1236 | 176 | | | |

0095

# STL Burlington - Target GC Injection Report

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| 56 | 26.383 | | | 9490 | 1517 | | | |
| 57 | 27.977 | | | 3648 | 407 | | | |
| 58 | 28.420 | | | 1689 | 202 | | | |
| 59 | 28.823 | | | 5910 | 486 | | | |
| 60 | 29.103 | | | 2073 | 213 | | | |
| 61 | 29.267 | | | 584 | 123 | | | |
| 62 | 29.462 | | | 1072 | 168 | | | |
| 63 | 29.890 | | | 2505 | 329 | | | |
| 64 | 30.080 | | | 4224 | 558 | | | |
| 65 | 30.614 | | | 3631 | 301 | | | |
| 66 | 30.750 | | | 2922 | 472 | | | |
| 67 | 31.494 | | | 9065 | 127 | | | |
| 68 | 31.873 | | | 5697 | 1009 | | | |
| 69 | 32.281 | | | 4078 | 204 | | | |
| 70 | 32.417 | | | 18347 | 3689 | | | |
| 71 | 32.884 | | | 27341 | 7343 | | | |
| 72 | 33.101 | | | 6341 | 659 | | | |
| 73 | 33.285 | | | 9817 | 869 | | | |
| 74 | 33.585 | | | 11445 | 928 | | | |
| 75 | 34.148 | | | 8464 | 555 | | | |
| 76 | 34.618 | | | 21111 | 2550 | | | |
| 77 | 35.278 | | | 4792 | 382 | | | |
| 78 | 35.402 | | | 4448 | 766 | | | |
| 79 | 35.531 | | | 6075 | 998 | | | |
| 80 | 36.395 | | | 739 | 134 | | | |
| 81 | 36.825 | | | 1363 | 169 | | | |
| 82 | 37.227 | | | 10167 | 1167 | | | |
| 83 | 39.024 | | | 989 | 155 | | | |
| 84 | 39.882 | | | 659 | 115 | | | |

Flags:
A - Peak quantitates above calibration range
a - Peak quantitates below reporting limit
H - User selected alternate compound hit
M - Peak manually integrated or manually identified
R - Peak fails recovery
U - User disabled peak ID: either peak quantitates below reporting limit or peak identification not confirmed on second column

## Target Compounds

| Peak RT | Expected RT | Target Compound |
|---|---|---|
| 5.389 | 5.391 | Tetrachloro-meta-xylene |
| | 6.592 | BZ#8 |
| | 7.698 | BZ#18 |
| 9.093 | 9.137 | BZ#28 |
| | 10.341 | BZ#52 |
| | 11.312 | BZ#44 |
| 13.018 | 13.056 | BZ#66 |
| | 13.914 | BZ#101 |
| | 16.080 | BZ#77 |
| | 17.075 | BZ#118 |
| | 17.995 | BZ#153 |
| | 18.720 | BZ#105 |
| 19.695 | 19.713 | BZ#138 |
| | 20.225 | BZ#126 |
| | 21.462 | BZ#128 |
| 23.082 | 23.115 | BZ#180 |
| 24.663 | 24.678 | BZ#198 |
| | 25.004 | BZ#170 |
| | 27.203 | BZ#195 |
| | 29.805 | BZ#206 |
| | 30.754 | BZ#209 |

FORM 1
OTHER ORGANICS ANALYSIS DATA SHEET

ENVNET SAMPLE NO.

F01009LS41

Lab Name: STL BURLINGTON Contract: 22000

Lab Code: STLVT Case No.: 22000 SAS No.: SDG No.: 89891

Matrix: (soil/water) SOIL Lab Sample ID: 502115

Sample wt/vol: 30.0 (g/mL) G Lab File ID: 03OCT021608-R181

% Moisture: 27 decanted: (Y/N) N Date Received: 09/25/02

Extraction: (SepF/Cont/Sonc) SOXH Date Extracted: 09/26/02

Concentrated Extract Volume: 10(mL) Date Analyzed: 10/04/02

Injection Volume: 1.0(uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: ____ Sulfur Cleanup: (Y/N) Y

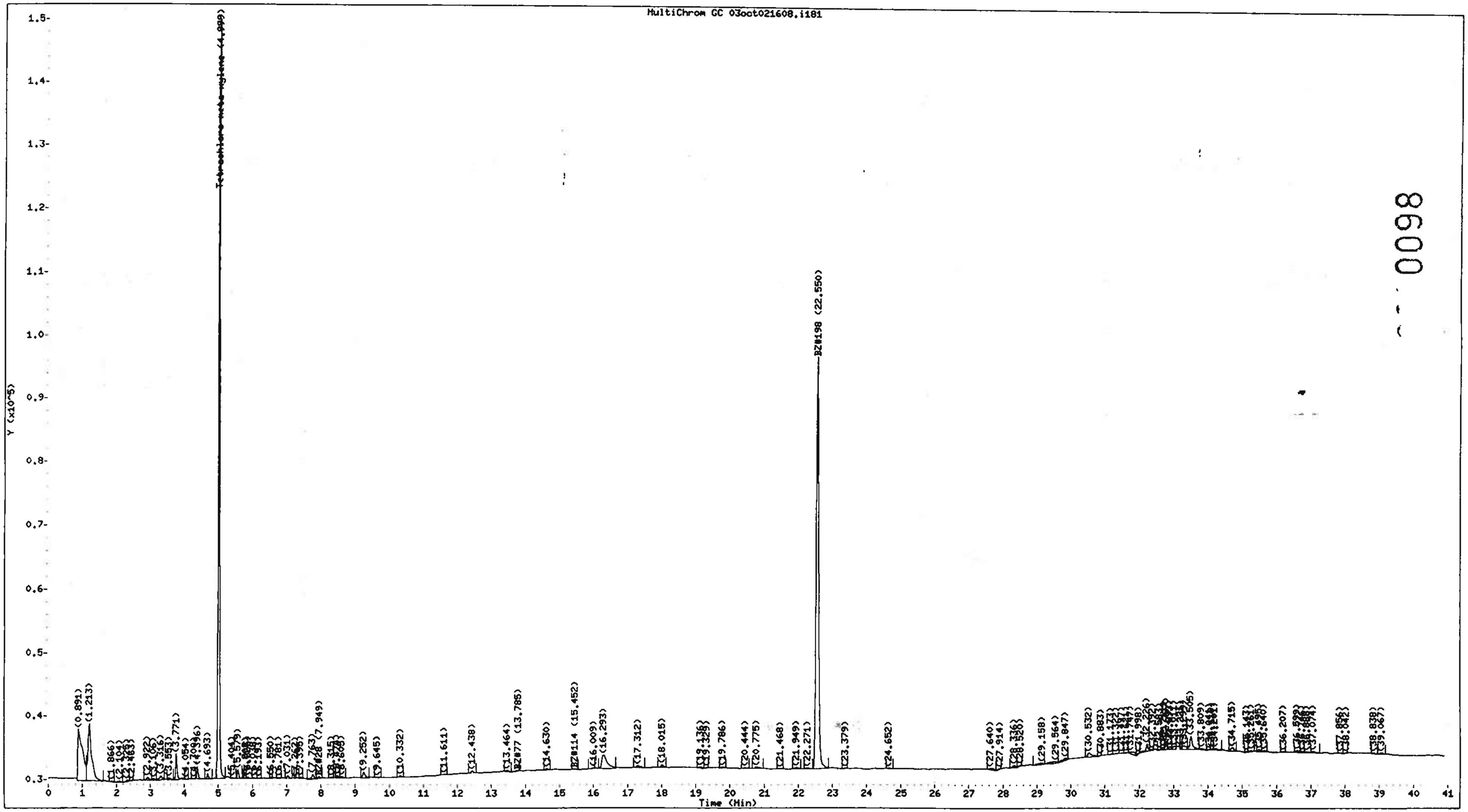
| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG | Q |
|---|---|---|---|
| 34883-43-7 | ------BZ#8 | 2.3 | U |
| 37680-65-2 | ------BZ#18 | 2.3 | U |
| 7012-37-5 | -------BZ#28 | 2.3 | U |
| 41464-39-5 | ------BZ#44 | 2.3 | U |
| 35693-99-3 | ------BZ#52 | 2.3 | U |
| 32598-10-0 | ------BZ#66 | 2.3 | U |
| 32598-13-3 | ------BZ#77 | 2.3 | U |
| 37680-73-2 | ------BZ#101 | 2.3 | U |
| 32598-14-4 | ------BZ#105 | 2.3 | U |
| 31508-00-6 | ------BZ#118 | 2.3 | U |
| 57465-28-8 | ------BZ#126 | 2.3 | U |
| 38380-07-3 | ------BZ#128 | 2.3 | U |
| 35065-28-2 | ------BZ#138 | 2.3 | U |
| 35065-27-1 | ------BZ#153 | 2.3 | U |
| 35065-30-6 | ------BZ#170 | 2.3 | U |
| 35065-29-3 | ------BZ#180 | 2.3 | U |
| 52663-68-0 | ------BZ#187 | 2.3 | U |
| 52663-78-2 | ------BZ#195 | 2.3 | U |
| 40186-72-9 | ------BZ#206 | 2.3 | U |
| 2051-24-3 | -------BZ#209 | 2.3 | U |

# STL Burlington - Target GC Chromatogram

**Lab Sample ID: 502115** **Client Sample ID: F01009LS41**

Matrix : SOIL
Analyst :
Instrument : 3327_1.i
Column : RTX-5
Integrator : Falcon
Method : /var/chem/3327_1.i/100302_1/03OCT021608.b/32CONG_3327RTX5_RAW.m
Reported : 17-Oct-2002 09:45 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 12:41
Dilution Factor : 1.00
Data File : 03oct021608-r181.d
Compound Sublist: ENVNET



# STL Burlington - Target GC Injection Report

Lab Sample ID: 502115 Client Sample ID: F01009LS41

Matrix : SOIL
Analyst :
Instrument : 3327_1.i
Column : RTX-5
Integrator : Falcon
Method : /var/chem/3327_1.i/100302_1/03OCT021608.b/32CONG_3327RTX5_RAW.m
Reported : 17-Oct-2002 09:45 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 12:41
Dilution Factor : 1.00
Data File : 03oct021608-r181.d
Compound Sublist: ENVNET

## Peaks

| | Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0.891 | | | 77081 | 8107 | | | |
| | 2 | 1.213 | | | 69729 | 8921 | | | |
| | 3 | 1.866 | | | 786 | 172 | | | |
| | 4 | 2.104 | | | 1708 | 224 | | | |
| | 5 | 2.325 | | | 1265 | 236 | | | |
| | 6 | 2.463 | | | 495 | 104 | | | |
| | 7 | 2.922 | | | 2497 | 450 | | | |
| | 8 | 3.106 | | | 1439 | 233 | | | |
| | 9 | 3.316 | | | 3679 | 635 | | | |
| | 10 | 3.553 | | | 1391 | 279 | | | |
| | 11 | 3.771 | | | 13820 | 4076 | | | |
| | 12 | 4.054 | | | 529 | 111 | | | |
| | 13 | 4.300 | | | 648 | 145 | | | |
| | 14 | 4.396 | | | 5979 | 1954 | | | |
| | 15 | 4.693 | | | 2887 | 891 | | | |
| $ | 16 | 4.999 | 5.001 | -0.002 | 344493 | 135840 | 43.1013 | | Tetrachloro-meta-xylene |
| | 17 | 5.404 | | | 856 | 146 | | | |
| | 18 | 5.579 | | | 4204 | 1422 | | | |
| | 19 | 5.808 | | | 246 | 83 | | | |
| | 20 | 5.865 | | | 827 | 240 | | | |
| | 21 | 6.038 | | | 432 | 162 | | | |
| | 22 | 6.193 | | | 254 | 66 | | | |
| | 23 | 6.550 | | | 581 | 219 | | | |
| | 24 | 6.781 | | | 698 | 126 | | | |
| | 25 | 7.031 | | | 1733 | 426 | | | |
| | 26 | 7.262 | | | 194 | 72 | | | |
| | 27 | 7.395 | | | 641 | 232 | | | |
| | 28 | 7.763 | | | 3592 | 695 | | | |
| | 29 | 7.949 | 7.925 | 0.024 | 1233 | 270 | 0.339781 | a | BZ#28 |
| | 30 | 8.315 | | | 572 | 166 | | | |
| | 31 | 8.474 | | | 1717 | 406 | | | |
| | 32 | 8.605 | | | 1386 | 265 | | | |
| | 33 | 9.252 | | | 4547 | 867 | | | |
| | 34 | 9.645 | | | 1113 | 136 | | | |
| | 35 | 10.332 | | | 952 | 224 | | | |
| | 36 | 11.611 | | | 409 | 92 | | | |
| | 37 | 12.438 | | | 1595 | 347 | | | |
| | 38 | 13.464 | | | 1509 | 200 | | | |
| | 39 | 13.785 | 13.752 | 0.033 | 1518 | 106 | 2.36482 | a | BZ#77 |
| | 40 | 14.630 | | | 1175 | 235 | | | |
| | 41 | 15.452 | | | 552 | 113 | | | |
| | 42 | 16.009 | | | 917 | 153 | | | |
| | 43 | 16.293 | | | 23264 | 2157 | | | |
| | 44 | 17.312 | | | 3171 | 322 | | | |
| | 45 | 18.015 | | | 2364 | 441 | | | |
| | 46 | 19.136 | | | 1156 | 170 | | | |
| | 47 | 19.329 | | | 318 | 65 | | | |
| | 48 | 19.786 | | | 1220 | 198 | | | |
| | 49 | 20.444 | | | 865 | 168 | | | |
| | 50 | 20.775 | | | 2479 | 281 | | | |
| | 51 | 21.468 | | | 407 | 86 | | | |
| | 52 | 21.949 | | | 1195 | 212 | | | |
| | 53 | 22.271 | | | 688 | 121 | | | |
| $ | 54 | 22.550 | 22.559 | -0.009 | 333192 | 65161 | 43.6795 | | BZ#198 |
| | 55 | 23.379 | | | 680 | 127 | | | |

0099

# STL Burlington - Target GC Injection Report

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| 56 | 24.652 | | | 769 | 133 | | | |
| 57 | 27.640 | | | 2709 | 264 | | | |
| 58 | 27.914 | | | 913 | 129 | | | |
| 59 | 28.336 | | | 1784 | 311 | | | |
| 60 | 28.520 | | | 981 | 171 | | | |
| 61 | 29.158 | | | 3141 | 241 | | | |
| 62 | 29.564 | | | 4558 | 276 | | | |
| 63 | 29.847 | | | 3735 | 349 | | | |
| 64 | 30.532 | | | 6202 | 706 | | | |
| 65 | 30.883 | | | 380 | 43 | | | |
| 66 | 31.173 | | | 277 | 55 | | | |
| 67 | 31.322 | | | 335 | 52 | | | |
| 68 | 31.497 | | | 335 | 77 | | | |
| 69 | 31.621 | | | 394 | 104 | | | |
| 70 | 31.747 | | | 4145 | 301 | | | |
| 71 | 31.998 | | | 533 | 79 | | | |
| 72 | 32.226 | | | 5269 | 1148 | | | |
| 73 | 32.392 | | | 854 | 136 | | | |
| 74 | 32.583 | | | 480 | 138 | | | |
| 75 | 32.711 | | | 1563 | 377 | | | |
| 76 | 32.787 | | | 2999 | 872 | | | |
| 77 | 32.893 | | | 2223 | 468 | | | |
| 78 | 33.011 | | | 3060 | 512 | | | |
| 79 | 33.221 | | | 1457 | 453 | | | |
| 80 | 33.299 | | | 4460 | 587 | | | |
| 81 | 33.505 | | | 13182 | 2126 | | | |
| 82 | 33.809 | | | 1721 | 199 | | | |
| 83 | 34.041 | | | 515 | 114 | | | |
| 84 | 34.119 | | | 904 | 237 | | | |
| 85 | 34.201 | | | 2566 | 291 | | | |
| 86 | 34.715 | | | 3417 | 580 | | | |
| 87 | 35.143 | | | 720 | 195 | | | |
| 88 | 35.261 | | | 1645 | 220 | | | |
| 89 | 35.495 | | | 1488 | 398 | | | |
| 90 | 35.640 | | | 1231 | 229 | | | |
| 91 | 36.207 | | | 632 | 113 | | | |
| 92 | 36.599 | | | 1938 | 352 | | | |
| 93 | 36.746 | | | 1166 | 212 | | | |
| 94 | 36.888 | | | 1032 | 147 | | | |
| 95 | 37.074 | | | 1606 | 237 | | | |
| 96 | 37.856 | | | 535 | 117 | | | |
| 97 | 38.042 | | | 268 | 51 | | | |
| 98 | 38.838 | | | 904 | 181 | | | |
| 99 | 39.067 | | | 1598 | 292 | | | |

Flags:
- A - Peak quantitates above calibration range
- a - Peak quantitates below reporting limit
- H - User selected alternate compound hit
- M - Peak manually integrated or manually identified
- R - Peak fails recovery
- U - User disabled peak ID: either peak quantitates below reporting limit or peak identification not confirmed on second column

## Target Compounds

| Peak RT | Expected RT | Target Compound |
|---|---|---|
| 4.999 | 5.001 | Tetrachloro-meta-xylene |
| | 5.761 | BZ#8 |
| | 6.701 | BZ#18 |
| 7.949 | 7.925 | BZ#28 |
| | 8.984 | BZ#52 |
| | 9.667 | BZ#44 |
| | 11.243 | BZ#66 |
| | 12.207 | BZ#101 |
| 13.785 | 13.752 | BZ#77 |
| | 14.938 | BZ#118 |
| | 15.993 | BZ#153 |

## STL Burlington - Target GC Injection Report

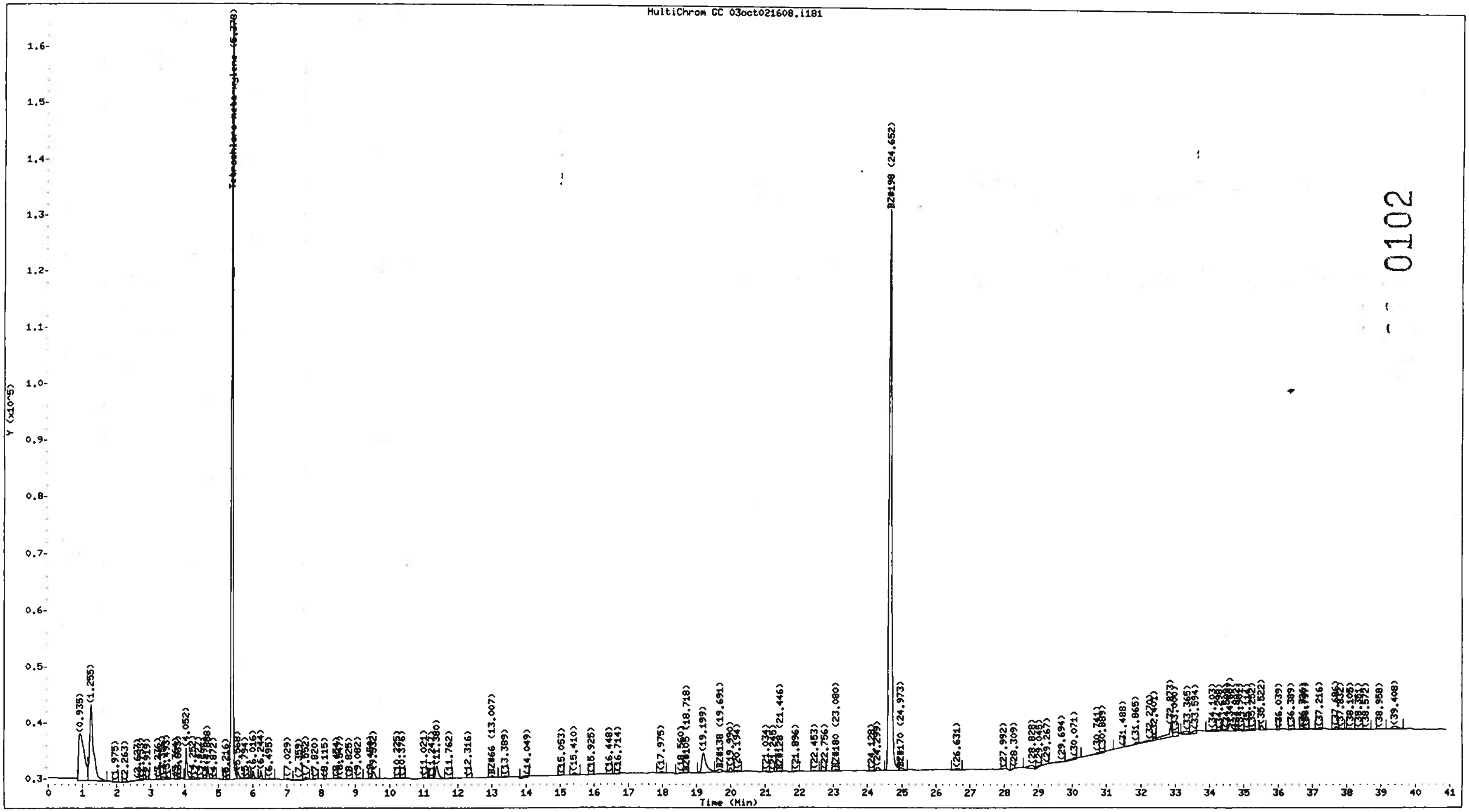
```
  Peak      Expected
   RT          RT                   Target Compound
========    ========    ====================================
               16.155   BZ#105
               17.328   BZ#138
               17.762   BZ#126
               18.647   BZ#128
               20.781   BZ#180
               22.271   BZ#170
  22.550       22.559   BZ#198
               24.552   BZ#195
               27.655   BZ#206
               29.180   BZ#209
```

# STL Burlington - Target GC Chromatogram

**Lab Sample ID: 502115** | **Client Sample ID: F01009LS41**

Matrix : SOIL
Analyst :
Instrument : 3327_2.i
Column : RTX-CLPII
Integrator : Falcon
Method : /var/chem/3327_2.i/100302_1/03OCT021608.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 09:56 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 12:41
Dilution Factor : 1.00
Data File : 03oct021608-r181.d
Compound Sublist: ENVNET



STL Burlington - Target GC Injection Report

```
 Lab Sample ID: 502115              Client Sample ID: F01009LS41

 Matrix        : SOIL               Sample Type      : SAMPLE
 Analyst       :                    Injection Date   : 04-OCT-2002 12:41
 Instrument    : 3327_2.i           Dilution Factor  : 1.00
 Column        : RTX-CLPII          Data File        : 03oct021608-r181.d
 Integrator    : Falcon             Compound Sublist: ENVNET
 Method        : /var/chem/3327_2.i/100302_1/03OCT021608.b/32CONG_3327RTXCLPII_RAW.m
 Reported      : 17-Oct-2002 09:56 rrm

 ______________________________ Peaks ______________________________

                                                        Extract
 Peak     Peak    Expected   Delta                       Conc.
  No.      RT        RT        RT       Area    Height   (ppb)     Flags          Peak Identification
 =====  ========  ========  ========  ========  ========  ==========  =====  ====================================
     1     0.935                         95239      8381
     2     1.255                        107969     13547
     3     1.975                           411        75
     4     2.263                           492        87
     5     2.627                          1558       155
     6     2.733                           781       208
     7     2.919                           603       126
     8     3.236                           596       156
     9     3.356                          2759       475
    10     3.493                          2319       618
    11     3.764                           579       156
    12     3.833                          1449       391
    13     4.052                         18159      5521
    14     4.252                          2941       501
    15     4.427                          1726       265
    16     4.595                           970       194
    17     4.688                          6980      2322
    18     4.872                           881       165
    19     5.216                           368        97
$   20     5.378     5.391    -0.013    469201    159576     42.3458          Tetrachloro-meta-xylene
    21     5.568                          6133      1272
    22     5.794                          1677       201
    23     6.016                          5010      1430
    24     6.244                          4831      1470
    25     6.495                          1312       213
    26     7.029                          2136       318
    27     7.359                          2011       183
    28     7.552                          2037       514
    29     7.820                           571       133
    30     8.115                           231        76
    31     8.454                           846       179
    32     8.547                          2094       328
    33     8.825                           475       107
    34     9.082                          1257       234
    35     9.450                          1127       389
    36     9.532                          7001      1295
    37    10.225                           741       154
    38    10.376                           923       213
    39    11.021                           797       226
    40    11.247                           495       100
    41    11.380                         13052      2157
    42    11.762                           876       151
    43    12.316                           414        90
    44    13.007    13.056    -0.049      2356       405     1.92420   a      BZ#66
    45    13.389                          1752       248
    46    14.049                          3241       191
    47    15.053                           665       117
    48    15.410                          2773       364
    49    15.925                           497        92
    50    16.448                           888       139
    51    16.714                           984       146
    52    17.975                          2199       284
    53    18.560                          1033        99
    54    18.718    18.720    -0.002       427        83     2.81603   a      BZ#105
    55    19.199                         31018      3494
```

|  | Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|---|
|  | 56 | 19.691 | 19.713 | -0.022 | 6603 | 522 | 0.499080 | a | BZ#138 |
|  | 57 | 19.990 |  |  | 4328 | 702 |  |  |  |
|  | 58 | 20.194 |  |  | 2764 | 318 |  |  |  |
|  | 59 | 21.034 |  |  | 1146 | 186 |  |  |  |
|  | 60 | 21.245 |  |  | 255 | 37 |  |  |  |
|  | 61 | 21.446 | 21.462 | -0.016 | 797 | 136 | 1.03835 | a | BZ#128 |
|  | 62 | 21.896 |  |  | 1076 | 178 |  |  |  |
|  | 63 | 22.453 |  |  | 1276 | 229 |  |  |  |
|  | 64 | 22.756 |  |  | 638 | 130 |  |  |  |
|  | 65 | 23.080 | 23.115 | -0.035 | 1710 | 326 | 0.587333 | a | BZ#180 |
|  | 66 | 24.128 |  |  | 368 | 84 |  |  |  |
|  | 67 | 24.299 |  |  | 4149 | 617 |  |  |  |
| $ | 68 | 24.652 | 24.678 | -0.027 | 535021 | 100155 | 42.0587 |  | BZ#198 |
|  | 69 | 24.973 | 25.004 | -0.031 | 4063 | 447 | 0.955157 | a | BZ#170 |
|  | 70 | 26.631 |  |  | 2780 | 274 |  |  |  |
|  | 71 | 27.992 |  |  | 420 | 90 |  |  |  |
|  | 72 | 28.309 |  |  | 530 | 35 |  |  |  |
|  | 73 | 28.828 |  |  | 6772 | 565 |  |  |  |
|  | 74 | 29.045 |  |  | 1529 | 242 |  |  |  |
|  | 75 | 29.267 |  |  | 467 | 80 |  |  |  |
|  | 76 | 29.694 |  |  | 4074 | 196 |  |  |  |
|  | 77 | 30.071 |  |  | 5133 | 385 |  |  |  |
|  | 78 | 30.741 |  |  | 3397 | 293 |  |  |  |
|  | 79 | 30.889 |  |  | 2345 | 340 |  |  |  |
|  | 80 | 31.488 |  |  | 575 | 52 |  |  |  |
|  | 81 | 31.865 |  |  | 2456 | 369 |  |  |  |
|  | 82 | 32.270 |  |  | 3510 | 195 |  |  |  |
|  | 83 | 32.401 |  |  | 2000 | 664 |  |  |  |
|  | 84 | 32.873 |  |  | 17269 | 2055 |  |  |  |
|  | 85 | 33.000 |  |  | 6812 | 716 |  |  |  |
|  | 86 | 33.365 |  |  | 5790 | 504 |  |  |  |
|  | 87 | 33.594 |  |  | 4516 | 505 |  |  |  |
|  | 88 | 34.103 |  |  | 4710 | 391 |  |  |  |
|  | 89 | 34.298 |  |  | 1696 | 254 |  |  |  |
|  | 90 | 34.509 |  |  | 2078 | 318 |  |  |  |
|  | 91 | 34.607 |  |  | 8883 | 1380 |  |  |  |
|  | 92 | 34.802 |  |  | 1624 | 315 |  |  |  |
|  | 93 | 34.901 |  |  | 1868 | 314 |  |  |  |
|  | 94 | 35.114 |  |  | 1310 | 215 |  |  |  |
|  | 95 | 35.252 |  |  | 2130 | 298 |  |  |  |
|  | 96 | 35.522 |  |  | 4891 | 916 |  |  |  |
|  | 97 | 36.039 |  |  | 482 | 128 |  |  |  |
|  | 98 | 36.389 |  |  | 1067 | 217 |  |  |  |
|  | 99 | 36.726 |  |  | 585 | 143 |  |  |  |
|  | 100 | 36.797 |  |  | 1732 | 226 |  |  |  |
|  | 101 | 37.216 |  |  | 2050 | 297 |  |  |  |
|  | 102 | 37.686 |  |  | 2489 | 454 |  |  |  |
|  | 103 | 37.832 |  |  | 1209 | 186 |  |  |  |
|  | 104 | 38.105 |  |  | 1288 | 227 |  |  |  |
|  | 105 | 38.351 |  |  | 1264 | 180 |  |  |  |
|  | 106 | 38.572 |  |  | 1065 | 139 |  |  |  |
|  | 107 | 38.958 |  |  | 787 | 118 |  |  |  |
|  | 108 | 39.408 |  |  | 7032 | 521 |  |  |  |

Flags:
A - Peak quantitates above calibration range
a - Peak quantitates below reporting limit
H - User selected alternate compound hit
M - Peak manually integrated or manually identified
R - Peak fails recovery
U - User disabled peak ID: either peak quantitates below reporting limit or peak identification not confirmed on second column

## Target Compounds

| Peak RT | Expected RT | Target Compound |
|---|---|---|
| 5.378 | 5.391 | Tetrachloro-meta-xylene |
|  | 6.592 | BZ#8 |

# STL Burlington - Target GC Injection Report

| Peak RT | Expected RT | Target Compound |
|---|---|---|
| | 7.698 | BZ#18 |
| | 9.137 | BZ#28 |
| | 10.341 | BZ#52 |
| | 11.312 | BZ#44 |
| 13.007 | 13.056 | BZ#66 |
| | 13.914 | BZ#101 |
| | 16.080 | BZ#77 |
| | 17.075 | BZ#118 |
| | 17.995 | BZ#153 |
| 18.718 | 18.720 | BZ#105 |
| 19.691 | 19.713 | BZ#138 |
| | 20.225 | BZ#126 |
| 21.446 | 21.462 | BZ#128 |
| 23.080 | 23.115 | BZ#180 |
| 24.652 | 24.678 | BZ#198 |
| 24.973 | 25.004 | BZ#170 |
| | 27.203 | BZ#195 |
| | 29.805 | BZ#206 |
| | 30.754 | BZ#209 |

FORM 1
OTHER ORGANICS ANALYSIS DATA SHEET

ENVNET SAMPLE NO.

F01009LS42

Lab Name: STL BURLINGTON Contract: 22000

Lab Code: STLVT Case No.: 22000 SAS No.: SDG No.: 89891

Matrix: (soil/water) SOIL Lab Sample ID: 502114

Sample wt/vol: 30.0 (g/mL) G Lab File ID: 03OCT021608-R171

% Moisture: 29 decanted: (Y/N) N Date Received: 09/25/02

Extraction: (SepF/Cont/Sonc) SOXH Date Extracted: 09/26/02

Concentrated Extract Volume: 10(mL) Date Analyzed: 10/04/02

Injection Volume: 1.0(uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: ___ Sulfur Cleanup: (Y/N) Y

| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG | Q |
|---|---|---|---|
| 34883-43-7 | BZ#8 | 2.4 | U |
| 37680-65-2 | BZ#18 | 2.4 | U |
| 7012-37-5 | BZ#28 | 2.4 | U |
| 41464-39-5 | BZ#44 | 2.4 | U |
| 35693-99-3 | BZ#52 | 2.4 | U |
| 32598-10-0 | BZ#66 | 2.4 | U |
| 32598-13-3 | BZ#77 | 2.4 | U |
| 37680-73-2 | BZ#101 | 2.4 | U |
| 32598-14-4 | BZ#105 | 2.4 | U |
| 31508-00-6 | BZ#118 | 2.4 | U |
| 57465-28-8 | BZ#126 | 2.4 | U |
| 38380-07-3 | BZ#128 | 2.4 | U |
| 35065-28-2 | BZ#138 | 2.4 | U |
| 35065-27-1 | BZ#153 | 2.4 | U |
| 35065-30-6 | BZ#170 | 2.4 | U |
| 35065-29-3 | BZ#180 | 2.4 | U |
| 52663-68-0 | BZ#187 | 2.4 | U |
| 52663-78-2 | BZ#195 | 2.4 | U |
| 40186-72-9 | BZ#206 | 2.4 | U |
| 2051-24-3 | BZ#209 | 2.4 | U |

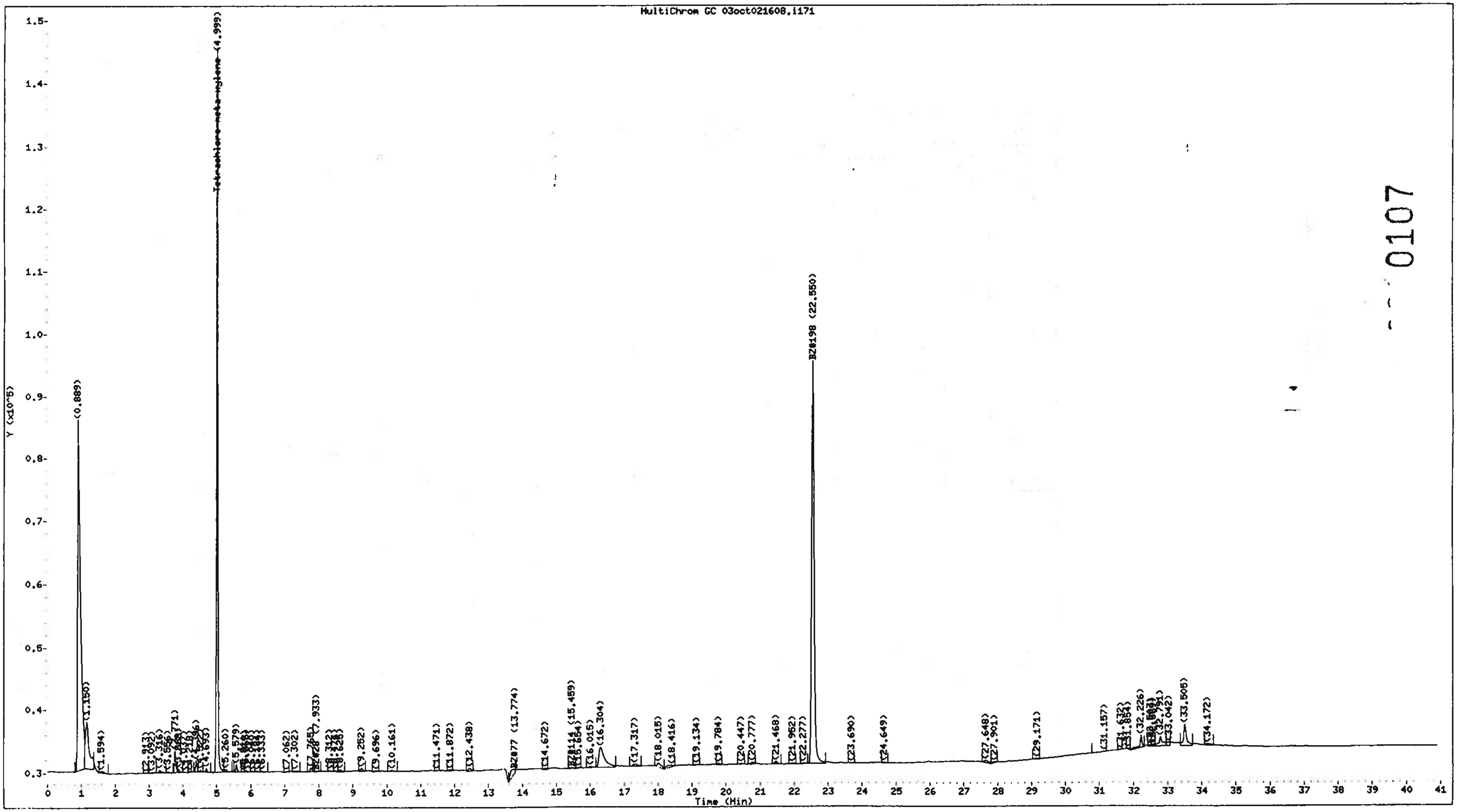
## STL Burlington - Target GC Chromatogram

Lab Sample ID: 502114    Client Sample ID: F01009LS42

| | | | |
|---|---|---|---|
| Matrix | : SOIL | Sample Type | : SAMPLE |
| Analyst | : | Injection Date | : 04-OCT-2002 11:55 |
| Instrument | : 3327_1.i | Dilution Factor | : 1.00 |
| Column | : RTX-5 | Data File | : 03oct021608-r171.d |
| Integrator | : Falcon | Compound Sublist | : ENVNET |

Method : /var/chem/3327_1.i/100302_1/03OCT021608.b/32CONG_3327RTX5_RAW.m

Reported : 17-Oct-2002 09:45 rrm



# STL Burlington - Target GC Injection Report

Lab Sample ID: 502114 Client Sample ID: F01009LS42

Matrix : SOIL
Analyst :
Instrument : 3327_1.i
Column : RTX-5
Integrator : Falcon
Method : /var/chem/3327_1.i/100302_1/03OCT021608.b/32CONG_3327RTX5_RAW.m
Reported : 17-Oct-2002 09:45 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 11:55
Dilution Factor : 1.00
Data File : 03oct021608-r171.d
Compound Sublist: ENVNET

## Peaks

| | Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0.889 | | | 338916 | 55922 | | | |
| | 2 | 1.150 | | | 58490 | 7375 | | | |
| | 3 | 1.594 | | | 2322 | 282 | | | |
| | 4 | 2.913 | | | 321 | 95 | | | |
| | 5 | 3.092 | | | 886 | 125 | | | |
| | 6 | 3.316 | | | 2730 | 469 | | | |
| | 7 | 3.556 | | | 1071 | 211 | | | |
| | 8 | 3.771 | | | 9827 | 3476 | | | |
| | 9 | 3.868 | | | 2037 | 517 | | | |
| | 10 | 4.037 | | | 355 | 104 | | | |
| | 11 | 4.218 | | | 383 | 154 | | | |
| | 12 | 4.396 | | | 4769 | 1801 | | | |
| | 13 | 4.522 | | | 1080 | 316 | | | |
| | 14 | 4.693 | | | 1794 | 610 | | | |
| $ | 15 | 4.999 | 5.001 | -0.002 | 291256 | 115494 | 36.6624 | | Tetrachloro-meta-xylene |
| | 16 | 5.260 | | | 2750 | 415 | | | |
| | 17 | 5.579 | | | 3401 | 1136 | | | |
| | 18 | 5.810 | | | 268 | 72 | | | |
| | 19 | 5.865 | | | 822 | 222 | | | |
| | 20 | 6.040 | | | 569 | 190 | | | |
| | 21 | 6.184 | | | 640 | 175 | | | |
| | 22 | 6.333 | | | 840 | 123 | | | |
| | 23 | 7.062 | | | 650 | 121 | | | |
| | 24 | 7.302 | | | 1073 | 163 | | | |
| | 25 | 7.765 | | | 2173 | 577 | | | |
| | 26 | 7.933 | 7.925 | 0.009 | 710 | 84 | 0.198765 | a | BZ#28 |
| | 27 | 8.312 | | | 798 | 172 | | | |
| | 28 | 8.474 | | | 713 | 185 | | | |
| | 29 | 8.625 | | | 1333 | 270 | | | |
| | 30 | 9.252 | | | 2632 | 474 | | | |
| | 31 | 9.696 | | | 845 | 114 | | | |
| | 32 | 10.161 | | | 1174 | 170 | | | |
| | 33 | 11.471 | | | 205 | 56 | | | |
| | 34 | 11.872 | | | 953 | 150 | | | |
| | 35 | 12.438 | | | 3127 | 448 | | | |
| | 36 | 13.774 | 13.752 | 0.022 | 10294 | 660 | 3.26306 | a | BZ#77 |
| | 37 | 14.672 | | | 1768 | 237 | | | |
| | 38 | 15.459 | | | 713 | 127 | | | |
| | 39 | 15.654 | | | 562 | 119 | | | |
| | 40 | 16.015 | | | 1587 | 169 | | | |
| | 41 | 16.304 | | | 39578 | 3230 | | | |
| | 42 | 17.317 | | | 3681 | 344 | | | |
| | 43 | 18.015 | | | 5849 | 673 | | | |
| | 44 | 18.416 | | | 4609 | 231 | | | |
| | 45 | 19.134 | | | 839 | 143 | | | |
| | 46 | 19.784 | | | 1064 | 209 | | | |
| | 47 | 20.447 | | | 701 | 147 | | | |
| | 48 | 20.777 | | | 2093 | 288 | | | |
| | 49 | 21.468 | | | 2247 | 446 | | | |
| | 50 | 21.952 | | | 802 | 141 | | | |
| | 51 | 22.277 | | | 660 | 113 | | | |
| $ | 52 | 22.550 | 22.559 | -0.009 | 333212 | 64245 | 43.0422 | | BZ#198 |
| | 53 | 23.690 | | | 690 | 107 | | | |
| | 54 | 24.649 | | | 758 | 136 | | | |
| | 55 | 27.648 | | | 2680 | 319 | | | |

# STL Burlington - Target GC Injection Report

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| 56 | 27.901 | | | 1213 | 191 | | | |
| 57 | 29.171 | | | 1290 | 175 | | | |
| 58 | 31.157 | | | 951 | 63 | | | |
| 59 | 31.632 | | | 267 | 65 | | | |
| 60 | 31.854 | | | 825 | 200 | | | |
| 61 | 32.226 | | | 10333 | 1909 | | | |
| 62 | 32.503 | | | 1277 | 248 | | | |
| 63 | 32.569 | | | 1698 | 317 | | | |
| 64 | 32.791 | | | 11597 | 1456 | | | |
| 65 | 33.042 | | | 3852 | 520 | | | |
| 66 | 33.505 | | | 20770 | 3372 | | | |
| 67 | 34.172 | | | 3042 | 274 | | | |

Flags:
A - Peak quantitates above calibration range
a - Peak quantitates below reporting limit
H - User selected alternate compound hit
M - Peak manually integrated or manually identified
R - Peak fails recovery
U - User disabled peak ID: either peak quantitates below reporting limit or peak identification not confirmed on second column

## Target Compounds

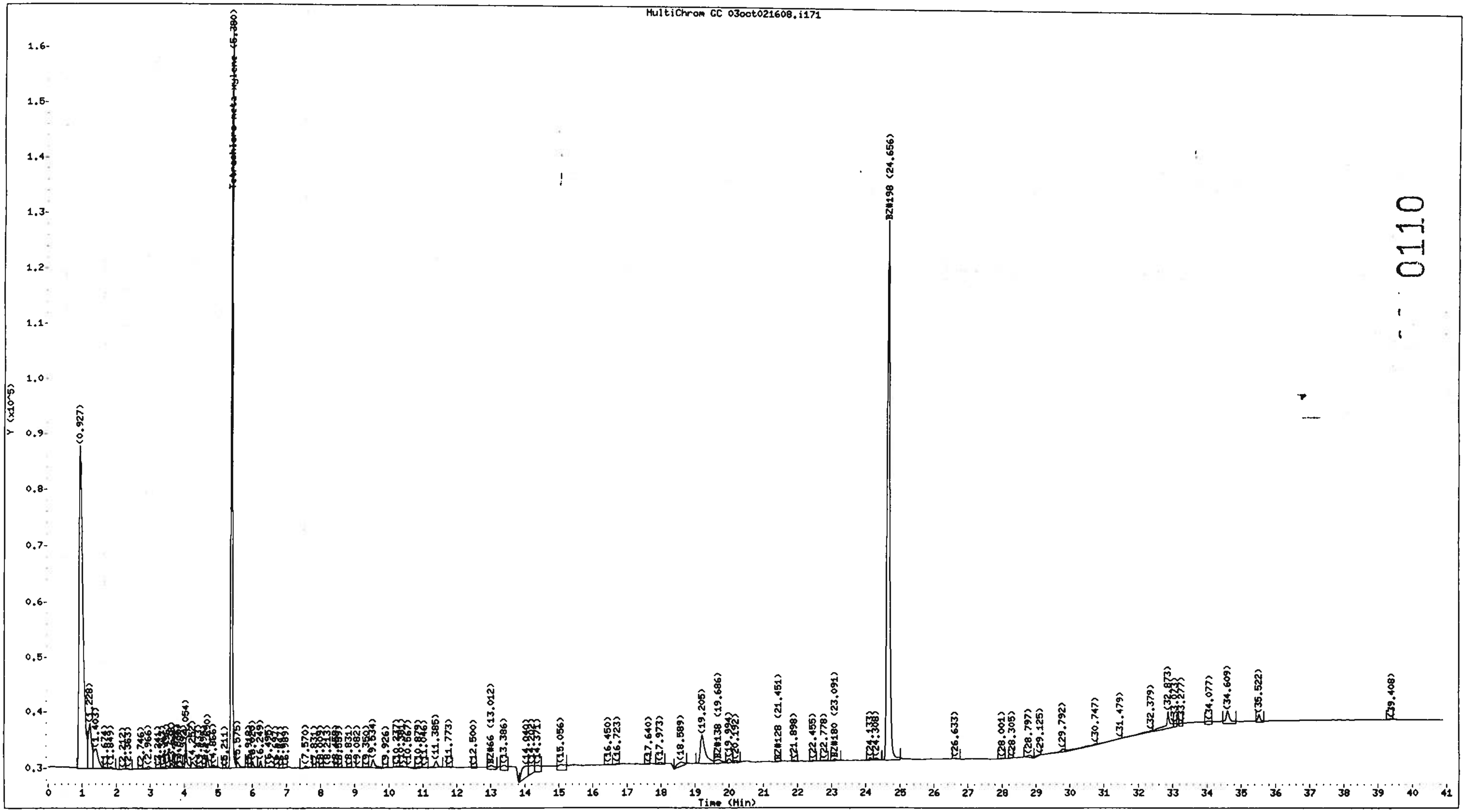
| Peak RT | Expected RT | Target Compound |
|---|---|---|
| 4.999 | 5.001 | Tetrachloro-meta-xylene |
| | 5.761 | BZ#8 |
| | 6.701 | BZ#18 |
| 7.933 | 7.925 | BZ#28 |
| | 8.984 | BZ#52 |
| | 9.667 | BZ#44 |
| | 11.243 | BZ#66 |
| | 12.207 | BZ#101 |
| 13.774 | 13.752 | BZ#77 |
| | 14.938 | BZ#118 |
| | 15.993 | BZ#153 |
| | 16.155 | BZ#105 |
| | 17.328 | BZ#138 |
| | 17.762 | BZ#126 |
| | 18.647 | BZ#128 |
| | 20.781 | BZ#180 |
| | 22.271 | BZ#170 |
| 22.550 | 22.559 | BZ#198 |
| | 24.552 | BZ#195 |
| | 27.655 | BZ#206 |
| | 29.180 | BZ#209 |

STL Burlington - Target GC Chromatogram

| | |
|---|---|
| Lab Sample ID: 502114 | Client Sample ID: F01009LS42 |

Matrix : SOIL
Analyst :
Instrument : 3327_2.i
Column : RTX-CLPII
Integrator : Falcon
Method : /var/chem/3327_2.i/100302_1/03OCT021608.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 09:56 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 11:55
Dilution Factor : 1.00
Data File : 03oct021608-r171.d
Compound Sublist: ENVNET



# STL Burlington - Target GC Injection Report

Lab Sample ID: 502114 Client Sample ID: F01009LS42

Matrix : SOIL
Analyst :
Instrument : 3327_2.i
Column : RTX-CLPII
Integrator : Falcon
Method : /var/chem/3327_2.i/100302_1/03OCT021608.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 09:56 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 11:55
Dilution Factor : 1.00
Data File : 03oct021608-r171.d
Compound Sublist: ENVNET

## Peaks

| | Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0.927 | | | 456156 | 57855 | | | |
| | 2 | 1.228 | | | 54796 | 7922 | | | |
| | 3 | 1.403 | | | 33262 | 3478 | | | |
| | 4 | 1.674 | | | 1346 | 273 | | | |
| | 5 | 1.849 | | | 2322 | 304 | | | |
| | 6 | 2.212 | | | 376 | 62 | | | |
| | 7 | 2.363 | | | 494 | 95 | | | |
| | 8 | 2.746 | | | 517 | 115 | | | |
| | 9 | 2.966 | | | 3869 | 402 | | | |
| | 10 | 3.241 | | | 871 | 183 | | | |
| | 11 | 3.367 | | | 1497 | 223 | | | |
| | 12 | 3.496 | | | 2504 | 505 | | | |
| | 13 | 3.638 | | | 3796 | 849 | | | |
| | 14 | 3.773 | | | 958 | 267 | | | |
| | 15 | 3.835 | | | 2421 | 406 | | | |
| | 16 | 3.992 | | | 592 | 219 | | | |
| | 17 | 4.054 | | | 16403 | 4792 | | | |
| | 18 | 4.252 | | | 6237 | 1052 | | | |
| | 19 | 4.433 | | | 2165 | 327 | | | |
| | 20 | 4.595 | | | 1216 | 237 | | | |
| | 21 | 4.690 | | | 6902 | 2256 | | | |
| | 22 | 4.866 | | | 3045 | 480 | | | |
| | 23 | 5.211 | | | 281 | 81 | | | |
| $ | 24 | 5.380 | 5.391 | -0.011 | 391668 | 135041 | 35.9325 | | Tetrachloro-meta-xylene |
| | 25 | 5.575 | | | 6079 | 1057 | | | |
| | 26 | 5.918 | | | 623 | 165 | | | |
| | 27 | 6.020 | | | 3697 | 1075 | | | |
| | 28 | 6.249 | | | 3782 | 1132 | | | |
| | 29 | 6.495 | | | 1796 | 305 | | | |
| | 30 | 6.697 | | | 464 | 121 | | | |
| | 31 | 6.847 | | | 282 | 84 | | | |
| | 32 | 6.989 | | | 454 | 115 | | | |
| | 33 | 7.570 | | | 2790 | 345 | | | |
| | 34 | 7.831 | | | 208 | 57 | | | |
| | 35 | 8.009 | | | 509 | 152 | | | |
| | 36 | 8.213 | | | 2228 | 177 | | | |
| | 37 | 8.459 | | | 551 | 134 | | | |
| | 38 | 8.559 | | | 407 | 105 | | | |
| | 39 | 8.831 | | | 886 | 203 | | | |
| | 40 | 9.082 | | | 896 | 159 | | | |
| | 41 | 9.350 | | | 757 | 151 | | | |
| | 42 | 9.534 | | | 10059 | 1393 | | | |
| | 43 | 9.926 | | | 643 | 104 | | | |
| | 44 | 10.237 | | | 1326 | 248 | | | |
| | 45 | 10.381 | | | 2036 | 327 | | | |
| | 46 | 10.567 | | | 1226 | 172 | | | |
| | 47 | 10.879 | | | 1547 | 258 | | | |
| | 48 | 11.046 | | | 432 | 95 | | | |
| | 49 | 11.385 | | | 7400 | 1081 | | | |
| | 50 | 11.773 | | | 847 | 180 | | | |
| | 51 | 12.500 | | | 1635 | 233 | | | |
| | 52 | 13.012 | 13.056 | -0.044 | 8259 | 709 | 2.10816 | a | BZ#66 |
| | 53 | 13.386 | | | 10281 | 930 | | | |
| | 54 | 14.040 | | | 27412 | 1986 | | | |
| | 55 | 14.202 | | | 15665 | 1442 | | | |

# STL Burlington - Target GC Injection Report

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| 56 | 14.371 | | | 12082 | 1098 | | | |
| 57 | 15.056 | | | 14887 | 988 | | | |
| 58 | 16.450 | | | 812 | 132 | | | |
| 59 | 16.723 | | | 1420 | 186 | | | |
| 60 | 17.640 | | | 989 | 163 | | | |
| 61 | 17.973 | | | 3421 | 361 | | | |
| 62 | 18.589 | | | 10230 | 737 | | | |
| 63 | 19.205 | | | 49374 | 5071 | | | |
| 64 | 19.686 | 19.713 | -0.027 | 8309 | 618 | 0.546659 | a | BZ#138 |
| 65 | 19.994 | | | 5303 | 767 | | | |
| 66 | 20.192 | | | 3500 | 366 | | | |
| 67 | 21.451 | 21.462 | -0.011 | 755 | 129 | 1.03527 | a | BZ#128 |
| 68 | 21.898 | | | 951 | 200 | | | |
| 69 | 22.455 | | | 1019 | 192 | | | |
| 70 | 22.778 | | | 938 | 138 | | | |
| 71 | 23.091 | 23.115 | -0.024 | 2314 | 365 | 0.604496 | a | BZ#180 |
| 72 | 24.133 | | | 2046 | 452 | | | |
| 73 | 24.308 | | | 2450 | 389 | | | |
| $ 74 | 24.656 | 24.678 | -0.022 | 532567 | 97894 | 41.1056 | | BZ#198 |
| 75 | 26.633 | | | 1033 | 157 | | | |
| 76 | 28.001 | | | 764 | 136 | | | |
| 77 | 28.305 | | | 231 | 46 | | | |
| 78 | 28.797 | | | 4060 | 406 | | | |
| 79 | 29.125 | | | 1663 | 57 | | | |
| 80 | 29.792 | | | 5888 | 557 | | | |
| 81 | 30.747 | | | 9822 | 313 | | | |
| 82 | 31.479 | | | 3608 | 81 | | | |
| 83 | 32.379 | | | 7500 | 260 | | | |
| 84 | 32.873 | | | 24205 | 2991 | | | |
| 85 | 33.073 | | | 3992 | 650 | | | |
| 86 | 33.277 | | | 4194 | 662 | | | |
| 87 | 34.077 | | | 6851 | 626 | | | |
| 88 | 34.609 | | | 19212 | 2248 | | | |
| 89 | 35.522 | | | 8079 | 1394 | | | |
| 90 | 39.408 | | | 805 | 113 | | | |

Flags: A - Peak quantitates above calibration range
a - Peak quantitates below reporting limit
H - User selected alternate compound hit
M - Peak manually integrated or manually identified
R - Peak fails recovery
U - User disabled peak ID: either peak quantitates below reporting limit or peak identification not confirmed on second column

## Target Compounds

| Peak RT | Expected RT | Target Compound |
|---|---|---|
| 5.380 | 5.391 | Tetrachloro-meta-xylene |
| | 6.592 | BZ#8 |
| | 7.698 | BZ#18 |
| | 9.137 | BZ#28 |
| | 10.341 | BZ#52 |
| | 11.312 | BZ#44 |
| 13.012 | 13.056 | BZ#66 |
| | 13.914 | BZ#101 |
| | 16.080 | BZ#77 |
| | 17.075 | BZ#118 |
| | 17.995 | BZ#153 |
| | 18.720 | BZ#105 |
| 19.686 | 19.713 | BZ#138 |
| | 20.225 | BZ#126 |
| 21.451 | 21.462 | BZ#128 |
| 23.091 | 23.115 | BZ#180 |
| 24.656 | 24.678 | BZ#198 |
| | 25.004 | BZ#170 |
| | 27.203 | BZ#195 |
| | 29.805 | BZ#206 |

0112

## STL Burlington - Target GC Injection Report

```
  Peak      Expected
   RT          RT                  Target Compound
========    ========    ====================================
             30.754     BZ#209
```

FORM 1
OTHER ORGANICS ANALYSIS DATA SHEET

ENVNET SAMPLE NO.

F01009LS43

Lab Name: STL BURLINGTON Contract: 22000

Lab Code: STLVT Case No.: 22000 SAS No.: SDG No.: 89891

Matrix: (soil/water) SOIL Lab Sample ID: 502113

Sample wt/vol: 30.0 (g/mL) G Lab File ID: 03OCT021608-R161

% Moisture: 32 decanted: (Y/N) N Date Received: 09/25/02

Extraction: (SepF/Cont/Sonc) SOXH Date Extracted: 09/26/02

Concentrated Extract Volume: 10(mL) Date Analyzed: 10/04/02

Injection Volume: 1.0(uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: ___ Sulfur Cleanup: (Y/N) Y

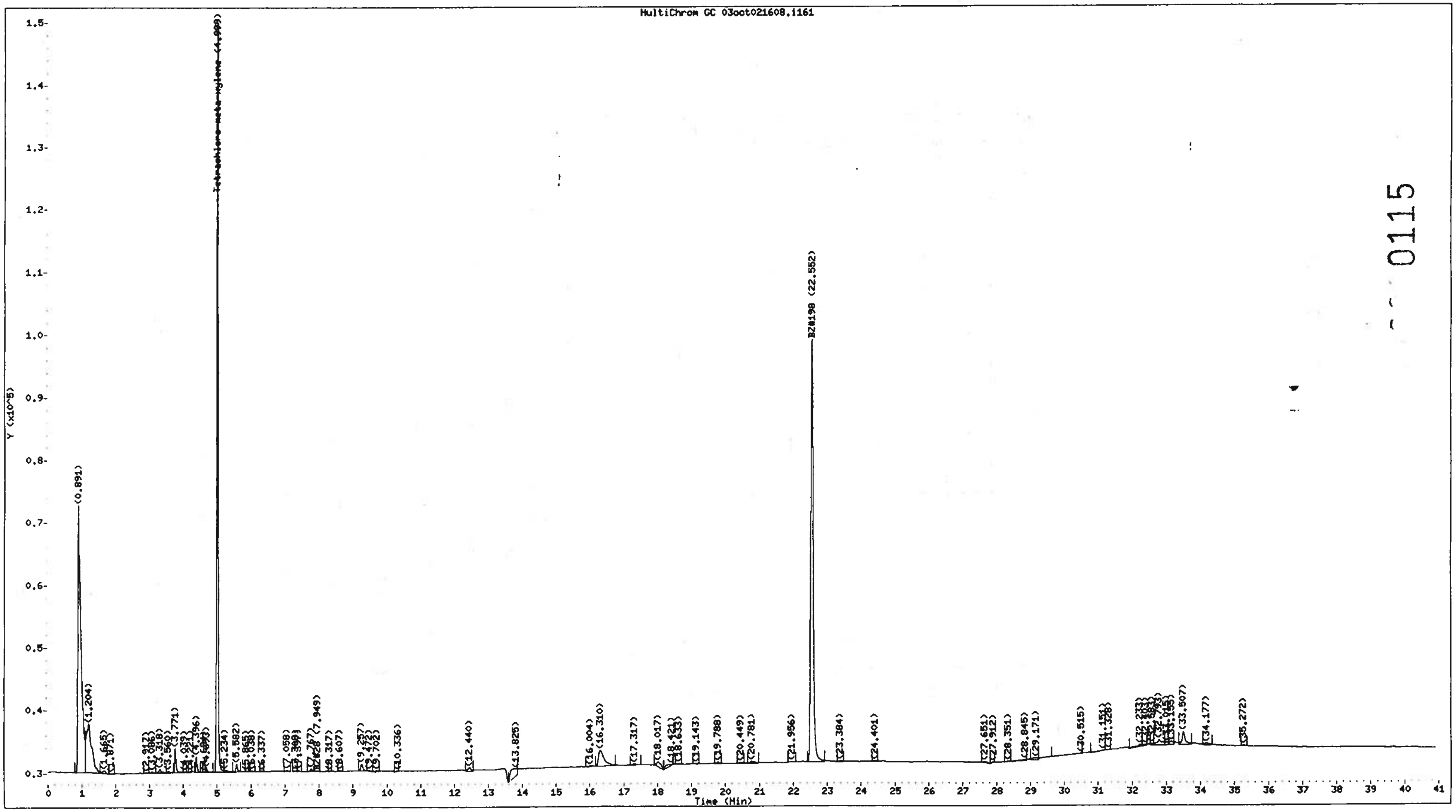
| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG | Q |
|---|---|---|---|
| 34883-43-7 | ------BZ#8 | 2.4 | U |
| 37680-65-2 | ------BZ#18 | 2.4 | U |
| 7012-37-5 | -------BZ#28 | 2.4 | U |
| 41464-39-5 | ------BZ#44 | 2.4 | U |
| 35693-99-3 | ------BZ#52 | 2.4 | U |
| 32598-10-0 | ------BZ#66 | 2.4 | U |
| 32598-13-3 | ------BZ#77 | 2.4 | U |
| 37680-73-2 | ------BZ#101 | 2.4 | U |
| 32598-14-4 | ------BZ#105 | 2.4 | U |
| 31508-00-6 | ------BZ#118 | 2.4 | U |
| 57465-28-8 | ------BZ#126 | 2.4 | U |
| 38380-07-3 | ------BZ#128 | 2.4 | U |
| 35065-28-2 | ------BZ#138 | 2.4 | U |
| 35065-27-1 | ------BZ#153 | 2.4 | U |
| 35065-30-6 | ------BZ#170 | 2.4 | U |
| 35065-29-3 | ------BZ#180 | 2.4 | U |
| 52663-68-0 | ------BZ#187 | 2.4 | U |
| 52663-78-2 | ------BZ#195 | 2.4 | U |
| 40186-72-9 | ------BZ#206 | 2.4 | U |
| 2051-24-3 | -------BZ#209 | 2.4 | U |

## STL Burlington - Target GC Chromatogram

Lab Sample ID: 502113 Client Sample ID: F01009LS43

Matrix : SOIL
Analyst :
Instrument : 3327_1.i
Column : RTX-5
Integrator : Falcon
Method : /var/chem/3327_1.i/100302_1/03OCT021608.b/32CONG_3327RTX5_RAW.m
Reported : 17-Oct-2002 09:45 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 11:10
Dilution Factor : 1.00
Data File : 03oct021608-r161.d
Compound Sublist: ENVNET



# STL Burlington - Target GC Injection Report

| Lab Sample ID: 502113 | Client Sample ID: F01009LS43 |
|---|---|

Matrix : SOIL
Analyst :
Instrument : 3327_1.i
Column : RTX-5
Integrator : Falcon
Method : /var/chem/3327_1.i/100302_1/03OCT021608.b/32CONG_3327RTX5_RAW.m
Reported : 17-Oct-2002 09:45 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 11:10
Dilution Factor : 1.00
Data File : 03oct021608-r161.d
Compound Sublist: ENVNET

## Peaks

| | Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0.891 | | | 273749 | 42731 | | | |
| | 2 | 1.204 | | | 90838 | 7737 | | | |
| | 3 | 1.665 | | | 3043 | 429 | | | |
| | 4 | 1.871 | | | 320 | 71 | | | |
| | 5 | 2.917 | | | 547 | 137 | | | |
| | 6 | 3.086 | | | 1029 | 209 | | | |
| | 7 | 3.318 | | | 3191 | 563 | | | |
| | 8 | 3.560 | | | 1295 | 242 | | | |
| | 9 | 3.771 | | | 11839 | 3849 | | | |
| | 10 | 4.039 | | | 311 | 110 | | | |
| | 11 | 4.221 | | | 467 | 167 | | | |
| | 12 | 4.396 | | | 6678 | 2519 | | | |
| | 13 | 4.624 | | | 300 | 117 | | | |
| | 14 | 4.693 | | | 2248 | 695 | | | |
| $ | 15 | 4.999 | 5.001 | -0.002 | 321524 | 127124 | 40.3430 | | Tetrachloro-meta-xylene |
| | 16 | 5.234 | | | 2827 | 331 | | | |
| | 17 | 5.582 | | | 4265 | 1302 | | | |
| | 18 | 5.865 | | | 479 | 128 | | | |
| | 19 | 6.038 | | | 451 | 156 | | | |
| | 20 | 6.337 | | | 389 | 99 | | | |
| | 21 | 7.058 | | | 1303 | 227 | | | |
| | 22 | 7.308 | | | 715 | 173 | | | |
| | 23 | 7.397 | | | 662 | 232 | | | |
| | 24 | 7.767 | | | 1678 | 433 | | | |
| | 25 | 7.949 | 7.925 | 0.024 | 391 | 80 | 0.195732 | a | BZ#28 |
| | 26 | 8.317 | | | 278 | 88 | | | |
| | 27 | 8.607 | | | 481 | 144 | | | |
| | 28 | 9.257 | | | 5609 | 1166 | | | |
| | 29 | 9.472 | | | 997 | 166 | | | |
| | 30 | 9.702 | | | 1040 | 142 | | | |
| | 31 | 10.336 | | | 291 | 35 | | | |
| | 32 | 12.440 | | | 4906 | 649 | | | |
| | 33 | 13.825 | | | 19396 | 1122 | | | |
| | 34 | 16.004 | | | 1135 | 137 | | | |
| | 35 | 16.310 | | | 30187 | 2529 | | | |
| | 36 | 17.317 | | | 1725 | 195 | | | |
| | 37 | 18.017 | | | 7223 | 810 | | | |
| | 38 | 18.421 | | | 4580 | 123 | | | |
| | 39 | 18.633 | | | 603 | 118 | | | |
| | 40 | 19.143 | | | 783 | 136 | | | |
| | 41 | 19.788 | | | 1428 | 246 | | | |
| | 42 | 20.449 | | | 878 | 169 | | | |
| | 43 | 20.781 | | | 2580 | 264 | | | |
| | 44 | 21.956 | | | 790 | 135 | | | |
| $ | 45 | 22.552 | 22.559 | -0.007 | 348988 | 67573 | 45.3576 | | BZ#198 |
| | 46 | 23.384 | | | 1129 | 177 | | | |
| | 47 | 24.401 | | | 838 | 141 | | | |
| | 48 | 27.651 | | | 1727 | 192 | | | |
| | 49 | 27.912 | | | 440 | 65 | | | |
| | 50 | 28.351 | | | 582 | 111 | | | |
| | 51 | 28.845 | | | 2773 | 145 | | | |
| | 52 | 29.171 | | | 3676 | 315 | | | |
| | 53 | 30.515 | | | 1311 | 9 | | | |
| | 54 | 31.151 | | | 1179 | 103 | | | |
| | 55 | 31.328 | | | 252 | 44 | | | |

# STL Burlington - Target GC Injection Report

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| 56 | 32.233 | | | 3572 | 340 | | | |
| 57 | 32.403 | | | 1389 | 190 | | | |
| 58 | 32.583 | | | 1333 | 283 | | | |
| 59 | 32.793 | | | 8954 | 885 | | | |
| 60 | 33.015 | | | 2928 | 446 | | | |
| 61 | 33.155 | | | 4523 | 555 | | | |
| 62 | 33.507 | | | 14783 | 2085 | | | |
| 63 | 34.177 | | | 2764 | 259 | | | |
| 64 | 35.272 | | | 436 | 102 | | | |

Flags:
A - Peak quantitates above calibration range
a - Peak quantitates below reporting limit
H - User selected alternate compound hit
M - Peak manually integrated or manually identified
R - Peak fails recovery
U - User disabled peak ID: either peak quantitates below reporting limit or peak identification not confirmed on second column

## Target Compounds

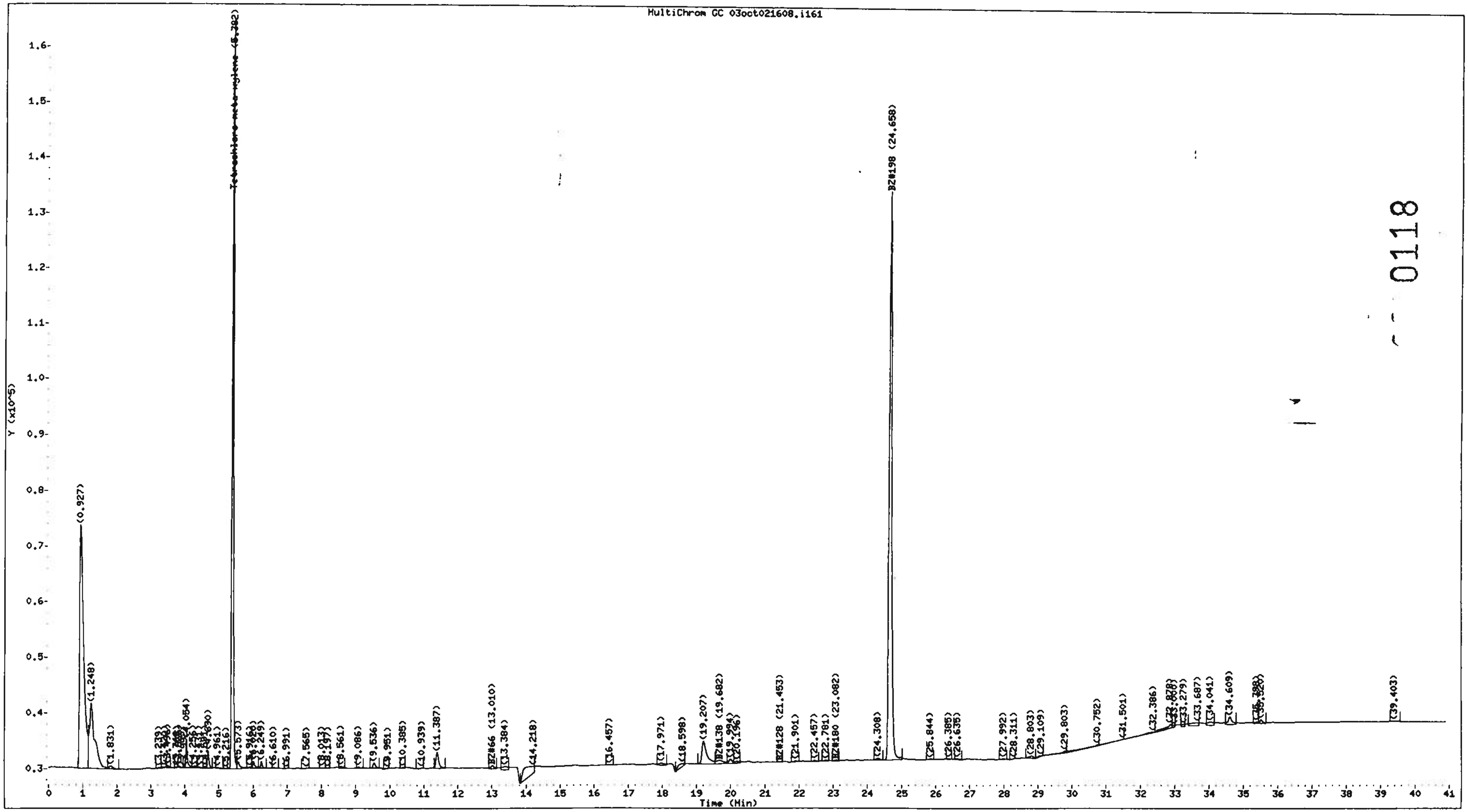
| Peak RT | Expected RT | Target Compound |
|---|---|---|
| 4.999 | 5.001 | Tetrachloro-meta-xylene |
| | 5.761 | BZ#8 |
| | 6.701 | BZ#18 |
| 7.949 | 7.925 | BZ#28 |
| | 8.984 | BZ#52 |
| | 9.667 | BZ#44 |
| | 11.243 | BZ#66 |
| | 12.207 | BZ#101 |
| | 13.752 | BZ#77 |
| | 14.938 | BZ#118 |
| | 15.993 | BZ#153 |
| | 16.155 | BZ#105 |
| | 17.328 | BZ#138 |
| | 17.762 | BZ#126 |
| | 18.647 | BZ#128 |
| | 20.781 | BZ#180 |
| | 22.271 | BZ#170 |
| 22.552 | 22.559 | BZ#198 |
| | 24.552 | BZ#195 |
| | 27.655 | BZ#206 |
| | 29.180 | BZ#209 |

# STL Burlington - Target GC Chromatogram

| Lab Sample ID: 502113 | Client Sample ID: F01009LS43 |
|---|---|

Matrix : SOIL
Analyst :
Instrument : 3327_2.i
Column : RTX-CLPII
Integrator : Falcon
Method : /var/chem/3327_2.i/100302_1/03OCT021608.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 09:56 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 11:10
Dilution Factor : 1.00
Data File : 03oct021608-r161.d
Compound Sublist: ENVNET



# STL Burlington - Target GC Injection Report

Lab Sample ID: 502113　　Client Sample ID: F01009LS43

| | | | |
|---|---|---|---|
| Matrix | : SOIL | Sample Type | : SAMPLE |
| Analyst | : | Injection Date | : 04-OCT-2002 11:10 |
| Instrument | : 3327_2.i | Dilution Factor | : 1.00 |
| Column | : RTX-CLPII | Data File | : 03oct021608-r161.d |
| Integrator | : Falcon | Compound Sublist: | ENVNET |

Method : /var/chem/3327_2.i/100302_1/03OCT021608.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 09:56 rrm

## Peaks

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.927 | | | 362919 | 43840 | | | |
| 2 | 1.248 | | | 131974 | 11781 | | | |
| 3 | 1.831 | | | 4562 | 533 | | | |
| 4 | 3.239 | | | 854 | 223 | | | |
| 5 | 3.420 | | | 1094 | 206 | | | |
| 6 | 3.496 | | | 1779 | 493 | | | |
| 7 | 3.768 | | | 718 | 232 | | | |
| 8 | 3.835 | | | 1435 | 345 | | | |
| 9 | 3.992 | | | 291 | 121 | | | |
| 10 | 4.054 | | | 16563 | 5147 | | | |
| 11 | 4.256 | | | 2180 | 319 | | | |
| 12 | 4.431 | | | 1269 | 189 | | | |
| 13 | 4.591 | | | 1333 | 289 | | | |
| 14 | 4.690 | | | 9220 | 3143 | | | |
| 15 | 4.961 | | | 1392 | 207 | | | |
| 16 | 5.216 | | | 427 | 103 | | | |
| $ 17 | 5.382 | 5.391 | -0.009 | 435429 | 148679 | 39.4974 | | Tetrachloro-meta-xylene |
| 18 | 5.573 | | | 7018 | 1243 | | | |
| 19 | 5.916 | | | 1683 | 253 | | | |
| 20 | 6.020 | | | 4969 | 1224 | | | |
| 21 | 6.249 | | | 4360 | 1259 | | | |
| 22 | 6.610 | | | 861 | 167 | | | |
| 23 | 6.991 | | | 226 | 59 | | | |
| 24 | 7.565 | | | 831 | 90 | | | |
| 25 | 8.013 | | | 507 | 132 | | | |
| 26 | 8.197 | | | 563 | 105 | | | |
| 27 | 8.561 | | | 2046 | 300 | | | |
| 28 | 9.086 | | | 1096 | 216 | | | |
| 29 | 9.536 | | | 5083 | 946 | | | |
| 30 | 9.951 | | | 753 | 75 | | | |
| 31 | 10.385 | | | 1038 | 191 | | | |
| 32 | 10.939 | | | 842 | 92 | | | |
| 33 | 11.387 | | | 16741 | 2863 | | | |
| 34 | 13.010 | 13.056 | -0.047 | 4589 | 618 | 2.05309 | a | BZ#66 |
| 35 | 13.384 | | | 6727 | 586 | | | |
| 36 | 14.218 | | | 38857 | 1198 | | | |
| 37 | 16.457 | | | 631 | 120 | | | |
| 38 | 17.971 | | | 4066 | 358 | | | |
| 39 | 18.598 | | | 7629 | 483 | | | |
| 40 | 19.207 | | | 41054 | 4136 | | | |
| 41 | 19.682 | 19.713 | -0.031 | 9180 | 613 | 0.544180 | a | BZ#138 |
| 42 | 19.994 | | | 5331 | 766 | | | |
| 43 | 20.196 | | | 3040 | 355 | | | |
| 44 | 21.453 | 21.462 | -0.009 | 634 | 109 | 1.02648 | a | BZ#128 |
| 45 | 21.901 | | | 1260 | 227 | | | |
| 46 | 22.457 | | | 1162 | 215 | | | |
| 47 | 22.781 | | | 1177 | 165 | | | |
| 48 | 23.082 | 23.115 | -0.033 | 1122 | 213 | 0.537602 | a | BZ#180 |
| 49 | 24.308 | | | 2304 | 374 | | | |
| $ 50 | 24.658 | 24.678 | -0.020 | 560450 | 102851 | 43.1951 | | BZ#198 |
| 51 | 25.844 | | | 952 | 135 | | | |
| 52 | 26.385 | | | 886 | 151 | | | |
| 53 | 26.635 | | | 1235 | 171 | | | |
| 54 | 27.992 | | | 933 | 146 | | | |
| 55 | 28.311 | | | 278 | 35 | | | |

## STL Burlington - Target GC Injection Report

```
                                                           Extract
Peak     Peak    Expected   Delta                          Conc.
 No.      RT       RT        RT       Area     Height      (ppb)    Flags            Peak Identification
=====  ========  ========  ========  ========  ========  ==========  =====  ======================================
   56    28.803                          3452       358
   57    29.109                          1603       125
   58    29.803                          4634       328
   59    30.752                          8724       234
   60    31.501                          3832        33
   61    32.386                          6127       179
   62    32.878                          9210       668
   63    33.000                          1856       405
   64    33.279                          2675       457
   65    33.687                          8619       541
   66    34.041                          6346       582
   67    34.609                         11660      1402
   68    35.398                          1964       291
   69    35.520                          4344       710
   70    39.403                          1534       159

Flags:  A - Peak quantitates above calibration range
        a - Peak quantitates below reporting limit
        H - User selected alternate compound hit
        M - Peak manually integrated or manually identified
        R - Peak fails recovery
        U - User disabled peak ID: either peak quantitates below reporting limit or
            peak identification not confirmed on second column
```

### Target Compounds

```
                          Peak       Expected
                           RT          RT                 Target Compound
                         ========    ========    ======================================
                            5.382       5.391    Tetrachloro-meta-xylene
                                        6.592    BZ#8
                                        7.698    BZ#18
                                        9.137    BZ#28
                                       10.341    BZ#52
                                       11.312    BZ#44
                           13.010      13.056    BZ#66
                                       13.914    BZ#101
                                       16.080    BZ#77
                                       17.075    BZ#118
                                       17.995    BZ#153
                                       18.720    BZ#105
                           19.682      19.713    BZ#138
                                       20.225    BZ#126
                           21.453      21.462    BZ#128
                           23.082      23.115    BZ#180
                           24.658      24.678    BZ#198
                                       25.004    BZ#170
                                       27.203    BZ#195
                                       29.805    BZ#206
                                       30.754    BZ#209
```

FORM 1
OTHER ORGANICS ANALYSIS DATA SHEET

ENVNET SAMPLE NO.

F01009LS51

Lab Name: STL BURLINGTON Contract: 22000

Lab Code: STLVT Case No.: 22000 SAS No.: SDG No.: 89891

Matrix: (soil/water) SOIL Lab Sample ID: 502118

Sample wt/vol: 30.0 (g/mL) G Lab File ID: 03OCT021608-R211

% Moisture: 38 decanted: (Y/N) N Date Received: 09/25/02

Extraction: (SepF/Cont/Sonc) SOXH Date Extracted: 09/26/02

Concentrated Extract Volume: 10(mL) Date Analyzed: 10/04/02

Injection Volume: 1.0(uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: ___ Sulfur Cleanup: (Y/N) Y

| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG | Q |
|---|---|---|---|
| 34883-43-7 | BZ#8 | 2.7 | U |
| 37680-65-2 | BZ#18 | 2.7 | U |
| 7012-37-5 | BZ#28 | 2.7 | U |
| 41464-39-5 | BZ#44 | 2.7 | U |
| 35693-99-3 | BZ#52 | 2.7 | U |
| 32598-10-0 | BZ#66 | 2.7 | U |
| 32598-13-3 | BZ#77 | 2.7 | U |
| 37680-73-2 | BZ#101 | 2.7 | U |
| 32598-14-4 | BZ#105 | 2.7 | U |
| 31508-00-6 | BZ#118 | 2.7 | U |
| 57465-28-8 | BZ#126 | 2.7 | U |
| 38380-07-3 | BZ#128 | 2.7 | U |
| 35065-28-2 | BZ#138 | 2.7 | U |
| 35065-27-1 | BZ#153 | 2.7 | U |
| 35065-30-6 | BZ#170 | 2.7 | U |
| 35065-29-3 | BZ#180 | 2.7 | U |
| 52663-68-0 | BZ#187 | 2.7 | U |
| 52663-78-2 | BZ#195 | 2.7 | U |
| 40186-72-9 | BZ#206 | 2.7 | U |
| 2051-24-3 | BZ#209 | 2.7 | U |

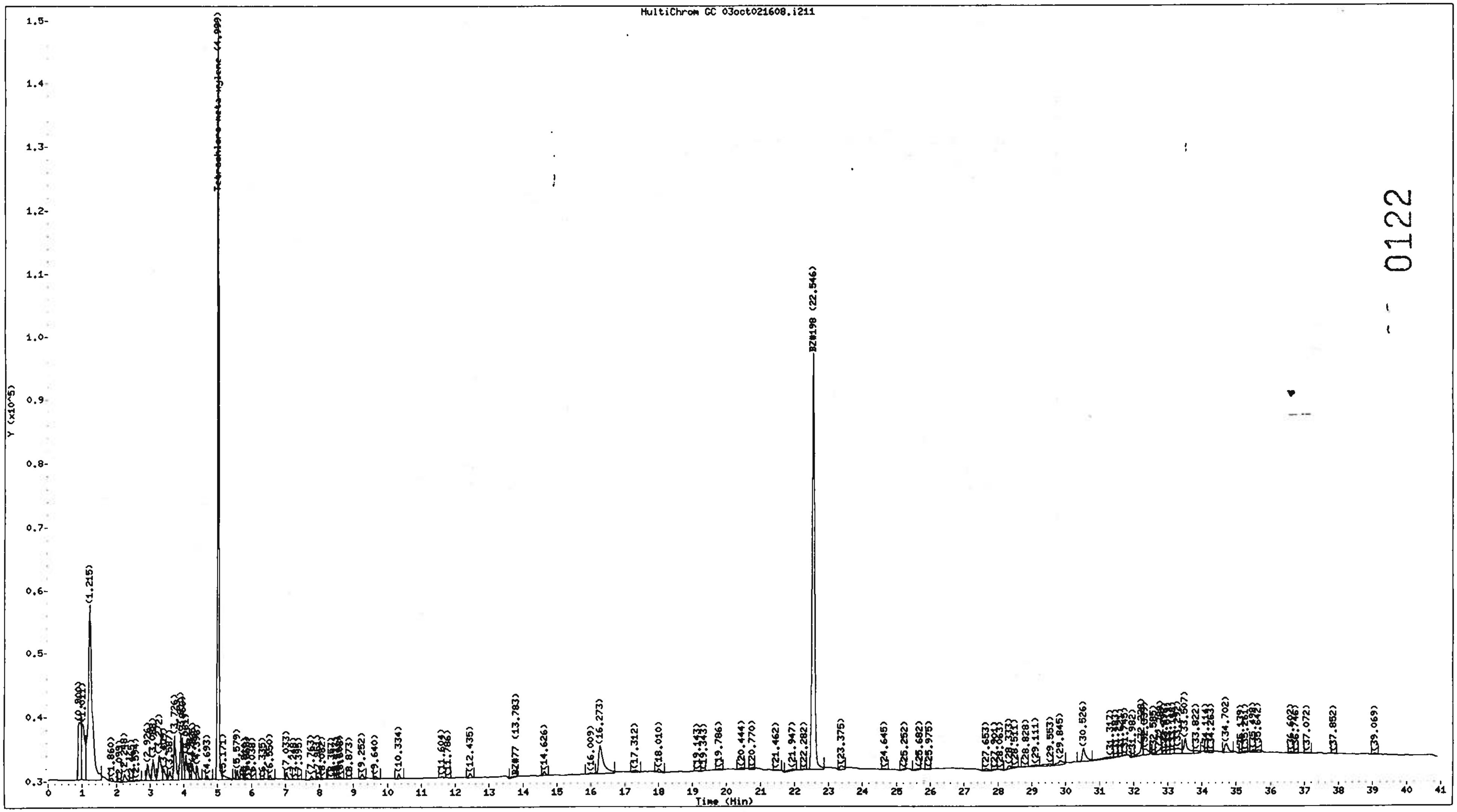
FORM I OTHER

## STL Burlington - Target GC Chromatogram

Lab Sample ID: 502118    Client Sample ID: F01009LS51

Matrix : SOIL
Analyst :
Instrument : 3327_1.i
Column : RTX-5
Integrator : Falcon
Method : /var/chem/3327_1.i/100302_1/03OCT021608.b/32CONG_3327RTX5_RAW.m
Reported : 17-Oct-2002 09:45 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 14:56
Dilution Factor : 1.00
Data File : 03oct021608-r211.d
Compound Sublist: ENVNET



# STL Burlington - Target GC Injection Report

Lab Sample ID: 502118 Client Sample ID: F01009LS51

Matrix : SOIL
Analyst :
Instrument : 3327_1.i
Column : RTX-5
Integrator : Falcon
Method : /var/chem/3327_1.i/100302_1/03OCT021608.b/32CONG_3327RTX5_RAW.m
Reported : 17-Oct-2002 09:45 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 14:56
Dilution Factor : 1.00
Data File : 03oct021608-r211.d
Compound Sublist: ENVNET

## Peaks

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.900 | | | 53293 | 8952 | | | |
| 2 | 1.011 | | | 59116 | 8720 | | | |
| 3 | 1.215 | | | 218354 | 27561 | | | |
| 4 | 1.860 | | | 2907 | 520 | | | |
| 5 | 2.099 | | | 314 | 107 | | | |
| 6 | 2.248 | | | 6772 | 1220 | | | |
| 7 | 2.465 | | | 759 | 147 | | | |
| 8 | 2.594 | | | 1851 | 245 | | | |
| 9 | 2.926 | | | 10893 | 2640 | | | |
| 10 | 3.088 | | | 14675 | 3281 | | | |
| 11 | 3.272 | | | 22581 | 3844 | | | |
| 12 | 3.409 | | | 8315 | 1693 | | | |
| 13 | 3.587 | | | 6258 | 1388 | | | |
| 14 | 3.726 | | | 28848 | 6899 | | | |
| 15 | 3.910 | | | 21969 | 7246 | | | |
| 16 | 3.966 | | | 20039 | 6635 | | | |
| 17 | 4.061 | | | 17536 | 3902 | | | |
| 18 | 4.198 | | | 2198 | 865 | | | |
| 19 | 4.265 | | | 10604 | 2472 | | | |
| 20 | 4.396 | | | 7041 | 2162 | | | |
| 21 | 4.693 | | | 2185 | 595 | | | |
| $ 22 | 4.999 | 5.001 | -0.002 | 343599 | 137010 | 43.4716 | | Tetrachloro-meta-xylene |
| 23 | 5.171 | | | 6193 | 679 | | | |
| 24 | 5.579 | | | 4464 | 1444 | | | |
| 25 | 5.810 | | | 234 | 86 | | | |
| 26 | 5.868 | | | 965 | 258 | | | |
| 27 | 6.038 | | | 488 | 174 | | | |
| 28 | 6.335 | | | 600 | 141 | | | |
| 29 | 6.550 | | | 2514 | 663 | | | |
| 30 | 7.033 | | | 4009 | 1116 | | | |
| 31 | 7.248 | | | 531 | 121 | | | |
| 32 | 7.395 | | | 307 | 113 | | | |
| 33 | 7.763 | | | 3350 | 570 | | | |
| 34 | 7.951 | | | 2025 | 521 | | | |
| 35 | 8.082 | | | 1018 | 267 | | | |
| 36 | 8.357 | | | 550 | 88 | | | |
| 37 | 8.477 | | | 472 | 154 | | | |
| 38 | 8.541 | | | 748 | 239 | | | |
| 39 | 8.603 | | | 1498 | 363 | | | |
| 40 | 8.873 | | | 560 | 105 | | | |
| 41 | 9.252 | | | 4223 | 760 | | | |
| 42 | 9.640 | | | 2469 | 459 | | | |
| 43 | 10.334 | | | 3266 | 777 | | | |
| 44 | 11.604 | | | 988 | 225 | | | |
| 45 | 11.786 | | | 395 | 92 | | | |
| 46 | 12.435 | | | 3449 | 650 | | | |
| 47 | 13.783 | 13.752 | 0.031 | 2202 | 184 | 2.49129 | a | BZ#77 |
| 48 | 14.626 | | | 3005 | 635 | | | |
| 49 | 16.009 | | | 1529 | 159 | | | |
| 50 | 16.273 | | | 42747 | 4345 | | | |
| 51 | 17.312 | | | 3098 | 272 | | | |
| 52 | 18.010 | | | 3196 | 515 | | | |
| 53 | 19.143 | | | 585 | 113 | | | |
| 54 | 19.343 | | | 265 | 43 | | | |
| 55 | 19.786 | | | 1724 | 230 | | | |

# STL Burlington - Target GC Injection Report

| | Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|---|
| | 56 | 20.444 | | | 2817 | 340 | | | |
| | 57 | 20.770 | | | 2778 | 352 | | | |
| | 58 | 21.462 | | | 942 | 146 | | | |
| | 59 | 21.947 | | | 3597 | 279 | | | |
| | 60 | 22.282 | | | 637 | 98 | | | |
| $ | 61 | 22.546 | 22.559 | -0.013 | 333236 | 65688 | 44.0461 | | BZ#198 |
| | 62 | 23.375 | | | 5150 | 667 | | | |
| | 63 | 24.645 | | | 890 | 154 | | | |
| | 64 | 25.252 | | | 1156 | 137 | | | |
| | 65 | 25.682 | | | 2128 | 206 | | | |
| | 66 | 25.975 | | | 1445 | 206 | | | |
| | 67 | 27.653 | | | 2864 | 317 | | | |
| | 68 | 27.901 | | | 868 | 143 | | | |
| | 69 | 28.063 | | | 1006 | 164 | | | |
| | 70 | 28.333 | | | 2990 | 538 | | | |
| | 71 | 28.511 | | | 1519 | 238 | | | |
| | 72 | 28.828 | | | 998 | 134 | | | |
| | 73 | 29.111 | | | 3313 | 252 | | | |
| | 74 | 29.553 | | | 6312 | 361 | | | |
| | 75 | 29.845 | | | 8439 | 685 | | | |
| | 76 | 30.526 | | | 14380 | 2056 | | | |
| | 77 | 31.317 | | | 5292 | 189 | | | |
| | 78 | 31.483 | | | 804 | 176 | | | |
| | 79 | 31.621 | | | 377 | 98 | | | |
| | 80 | 31.745 | | | 604 | 155 | | | |
| | 81 | 31.982 | | | 553 | 142 | | | |
| | 82 | 32.228 | | | 8941 | 1486 | | | |
| | 83 | 32.339 | | | 8538 | 892 | | | |
| | 84 | 32.585 | | | 1044 | 313 | | | |
| | 85 | 32.789 | | | 6619 | 1031 | | | |
| | 86 | 32.898 | | | 3180 | 603 | | | |
| | 87 | 33.019 | | | 3850 | 662 | | | |
| | 88 | 33.148 | | | 5029 | 737 | | | |
| | 89 | 33.292 | | | 9940 | 840 | | | |
| | 90 | 33.507 | | | 17075 | 2289 | | | |
| | 91 | 33.822 | | | 4041 | 406 | | | |
| | 92 | 34.114 | | | 1237 | 309 | | | |
| | 93 | 34.263 | | | 3019 | 358 | | | |
| | 94 | 34.702 | | | 10793 | 1393 | | | |
| | 95 | 35.139 | | | 760 | 201 | | | |
| | 96 | 35.261 | | | 1923 | 264 | | | |
| | 97 | 35.498 | | | 2400 | 443 | | | |
| | 98 | 35.642 | | | 2743 | 387 | | | |
| | 99 | 36.602 | | | 1474 | 275 | | | |
| | 100 | 36.746 | | | 739 | 156 | | | |
| | 101 | 37.072 | | | 1004 | 180 | | | |
| | 102 | 37.852 | | | 808 | 148 | | | |
| | 103 | 39.069 | | | 1173 | 219 | | | |

Flags:
- A - Peak quantitates above calibration range
- a - Peak quantitates below reporting limit
- H - User selected alternate compound hit
- M - Peak manually integrated or manually identified
- R - Peak fails recovery
- U - User disabled peak ID: either peak quantitates below reporting limit or peak identification not confirmed on second column

## Target Compounds

| Peak RT | Expected RT | Target Compound |
|---|---|---|
| 4.999 | 5.001 | Tetrachloro-meta-xylene |
| | 5.761 | BZ#8 |
| | 6.701 | BZ#18 |
| | 7.925 | BZ#28 |
| | 8.984 | BZ#52 |
| | 9.667 | BZ#44 |
| | 11.243 | BZ#66 |

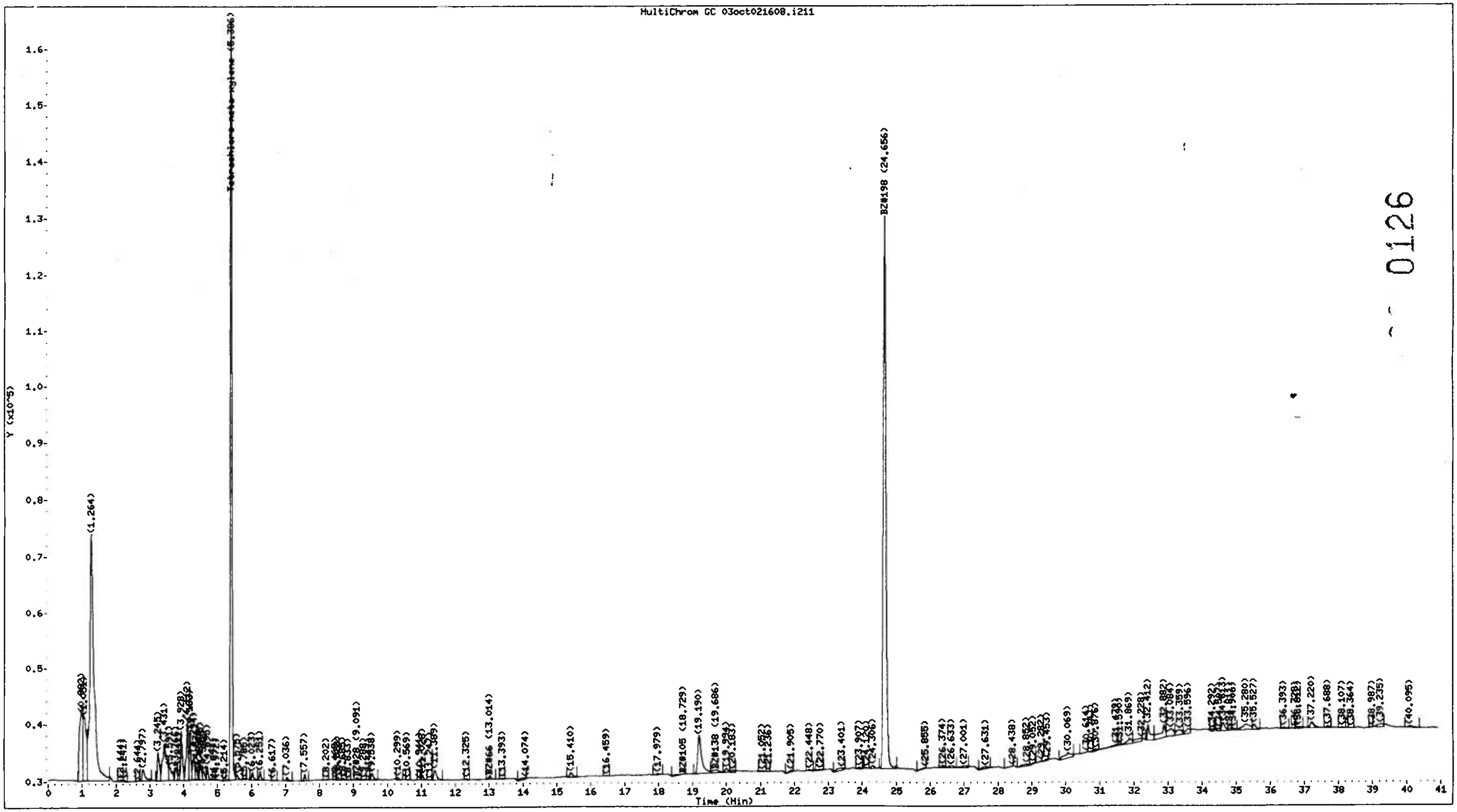
```
              STL Burlington - Target GC Injection Report

  Peak      Expected
   RT          RT                  Target Compound
========   ========   =====================================
             12.207   BZ#101
  13.783     13.752   BZ#77
             14.938   BZ#118
             15.993   BZ#153
             16.155   BZ#105
             17.328   BZ#138
             17.762   BZ#126
             18.647   BZ#128
             20.781   BZ#180
             22.271   BZ#170
  22.546     22.559   BZ#198
             24.552   BZ#195
             27.655   BZ#206
             29.180   BZ#209
```

# STL Burlington - Target GC Chromatogram

**Lab Sample ID: 502118** **Client Sample ID: F01009LS51**

Matrix : SOIL
Analyst :
Instrument : 3327_2.i
Column : RTX-CLPII
Integrator : Falcon
Method : /var/chem/3327_2.i/100302_1/03OCT021608.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 09:57 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 14:56
Dilution Factor : 1.00
Data File : 03oct021608-r211.d
Compound Sublist: ENVNET



# STL Burlington - Target GC Injection Report

**Lab Sample ID: 502118** **Client Sample ID: F01009LS51**

Matrix : SOIL
Analyst :
Instrument : 3327_2.i
Column : RTX-CLPII
Integrator : Falcon
Method : /var/chem/3327_2.i/100302_1/03OCT021608.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 09:57 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 14:56
Dilution Factor : 1.00
Data File : 03oct021608-r211.d
Compound Sublist: ENVNET

## Peaks

| | Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0.982 | | | 79152 | 11845 | | | |
| | 2 | 1.051 | | | 74401 | 11255 | | | |
| | 3 | 1.264 | | | 372482 | 43833 | | | |
| | 4 | 2.144 | | | 1825 | 358 | | | |
| | 5 | 2.241 | | | 1436 | 362 | | | |
| | 6 | 2.644 | | | 319 | 91 | | | |
| | 7 | 2.797 | | | 13976 | 2039 | | | |
| | 8 | 3.245 | | | 20924 | 4893 | | | |
| | 9 | 3.431 | | | 54132 | 6423 | | | |
| | 10 | 3.591 | | | 14651 | 2355 | | | |
| | 11 | 3.766 | | | 8610 | 2286 | | | |
| | 12 | 3.841 | | | 3799 | 1214 | | | |
| | 13 | 3.928 | | | 31318 | 8524 | | | |
| | 14 | 4.112 | | | 39693 | 10279 | | | |
| | 15 | 4.183 | | | 26901 | 8778 | | | |
| | 16 | 4.294 | | | 17281 | 4598 | | | |
| | 17 | 4.371 | | | 7433 | 2523 | | | |
| | 18 | 4.451 | | | 2430 | 1251 | | | |
| | 19 | 4.495 | | | 9783 | 2901 | | | |
| | 20 | 4.582 | | | 6109 | 1564 | | | |
| | 21 | 4.695 | | | 7544 | 2401 | | | |
| | 22 | 4.897 | | | 363 | 99 | | | |
| | 23 | 4.972 | | | 1266 | 166 | | | |
| | 24 | 5.214 | | | 197 | 44 | | | |
| $ | 25 | 5.386 | 5.391 | -0.004 | 469529 | 160701 | 42.6398 | | Tetrachloro-meta-xylene |
| | 26 | 5.575 | | | 3760 | 896 | | | |
| | 27 | 5.785 | | | 1291 | 297 | | | |
| | 28 | 6.023 | | | 4879 | 1295 | | | |
| | 29 | 6.251 | | | 4450 | 1425 | | | |
| | 30 | 6.617 | | | 549 | 135 | | | |
| | 31 | 7.036 | | | 3104 | 664 | | | |
| | 32 | 7.557 | | | 3697 | 1139 | | | |
| | 33 | 8.202 | | | 839 | 154 | | | |
| | 34 | 8.465 | | | 915 | 217 | | | |
| | 35 | 8.528 | | | 2531 | 544 | | | |
| | 36 | 8.685 | | | 1193 | 350 | | | |
| | 37 | 8.833 | | | 306 | 95 | | | |
| | 38 | 9.091 | 9.137 | -0.047 | 2371 | 422 | 1.31493 | a | BZ#28 |
| | 39 | 9.288 | | | 671 | 136 | | | |
| | 40 | 9.447 | | | 655 | 162 | | | |
| | 41 | 9.538 | | | 5909 | 1094 | | | |
| | 42 | 10.299 | | | 2029 | 435 | | | |
| | 43 | 10.569 | | | 640 | 170 | | | |
| | 44 | 10.941 | | | 257 | 78 | | | |
| | 45 | 11.028 | | | 3262 | 829 | | | |
| | 46 | 11.247 | | | 674 | 128 | | | |
| | 47 | 11.389 | | | 9967 | 1687 | | | |
| | 48 | 12.325 | | | 752 | 197 | | | |
| | 49 | 13.014 | 13.056 | -0.042 | 3512 | 658 | 2.07730 | a | BZ#66 |
| | 50 | 13.393 | | | 1179 | 177 | | | |
| | 51 | 14.074 | | | 3801 | 199 | | | |
| | 52 | 15.410 | | | 5346 | 795 | | | |
| | 53 | 16.459 | | | 668 | 115 | | | |
| | 54 | 17.979 | | | 1503 | 206 | | | |
| | 55 | 18.729 | 18.720 | 0.009 | 2187 | 50[illegible] | 2.80036 | a | BZ#105 |

# STL Burlington - Target GC Injection Report

| | Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|---|
| | 56 | 19.190 | | | 52936 | 6633 | | | |
| | 57 | 19.686 | 19.713 | -0.027 | 7035 | 511 | 0.493629 | a | BZ#138 |
| | 58 | 19.994 | | | 3983 | 690 | | | |
| | 59 | 20.183 | | | 2767 | 336 | | | |
| | 60 | 21.052 | | | 1617 | 208 | | | |
| | 61 | 21.236 | | | 336 | 84 | | | |
| | 62 | 21.905 | | | 1630 | 231 | | | |
| | 63 | 22.448 | | | 1136 | 226 | | | |
| | 64 | 22.770 | | | 1222 | 157 | | | |
| | 65 | 23.401 | | | 5739 | 331 | | | |
| | 66 | 23.907 | | | 1937 | 280 | | | |
| | 67 | 24.120 | | | 1179 | 210 | | | |
| | 68 | 24.306 | | | 3932 | 513 | | | |
| $ | 69 | 24.656 | 24.678 | -0.022 | 531541 | 98310 | 41.2810 | | BZ#198 |
| | 70 | 25.855 | | | 2082 | 93 | | | |
| | 71 | 26.374 | | | 2723 | 474 | | | |
| | 72 | 26.633 | | | 4159 | 392 | | | |
| | 73 | 27.001 | | | 4941 | 364 | | | |
| | 74 | 27.631 | | | 4134 | 334 | | | |
| | 75 | 28.438 | | | 892 | 14 | | | |
| | 76 | 28.852 | | | 5272 | 358 | | | |
| | 77 | 29.052 | | | 1196 | 200 | | | |
| | 78 | 29.282 | | | 661 | 105 | | | |
| | 79 | 29.453 | | | 1544 | 254 | | | |
| | 80 | 30.069 | | | 12352 | 896 | | | |
| | 81 | 30.614 | | | 790 | 103 | | | |
| | 82 | 30.747 | | | 668 | 166 | | | |
| | 83 | 30.876 | | | 1978 | 392 | | | |
| | 84 | 31.479 | | | 3898 | 246 | | | |
| | 85 | 31.590 | | | 869 | 180 | | | |
| | 86 | 31.869 | | | 8660 | 961 | | | |
| | 87 | 32.228 | | | 8399 | 492 | | | |
| | 88 | 32.412 | | | 16872 | 2688 | | | |
| | 89 | 32.882 | | | 22467 | 2232 | | | |
| | 90 | 33.084 | | | 16177 | 1297 | | | |
| | 91 | 33.359 | | | 10643 | 885 | | | |
| | 92 | 33.596 | | | 8436 | 838 | | | |
| | 93 | 34.292 | | | 2161 | 340 | | | |
| | 94 | 34.507 | | | 2654 | 396 | | | |
| | 95 | 34.613 | | | 9455 | 1382 | | | |
| | 96 | 34.811 | | | 2127 | 392 | | | |
| | 97 | 34.906 | | | 2477 | 368 | | | |
| | 98 | 35.280 | | | 15976 | 976 | | | |
| | 99 | 35.527 | | | 6533 | 987 | | | |
| | 100 | 36.393 | | | 1738 | 250 | | | |
| | 101 | 36.728 | | | 379 | 113 | | | |
| | 102 | 36.812 | | | 2468 | 240 | | | |
| | 103 | 37.220 | | | 8746 | 1036 | | | |
| | 104 | 37.688 | | | 1987 | 379 | | | |
| | 105 | 38.107 | | | 952 | 185 | | | |
| | 106 | 38.364 | | | 410 | 89 | | | |
| | 107 | 38.987 | | | 366 | 86 | | | |
| | 108 | 39.235 | | | 7064 | 556 | | | |
| | 109 | 40.095 | | | 3375 | 269 | | | |

Flags:
A - Peak quantitates above calibration range
a - Peak quantitates below reporting limit
H - User selected alternate compound hit
M - Peak manually integrated or manually identified
R - Peak fails recovery
U - User disabled peak ID: either peak quantitates below reporting limit or peak identification not confirmed on second column

## Target Compounds

| Peak RT | Expected RT | Target Compound |
|---|---|---|
| 5.386 | 5.391 | Tetrachloro-meta-xylene |
| | 6.592 | BZ#8 |
| | 7.698 | BZ#18 |
| 9.091 | 9.137 | BZ#28 |
| | 10.341 | BZ#52 |
| | 11.312 | BZ#44 |
| 13.014 | 13.056 | BZ#66 |
| | 13.914 | BZ#101 |
| | 16.080 | BZ#77 |
| | 17.075 | BZ#118 |
| | 17.995 | BZ#153 |
| 18.729 | 18.720 | BZ#105 |
| 19.686 | 19.713 | BZ#138 |
| | 20.225 | BZ#126 |
| | 21.462 | BZ#128 |
| | 23.115 | BZ#180 |
| 24.656 | 24.678 | BZ#198 |
| | 25.004 | BZ#170 |
| | 27.203 | BZ#195 |
| | 29.805 | BZ#206 |
| | 30.754 | BZ#209 |

FORM 1
OTHER ORGANICS ANALYSIS DATA SHEET

ENVNET SAMPLE NO.

F01009LS52

Lab Name: STL BURLINGTON Contract: 22000

Lab Code: STLVT Case No.: 22000 SAS No.: SDG No.: 89891

Matrix: (soil/water) SOIL Lab Sample ID: 502117

Sample wt/vol: 30.0 (g/mL) G Lab File ID: 03OCT021608-R201

% Moisture: 24 decanted: (Y/N) N Date Received: 09/25/02

Extraction: (SepF/Cont/Sonc) SOXH Date Extracted: 09/26/02

Concentrated Extract Volume: 10(mL) Date Analyzed: 10/04/02

Injection Volume: 1.0(uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: ___ Sulfur Cleanup: (Y/N) Y

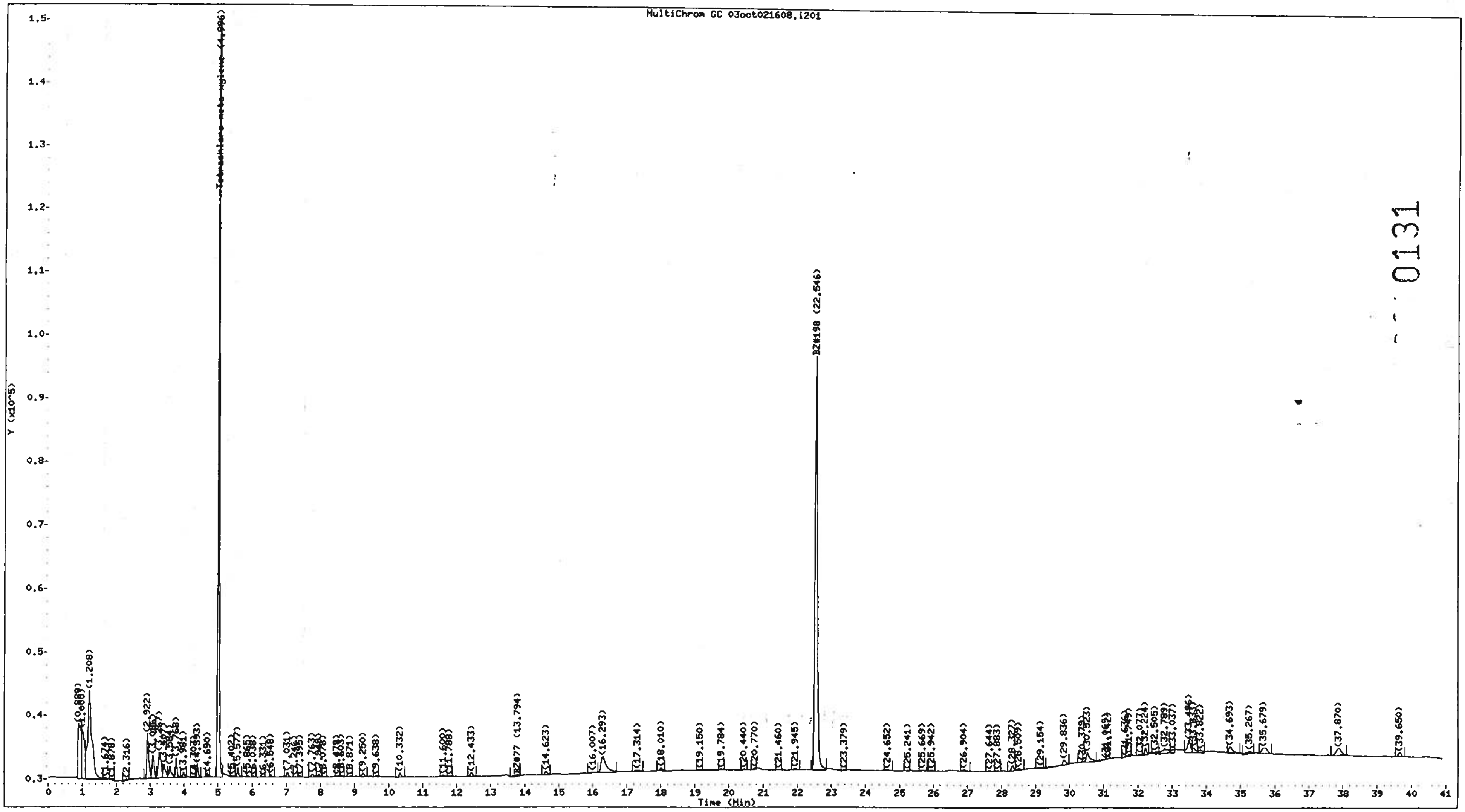
| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG | Q |
|---|---|---|---|
| 34883-43-7 | BZ#8 | 2.2 | U |
| 37680-65-2 | BZ#18 | 2.2 | U |
| 7012-37-5 | BZ#28 | 2.2 | U |
| 41464-39-5 | BZ#44 | 2.2 | U |
| 35693-99-3 | BZ#52 | 2.2 | U |
| 32598-10-0 | BZ#66 | 2.2 | U |
| 32598-13-3 | BZ#77 | 2.2 | U |
| 37680-73-2 | BZ#101 | 2.2 | U |
| 32598-14-4 | BZ#105 | 2.2 | U |
| 31508-00-6 | BZ#118 | 2.2 | U |
| 57465-28-8 | BZ#126 | 2.2 | U |
| 38380-07-3 | BZ#128 | 2.2 | U |
| 35065-28-2 | BZ#138 | 2.2 | U |
| 35065-27-1 | BZ#153 | 2.2 | U |
| 35065-30-6 | BZ#170 | 2.2 | U |
| 35065-29-3 | BZ#180 | 2.2 | U |
| 52663-68-0 | BZ#187 | 2.2 | U |
| 52663-78-2 | BZ#195 | 2.2 | U |
| 40186-72-9 | BZ#206 | 2.2 | U |
| 2051-24-3 | BZ#209 | 2.2 | U |

# STL Burlington - Target GC Chromatogram

**Lab Sample ID: 502117** **Client Sample ID: F01009LS52**

| | | | |
|---|---|---|---|
| Matrix | : SOIL | Sample Type | : SAMPLE |
| Analyst | : | Injection Date | : 04-OCT-2002 14:11 |
| Instrument | : 3327_1.i | Dilution Factor | : 1.00 |
| Column | : RTX-5 | Data File | : 03oct021608-r201.d |
| Integrator | : Falcon | Compound Sublist | : ENVNET |

Method : /var/chem/3327_1.i/100302_1/03OCT021608.b/32CONG_3327RTX5_RAW.m
Reported : 17-Oct-2002 09:45 rrm



# STL Burlington - Target GC Injection Report

**Lab Sample ID: 502117** **Client Sample ID: F01009LS52**

| | | | |
|---|---|---|---|
| Matrix | : SOIL | Sample Type | : SAMPLE |
| Analyst | : | Injection Date | : 04-OCT-2002 14:11 |
| Instrument | : 3327_1.i | Dilution Factor | : 1.00 |
| Column | : RTX-5 | Data File | : 03oct021608-r201.d |
| Integrator | : Falcon | Compound Sublist | : ENVNET |

Method : /var/chem/3327_1.i/100302_1/03OCT021608.b/32CONG_3327RTX5_RAW.m
Reported : 17-Oct-2002 09:45 rrm

## Peaks

| | Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0.889 | | | 50663 | 8659 | | | |
| | 2 | 1.000 | | | 47398 | 7700 | | | |
| | 3 | 1.208 | | | 120573 | 13955 | | | |
| | 4 | 1.674 | | | 1374 | 252 | | | |
| | 5 | 1.878 | | | 1155 | 241 | | | |
| | 6 | 2.316 | | | 1515 | 211 | | | |
| | 7 | 2.922 | | | 28534 | 7050 | | | |
| | 8 | 3.086 | | | 15750 | 3637 | | | |
| | 9 | 3.267 | | | 23409 | 4072 | | | |
| | 10 | 3.407 | | | 10874 | 2175 | | | |
| | 11 | 3.584 | | | 9196 | 1808 | | | |
| | 12 | 3.768 | | | 9515 | 3028 | | | |
| | 13 | 3.981 | | | 3466 | 864 | | | |
| | 14 | 4.303 | | | 1009 | 155 | | | |
| | 15 | 4.393 | | | 5690 | 2034 | | | |
| | 16 | 4.690 | | | 1566 | 606 | | | |
| $ | 17 | 4.996 | 5.001 | -0.005 | 345031 | 137446 | 43.6096 | | Tetrachloro-meta-xylene |
| | 18 | 5.402 | | | 1120 | 185 | | | |
| | 19 | 5.577 | | | 4541 | 1447 | | | |
| | 20 | 5.865 | | | 752 | 194 | | | |
| | 21 | 6.038 | | | 462 | 168 | | | |
| | 22 | 6.331 | | | 242 | 64 | | | |
| | 23 | 6.548 | | | 1256 | 402 | | | |
| | 24 | 7.031 | | | 2845 | 787 | | | |
| | 25 | 7.246 | | | 299 | 94 | | | |
| | 26 | 7.395 | | | 615 | 219 | | | |
| | 27 | 7.763 | | | 2255 | 556 | | | |
| | 28 | 7.949 | | | 1717 | 462 | | | |
| | 29 | 8.078 | | | 588 | 150 | | | |
| | 30 | 8.479 | | | 1135 | 183 | | | |
| | 31 | 8.603 | | | 972 | 264 | | | |
| | 32 | 8.871 | | | 417 | 92 | | | |
| | 33 | 9.250 | | | 2979 | 585 | | | |
| | 34 | 9.638 | | | 1033 | 232 | | | |
| | 35 | 10.332 | | | 2890 | 627 | | | |
| | 36 | 11.600 | | | 1108 | 258 | | | |
| | 37 | 11.788 | | | 387 | 90 | | | |
| | 38 | 12.433 | | | 3319 | 626 | | | |
| | 39 | 13.794 | 13.752 | 0.042 | 2498 | 186 | 2.49453 | a | BZ#77 |
| | 40 | 14.623 | | | 2705 | 543 | | | |
| | 41 | 16.007 | | | 1540 | 165 | | | |
| | 42 | 16.293 | | | 27345 | 2493 | | | |
| | 43 | 17.314 | | | 2537 | 243 | | | |
| | 44 | 18.010 | | | 2345 | 452 | | | |
| | 45 | 19.150 | | | 680 | 127 | | | |
| | 46 | 19.784 | | | 834 | 165 | | | |
| | 47 | 20.440 | | | 784 | 162 | | | |
| | 48 | 20.770 | | | 1302 | 252 | | | |
| | 49 | 21.460 | | | 571 | 118 | | | |
| | 50 | 21.945 | | | 1232 | 226 | | | |
| $ | 51 | 22.546 | 22.559 | -0.013 | 336649 | 65598 | 43.9835 | | BZ#198 |
| | 52 | 23.379 | | | 791 | 148 | | | |
| | 53 | 24.652 | | | 1096 | 173 | | | |
| | 54 | 25.241 | | | 617 | 102 | | | |
| | 55 | 25.669 | | | 837 | 119 | | | |

0132

# STL Burlington - Target GC Injection Report

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| 56 | 25.942 | | | 774 | 118 | | | |
| 57 | 26.904 | | | 1790 | 230 | | | |
| 58 | 27.644 | | | 1242 | 161 | | | |
| 59 | 27.883 | | | 510 | 91 | | | |
| 60 | 28.327 | | | 4333 | 817 | | | |
| 61 | 28.509 | | | 2205 | 258 | | | |
| 62 | 29.154 | | | 1263 | 161 | | | |
| 63 | 29.836 | | | 6624 | 814 | | | |
| 64 | 30.379 | | | 481 | 64 | | | |
| 65 | 30.523 | | | 11822 | 1483 | | | |
| 66 | 31.069 | | | 1739 | 0 | | | |
| 67 | 31.142 | | | 299 | 80 | | | |
| 68 | 31.636 | | | 318 | 38 | | | |
| 69 | 31.749 | | | 1843 | 313 | | | |
| 70 | 32.077 | | | 990 | 149 | | | |
| 71 | 32.224 | | | 4402 | 1052 | | | |
| 72 | 32.505 | | | 2412 | 236 | | | |
| 73 | 32.789 | | | 8916 | 761 | | | |
| 74 | 33.037 | | | 3158 | 519 | | | |
| 75 | 33.496 | | | 12291 | 1924 | | | |
| 76 | 33.633 | | | 4767 | 783 | | | |
| 77 | 33.822 | | | 3626 | 391 | | | |
| 78 | 34.693 | | | 7846 | 1015 | | | |
| 79 | 35.267 | | | 3774 | 398 | | | |
| 80 | 35.679 | | | 10390 | 954 | | | |
| 81 | 37.870 | | | 12428 | 1147 | | | |
| 82 | 39.650 | | | 3933 | 655 | | | |

Flags:
A - Peak quantitates above calibration range
a - Peak quantitates below reporting limit
H - User selected alternate compound hit
M - Peak manually integrated or manually identified
R - Peak fails recovery
U - User disabled peak ID: either peak quantitates below reporting limit or peak identification not confirmed on second column

## Target Compounds

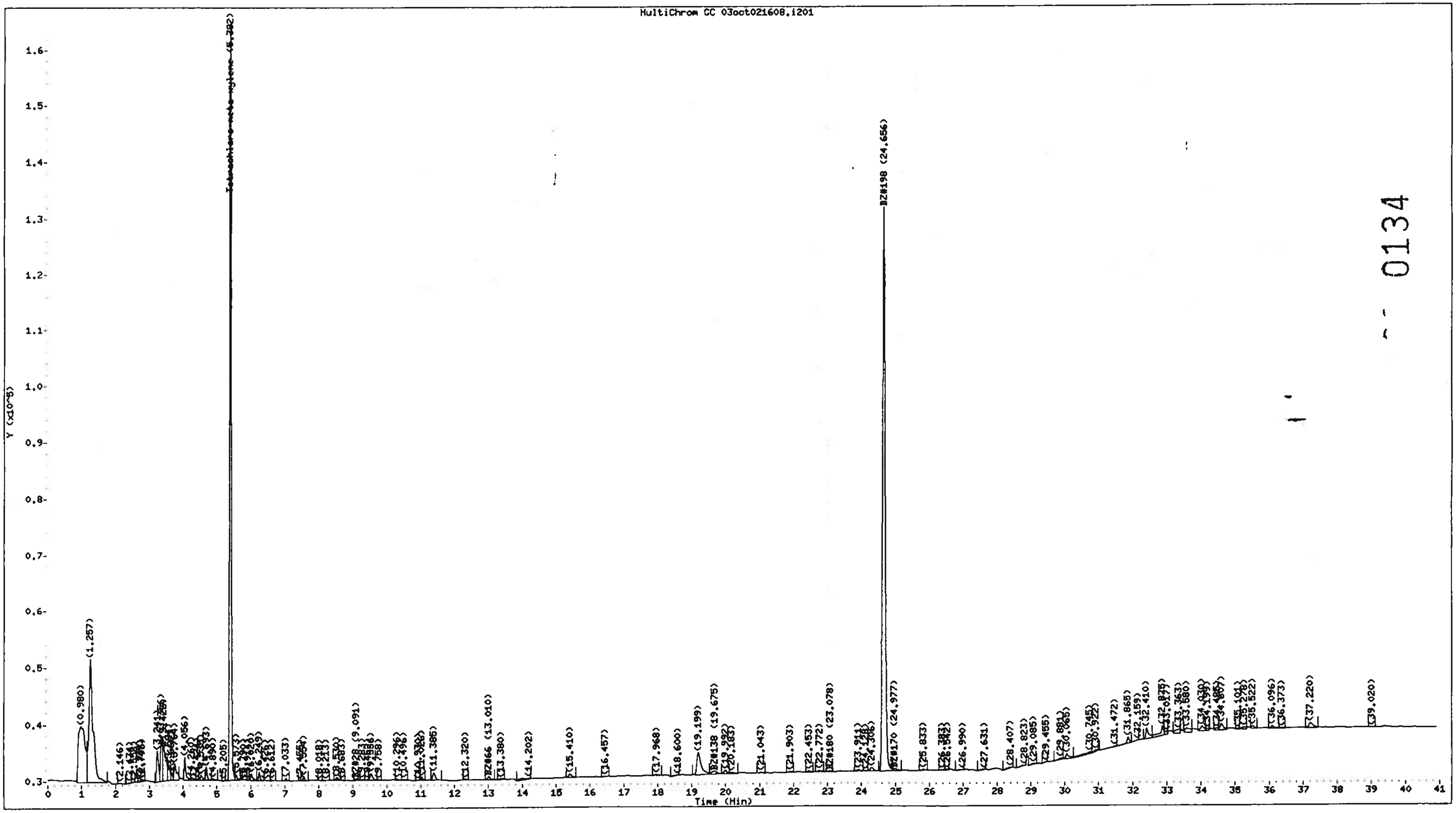
| Peak RT | Expected RT | Target Compound |
|---|---|---|
| 4.996 | 5.001 | Tetrachloro-meta-xylene |
| | 5.761 | BZ#8 |
| | 6.701 | BZ#18 |
| | 7.925 | BZ#28 |
| | 8.984 | BZ#52 |
| | 9.667 | BZ#44 |
| | 11.243 | BZ#66 |
| | 12.207 | BZ#101 |
| 13.794 | 13.752 | BZ#77 |
| | 14.938 | BZ#118 |
| | 15.993 | BZ#153 |
| | 16.155 | BZ#105 |
| | 17.328 | BZ#138 |
| | 17.762 | BZ#126 |
| | 18.647 | BZ#128 |
| | 20.781 | BZ#180 |
| | 22.271 | BZ#170 |
| 22.546 | 22.559 | BZ#198 |
| | 24.552 | BZ#195 |
| | 27.655 | BZ#206 |
| | 29.180 | BZ#209 |

# STL Burlington - Target GC Chromatogram

**Lab Sample ID: 502117** **Client Sample ID: F01009LS52**

Matrix : SOIL
Analyst :
Instrument : 3327_2.i
Column : RTX-CLPII
Integrator : Falcon
Method : /var/chem/3327_2.i/100302_1/03OCT021608.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 09:57 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 14:11
Dilution Factor : 1.00
Data File : 03oct021608-r201.d
Compound Sublist: ENVNET



# STL Burlington - Target GC Injection Report

Lab Sample ID: 502117 Client Sample ID: F01009LS52

Matrix : SOIL
Analyst :
Instrument : 3327_2.i
Column : RTX-CLPII
Integrator : Falcon
Method : /var/chem/3327_2.i/100302_1/03OCT021608.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 09:57 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 14:11
Dilution Factor : 1.00
Data File : 03oct021608-r201.d
Compound Sublist: ENVNET

## Peaks

| | Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0.980 | | | 136542 | 9891 | | | |
| | 2 | 1.257 | | | 186132 | 21671 | | | |
| | 3 | 2.146 | | | 657 | 127 | | | |
| | 4 | 2.434 | | | 774 | 127 | | | |
| | 5 | 2.558 | | | 216 | 31 | | | |
| | 6 | 2.729 | | | 378 | 146 | | | |
| | 7 | 2.795 | | | 1346 | 280 | | | |
| | 8 | 3.241 | | | 22877 | 5468 | | | |
| | 9 | 3.356 | | | 28523 | 8135 | | | |
| | 10 | 3.425 | | | 42148 | 7233 | | | |
| | 11 | 3.584 | | | 12812 | 2723 | | | |
| | 12 | 3.660 | | | 4441 | 1387 | | | |
| | 13 | 3.764 | | | 15697 | 2869 | | | |
| | 14 | 4.056 | | | 14245 | 4085 | | | |
| | 15 | 4.260 | | | 2831 | 467 | | | |
| | 16 | 4.424 | | | 968 | 234 | | | |
| | 17 | 4.535 | | | 4361 | 881 | | | |
| | 18 | 4.693 | | | 6935 | 2303 | | | |
| | 19 | 4.890 | | | 1616 | 280 | | | |
| | 20 | 5.205 | | | 259 | 70 | | | |
| $ | 21 | 5.382 | 5.391 | -0.009 | 474950 | 162042 | 42.9904 | | Tetrachloro-meta-xylene |
| | 22 | 5.573 | | | 3784 | 936 | | | |
| | 23 | 5.790 | | | 1168 | 162 | | | |
| | 24 | 5.914 | | | 405 | 139 | | | |
| | 25 | 6.020 | | | 4496 | 1156 | | | |
| | 26 | 6.249 | | | 4480 | 1441 | | | |
| | 27 | 6.426 | | | 430 | 62 | | | |
| | 28 | 6.612 | | | 550 | 126 | | | |
| | 29 | 7.033 | | | 1277 | 403 | | | |
| | 30 | 7.455 | | | 207 | 75 | | | |
| | 31 | 7.554 | | | 2547 | 796 | | | |
| | 32 | 8.018 | | | 253 | 79 | | | |
| | 33 | 8.213 | | | 643 | 77 | | | |
| | 34 | 8.530 | | | 2459 | 467 | | | |
| | 35 | 8.683 | | | 435 | 145 | | | |
| | 36 | 9.091 | 9.137 | -0.047 | 1338 | 310 | 1.25026 | a | BZ#28 |
| | 37 | 9.283 | | | 694 | 149 | | | |
| | 38 | 9.452 | | | 860 | 193 | | | |
| | 39 | 9.536 | | | 6516 | 1187 | | | |
| | 40 | 9.758 | | | 500 | 116 | | | |
| | 41 | 10.296 | | | 1251 | 242 | | | |
| | 42 | 10.496 | | | 1065 | 144 | | | |
| | 43 | 10.930 | | | 231 | 69 | | | |
| | 44 | 11.026 | | | 2140 | 577 | | | |
| | 45 | 11.385 | | | 7474 | 1307 | | | |
| | 46 | 12.320 | | | 869 | 236 | | | |
| | 47 | 13.010 | 13.056 | -0.047 | 3041 | 582 | 2.03131 | a | BZ#66 |
| | 48 | 13.380 | | | 1417 | 199 | | | |
| | 49 | 14.202 | | | 5855 | 201 | | | |
| | 50 | 15.410 | | | 4653 | 687 | | | |
| | 51 | 16.457 | | | 1041 | 172 | | | |
| | 52 | 17.968 | | | 1838 | 234 | | | |
| | 53 | 18.600 | | | 1033 | 51 | | | |
| | 54 | 19.199 | | | 34487 | 3954 | | | |
| | 55 | 19.675 | 19.713 | -0.038 | 6582 | 524 | 0.500072 | a | BZ#138 |

```
                                                                  Extract
 Peak     Peak    Expected   Delta                                 Conc.
  No.      RT        RT        RT        Area      Height         (ppb)     Flags              Peak Identification
=====  ========  ========  ========  ========  ========  ==========  =====  ====================================
   56   19.992                            4127       663
   57   20.183                            2847       278
   58   21.043                            1287       149
   59   21.903                             961       182
   60   22.453                            1215       225
   61   22.772                            1530       222
   62   23.078    23.115    -0.038        1086       227    0.543763   a        BZ#180
   63   23.911                            1641       286
   64   24.128                             365        95
   65   24.306                            4084       637
$  66   24.656    24.678    -0.022      541620    100381    42.1540            BZ#198
   67   24.977    25.004    -0.027        3305       382    0.927647   a        BZ#170
   68   25.833                            1189       176
   69   26.383                             422        98
   70   26.542                             800       157
   71   26.990                            1336       126
   72   27.631                             888        50
   73   28.407                            2483       181
   74   28.823                            1327        89
   75   29.085                            1544       200
   76   29.455                             509        91
   77   29.881                            2276       320
   78   30.065                            6905       888
   79   30.745                            7535       347
   80   30.922                            1887       322
   81   31.472                            1513       134
   82   31.865                            4919      1073
   83   32.159                             343        40
   84   32.410                           11251      1896
   85   32.875                           12859      1730
   86   33.017                            3115       586
   87   33.363                            6338       648
   88   33.580                            8241       761
   89   34.030                            7115       896
   90   34.199                            2468       416
   91   34.485                            2656       362
   92   34.607                            8283      1137
   93   35.101                             952       202
   94   35.278                            3824       376
   95   35.522                            3777       569
   96   36.096                            3889       480
   97   36.373                            1556       186
   98   37.220                            8429       917
   99   39.020                             662       114

Flags:  A - Peak quantitates above calibration range
        a - Peak quantitates below reporting limit
        H - User selected alternate compound hit
        M - Peak manually integrated or manually identified
        R - Peak fails recovery
        U - User disabled peak ID: either peak quantitates below reporting limit or
            peak identification not confirmed on second column
```

## Target Compounds

```
                      Peak      Expected
                       RT          RT                 Target Compound
                    ========  ========  ======================================
                     5.382       5.391   Tetrachloro-meta-xylene
                                 6.592   BZ#8
                                 7.698   BZ#18
                     9.091       9.137   BZ#28
                                10.341   BZ#52
                                11.312   BZ#44
                    13.010      13.056   BZ#66
                                13.914   BZ#101
                                16.080   BZ#77
                                17.075   BZ#118
                                17.995   BZ#153
```

# STL Burlington - Target GC Injection Report

```
  Peak        Expected
   RT            RT                      Target Compound
========     ========     ===================================
               18.720     BZ#105
 19.675        19.713     BZ#138
               20.225     BZ#126
               21.462     BZ#128
 23.078        23.115     BZ#180
 24.656        24.678     BZ#198
 24.977        25.004     BZ#170
               27.203     BZ#195
               29.805     BZ#206
               30.754     BZ#209
```

FORM 1
OTHER ORGANICS ANALYSIS DATA SHEET

ENVNET SAMPLE NO.

F01009LS53

Lab Name: STL BURLINGTON Contract: 22000

Lab Code: STLVT Case No.: 22000 SAS No.: SDG No.: 89891

Matrix: (soil/water) SOIL Lab Sample ID: 502116

Sample wt/vol: 30.1 (g/mL) G Lab File ID: 03OCT021608-R191

% Moisture: 20 decanted: (Y/N) N Date Received: 09/25/02

Extraction: (SepF/Cont/Sonc) SOXH Date Extracted: 09/26/02

Concentrated Extract Volume: 10(mL) Date Analyzed: 10/04/02

Injection Volume: 1.0(uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: ___ Sulfur Cleanup: (Y/N) Y

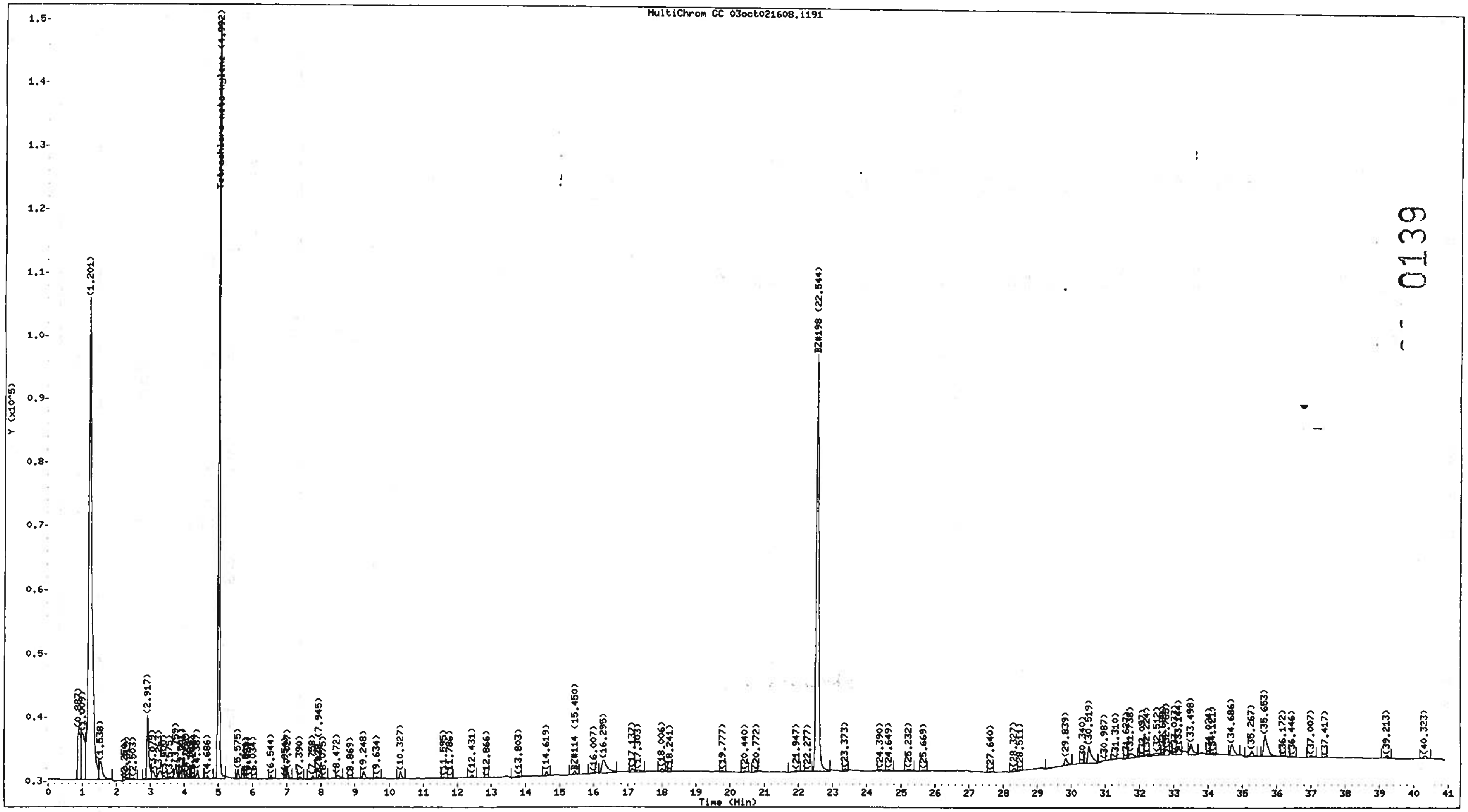
| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG | Q |
|---|---|---|---|
| 34883-43-7 | BZ#8 | 2.1 | U |
| 37680-65-2 | BZ#18 | 2.1 | U |
| 7012-37-5 | BZ#28 | 2.1 | U |
| 41464-39-5 | BZ#44 | 2.1 | U |
| 35693-99-3 | BZ#52 | 2.1 | U |
| 32598-10-0 | BZ#66 | 2.1 | U |
| 32598-13-3 | BZ#77 | 2.1 | U |
| 37680-73-2 | BZ#101 | 2.1 | U |
| 32598-14-4 | BZ#105 | 2.1 | U |
| 31508-00-6 | BZ#118 | 2.1 | U |
| 57465-28-8 | BZ#126 | 2.1 | U |
| 38380-07-3 | BZ#128 | 2.1 | U |
| 35065-28-2 | BZ#138 | 2.1 | U |
| 35065-27-1 | BZ#153 | 2.1 | U |
| 35065-30-6 | BZ#170 | 2.1 | U |
| 35065-29-3 | BZ#180 | 2.1 | U |
| 52663-68-0 | BZ#187 | 2.1 | U |
| 52663-78-2 | BZ#195 | 2.1 | U |
| 40186-72-9 | BZ#206 | 2.1 | U |
| 2051-24-3 | BZ#209 | 2.1 | U |

# STL Burlington - Target GC Chromatogram

**Lab Sample ID: 502116** **Client Sample ID: F01009LS53**

Matrix : SOIL
Analyst :
Instrument : 3327_1.i
Column : RTX-5
Integrator : Falcon
Method : /var/chem/3327_1.i/100302_1/03OCT021608.b/32CONG_3327RTX5_RAW.m
Reported : 17-Oct-2002 09:45 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 13:26
Dilution Factor : 1.00
Data File : 03oct021608-r191.d
Compound Sublist: ENVNET



# STL Burlington - Target GC Injection Report

Lab Sample ID: 502116 Client Sample ID: F01009LS53

Matrix : SOIL
Analyst : Jm
Instrument : 3327_1.i
Column : RTX-5
Integrator : Falcon
Method : /var/chem/3327_1.i/100302_1/03OCT021608.b/32CONG_3327RTX5_RAW.m
Reported : 17-Oct-2002 09:45 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 13:26
Dilution Factor : 1.00
Data File : 03oct021608-r191.d
Compound Sublist: ENVNET

## Peaks

| | Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0.887 | | | 43609 | 7903 | | | |
| | 2 | 1.009 | | | 52832 | 7349 | | | |
| | 3 | 1.201 | | | 498493 | 75769 | | | |
| | 4 | 1.538 | | | 19787 | 2788 | | | |
| | 5 | 2.250 | | | 245 | 60 | | | |
| | 6 | 2.319 | | | 1187 | 352 | | | |
| | 7 | 2.503 | | | 1633 | 251 | | | |
| | 8 | 2.917 | | | 42719 | 10117 | | | |
| | 9 | 3.079 | | | 7558 | 1293 | | | |
| | 10 | 3.263 | | | 8636 | 1209 | | | |
| | 11 | 3.400 | | | 2399 | 491 | | | |
| | 12 | 3.575 | | | 1819 | 379 | | | |
| | 13 | 3.759 | | | 9684 | 2220 | | | |
| | 14 | 3.901 | | | 4244 | 1325 | | | |
| | 15 | 3.961 | | | 4131 | 1346 | | | |
| | 16 | 4.052 | | | 2748 | 684 | | | |
| | 17 | 4.189 | | | 216 | 97 | | | |
| | 18 | 4.258 | | | 976 | 346 | | | |
| | 19 | 4.387 | | | 4768 | 1283 | | | |
| | 20 | 4.686 | | | 1361 | 465 | | | |
| $ | 21 | 4.992 | 5.001 | -0.009 | 346557 | 137374 | 43.5868 | | Tetrachloro-meta-xylene |
| | 22 | 5.575 | | | 4312 | 1420 | | | |
| | 23 | 5.801 | | | 233 | 92 | | | |
| | 24 | 5.859 | | | 773 | 210 | | | |
| | 25 | 6.034 | | | 453 | 167 | | | |
| | 26 | 6.544 | | | 1986 | 607 | | | |
| | 27 | 6.954 | | | 339 | 115 | | | |
| | 28 | 7.027 | | | 4201 | 1308 | | | |
| | 29 | 7.390 | | | 1121 | 358 | | | |
| | 30 | 7.758 | | | 2916 | 506 | | | |
| | 31 | 7.945 | 7.925 | 0.020 | 2934 | 793 | 0.736296 | a | BZ#28 |
| | 32 | 8.075 | | | 1272 | 306 | | | |
| | 33 | 8.472 | | | 4137 | 537 | | | |
| | 34 | 8.869 | | | 637 | 111 | | | |
| | 35 | 9.248 | | | 6374 | 1087 | | | |
| | 36 | 9.634 | | | 1954 | 363 | | | |
| | 37 | 10.327 | | | 4302 | 1063 | | | |
| | 38 | 11.595 | | | 803 | 197 | | | |
| | 39 | 11.786 | | | 376 | 96 | | | |
| | 40 | 12.431 | | | 2583 | 463 | | | |
| | 41 | 12.866 | | | 352 | 72 | | | |
| | 42 | 13.803 | | | 2570 | 202 | | | |
| | 43 | 14.619 | | | 2886 | 643 | | | |
| | 44 | 15.450 | | | 2679 | 505 | | | |
| | 45 | 16.007 | | | 880 | 127 | | | |
| | 46 | 16.295 | | | 22766 | 2023 | | | |
| | 47 | 17.137 | | | 2788 | 532 | | | |
| | 48 | 17.303 | | | 3332 | 294 | | | |
| | 49 | 18.006 | | | 2832 | 495 | | | |
| | 50 | 18.241 | | | 348 | 81 | | | |
| | 51 | 19.777 | | | 923 | 178 | | | |
| | 52 | 20.440 | | | 921 | 169 | | | |
| | 53 | 20.772 | | | 1109 | 218 | | | |
| | 54 | 21.947 | | | 1864 | 222 | | | |
| | 55 | 22.277 | | | 638 | 102 | | | |

# STL Burlington - Target GC Injection Report

```
                                                              Extract
 Peak     Peak    Expected   Delta                             Conc.
  No.      RT        RT        RT       Area      Height       (ppb)     Flags           Peak Identification
=====  ========  ========  ========  ========  ========  ==========  =====  ======================================
$  56    22.544    22.559    -0.016    339145     66005     44.2667          BZ#198
   57    23.373                          2438       413
   58    24.390                          1845       275
   59    24.649                          1696       234
   60    25.232                          2211       279
   61    25.669                          1267       176
   62    27.640                           598       110
   63    28.327                          2793       508
   64    28.511                          1077       179
   65    29.839                          8242      1073
   66    30.340                           334        69
   67    30.519                         20636      2715
   68    30.987                          1460        43
   69    31.310                           250        36
   70    31.627                           522       113
   71    31.738                          7426       790
   72    32.097                           687       117
   73    32.224                          1838       354
   74    32.512                          5283       345
   75    32.689                          2210       443
   76    32.785                          6037       917
   77    33.033                          2717       540
   78    33.144                          8241      1392
   79    33.498                         11828      1741
   80    34.024                           995       163
   81    34.121                          2430       318
   82    34.686                         12424      1688
   83    35.267                          5718       873
   84    35.653                         27411      3361
   85    36.172                           820       139
   86    36.446                           820       170
   87    37.007                          1830       269
   88    37.417                           465        94
   89    39.213                          2801       406
   90    40.323                          2924       394
```

```
Flags:  A - Peak quantitates above calibration range
        a - Peak quantitates below reporting limit
        H - User selected alternate compound hit
        M - Peak manually integrated or manually identified
        R - Peak fails recovery
        U - User disabled peak ID: either peak quantitates below reporting limit or
            peak identification not confirmed on second column
```

## Target Compounds

```
  Peak      Expected
   RT          RT                Target Compound
========    ========    ====================================
   4.992       5.001    Tetrachloro-meta-xylene
               5.761    BZ#8
               6.701    BZ#18
   7.945       7.925    BZ#28
               8.984    BZ#52
               9.667    BZ#44
              11.243    BZ#66
              12.207    BZ#101
              13.752    BZ#77
              14.938    BZ#118
              15.993    BZ#153
              16.155    BZ#105
              17.328    BZ#138
              17.762    BZ#126
              18.647    BZ#128
              20.781    BZ#180
              22.271    BZ#170
  22.544      22.559    BZ#198
              24.552    BZ#195
              27.655    BZ#206
```

0141

## STL Burlington - Target GC Injection Report

```
  Peak      Expected
   RT          RT                   Target Compound
========    ========    ====================================
              29.180    BZ#209
```

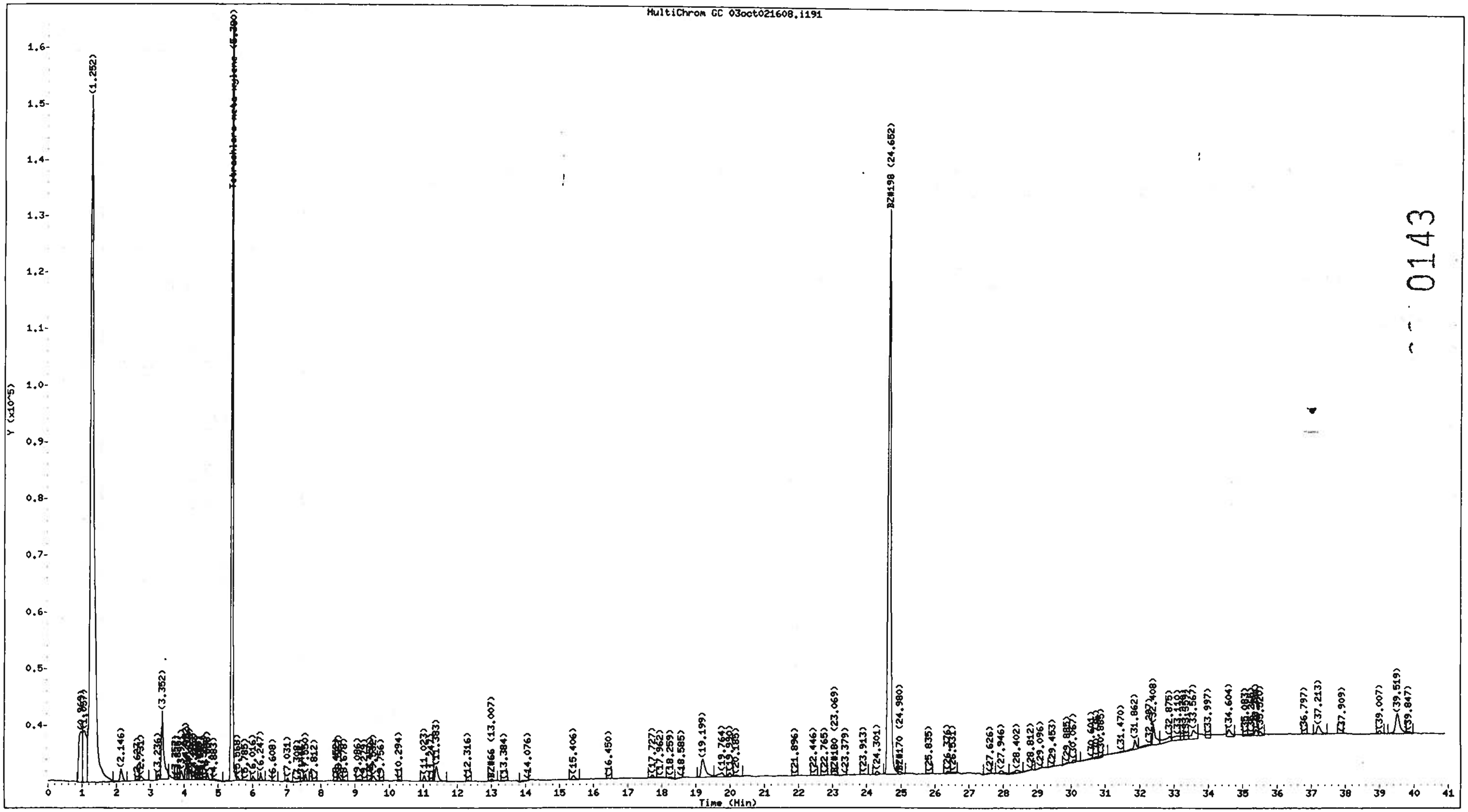
0142

# STL Burlington - Target GC Chromatogram

| Lab Sample ID: 502116 | Client Sample ID: F01009LS53 |
|---|---|

Matrix : SOIL
Analyst :
Instrument : 3327_2.i
Column : RTX-CLPII
Integrator : Falcon
Method : /var/chem/3327_2.i/100302_1/03OCT021608.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 09:57 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 13:26
Dilution Factor : 1.00
Data File : 03oct021608-r191.d
Compound Sublist: ENVNET



# STL Burlington - Target GC Injection Report

| | |
|---|---|
| Lab Sample ID: 502116 | Client Sample ID: F01009LS53 |

Matrix : SOIL
Analyst :
Instrument : 3327_2.i
Column : RTX-CLPII
Integrator : Falcon
Method : /var/chem/3327_2.i/100302_1/03OCT021608.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 09:57 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 13:26
Dilution Factor : 1.00
Data File : 03oct021608-r191.d
Compound Sublist: ENVNET

## Peaks

| | Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0.969 | | | 60649 | 8907 | | | |
| | 2 | 1.057 | | | 74184 | 9035 | | | |
| | 3 | 1.252 | | | 903008 | 121461 | | | |
| | 4 | 2.146 | | | 12992 | 2196 | | | |
| | 5 | 2.627 | | | 1250 | 327 | | | |
| | 6 | 2.731 | | | 4860 | 805 | | | |
| | 7 | 3.236 | | | 3951 | 1052 | | | |
| | 8 | 3.352 | | | 58034 | 11935 | | | |
| | 9 | 3.757 | | | 1832 | 517 | | | |
| | 10 | 3.835 | | | 1631 | 492 | | | |
| | 11 | 3.921 | | | 6054 | 1528 | | | |
| | 12 | 4.052 | | | 7414 | 2708 | | | |
| | 13 | 4.101 | | | 5780 | 2107 | | | |
| | 14 | 4.176 | | | 5409 | 1679 | | | |
| | 15 | 4.285 | | | 3737 | 905 | | | |
| | 16 | 4.362 | | | 1346 | 477 | | | |
| | 17 | 4.438 | | | 1060 | 361 | | | |
| | 18 | 4.487 | | | 1836 | 461 | | | |
| | 19 | 4.586 | | | 2671 | 623 | | | |
| | 20 | 4.688 | | | 3428 | 1201 | | | |
| | 21 | 4.883 | | | 2746 | 264 | | | |
| $ | 22 | 5.380 | 5.391 | -0.011 | 474521 | 161320 | 42.8016 | | Tetrachloro-meta-xylene |
| | 23 | 5.568 | | | 3448 | 774 | | | |
| | 24 | 5.785 | | | 1596 | 168 | | | |
| | 25 | 6.016 | | | 3507 | 875 | | | |
| | 26 | 6.247 | | | 4747 | 1469 | | | |
| | 27 | 6.608 | | | 457 | 142 | | | |
| | 28 | 7.031 | | | 2498 | 666 | | | |
| | 29 | 7.308 | | | 610 | 61 | | | |
| | 30 | 7.446 | | | 235 | 83 | | | |
| | 31 | 7.550 | | | 3932 | 1323 | | | |
| | 32 | 7.812 | | | 540 | 119 | | | |
| | 33 | 8.452 | | | 763 | 198 | | | |
| | 34 | 8.523 | | | 3925 | 809 | | | |
| | 35 | 8.678 | | | 970 | 287 | | | |
| | 36 | 9.086 | | | 2274 | 316 | | | |
| | 37 | 9.279 | | | 876 | 171 | | | |
| | 38 | 9.450 | | | 1983 | 525 | | | |
| | 39 | 9.532 | | | 5489 | 950 | | | |
| | 40 | 9.756 | | | 570 | 120 | | | |
| | 41 | 10.294 | | | 1228 | 330 | | | |
| | 42 | 11.023 | | | 3834 | 1038 | | | |
| | 43 | 11.247 | | | 333 | 79 | | | |
| | 44 | 11.383 | | | 14440 | 2536 | | | |
| | 45 | 12.316 | | | 853 | 224 | | | |
| | 46 | 13.007 | 13.056 | -0.049 | 2411 | 434 | 1.94175 | a | BZ#66 |
| | 47 | 13.384 | | | 1249 | 171 | | | |
| | 48 | 14.076 | | | 2866 | 165 | | | |
| | 49 | 15.406 | | | 4830 | 768 | | | |
| | 50 | 16.450 | | | 440 | 92 | | | |
| | 51 | 17.727 | | | 2556 | 528 | | | |
| | 52 | 17.962 | | | 1341 | 183 | | | |
| | 53 | 18.259 | | | 2199 | 276 | | | |
| | 54 | 18.585 | | | 960 | 50 | | | |
| | 55 | 19.199 | | | 28378 | 3124 | | | |

# STL Burlington - Target GC Injection Report

| | Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|---|
| | 56 | 19.764 | | | 8308 | 731 | | | |
| | 57 | 19.990 | | | 4293 | 706 | | | |
| | 58 | 20.185 | | | 3255 | 295 | | | |
| | 59 | 21.896 | | | 758 | 170 | | | |
| | 60 | 22.446 | | | 1031 | 202 | | | |
| | 61 | 22.765 | | | 834 | 147 | | | |
| | 62 | 23.069 | 23.115 | -0.047 | 1159 | 240 | 0.549484 | a | BZ#180 |
| | 63 | 23.379 | | | 945 | 97 | | | |
| | 64 | 23.913 | | | 852 | 157 | | | |
| | 65 | 24.301 | | | 3749 | 553 | | | |
| $ | 66 | 24.652 | 24.678 | -0.027 | 543109 | 100475 | 42.1936 | | BZ#198 |
| | 67 | 24.980 | 25.004 | -0.024 | 3665 | 430 | 0.947962 | a | BZ#170 |
| | 68 | 25.835 | | | 929 | 132 | | | |
| | 69 | 26.376 | | | 1866 | 367 | | | |
| | 70 | 26.531 | | | 2072 | 222 | | | |
| | 71 | 27.626 | | | 640 | 23 | | | |
| | 72 | 27.946 | | | 5540 | 527 | | | |
| | 73 | 28.402 | | | 5885 | 518 | | | |
| | 74 | 28.812 | | | 813 | 60 | | | |
| | 75 | 29.096 | | | 739 | 123 | | | |
| | 76 | 29.453 | | | 667 | 109 | | | |
| | 77 | 29.885 | | | 1794 | 243 | | | |
| | 78 | 30.067 | | | 3087 | 517 | | | |
| | 79 | 30.601 | | | 2020 | 159 | | | |
| | 80 | 30.736 | | | 2251 | 393 | | | |
| | 81 | 30.885 | | | 2170 | 423 | | | |
| | 82 | 31.470 | | | 2667 | 239 | | | |
| | 83 | 31.862 | | | 10310 | 1632 | | | |
| | 84 | 32.297 | | | 4125 | 143 | | | |
| | 85 | 32.408 | | | 20623 | 3631 | | | |
| | 86 | 32.875 | | | 12899 | 935 | | | |
| | 87 | 33.110 | | | 10316 | 756 | | | |
| | 88 | 33.270 | | | 3524 | 648 | | | |
| | 89 | 33.359 | | | 6315 | 758 | | | |
| | 90 | 33.567 | | | 16438 | 1581 | | | |
| | 91 | 33.997 | | | 5763 | 637 | | | |
| | 92 | 34.604 | | | 9941 | 1246 | | | |
| | 93 | 35.083 | | | 1786 | 270 | | | |
| | 94 | 35.265 | | | 2871 | 342 | | | |
| | 95 | 35.394 | | | 5613 | 1052 | | | |
| | 96 | 35.520 | | | 4186 | 657 | | | |
| | 97 | 36.797 | | | 1163 | 179 | | | |
| | 98 | 37.213 | | | 11074 | 1448 | | | |
| | 99 | 37.909 | | | 993 | 151 | | | |
| | 100 | 39.007 | | | 2885 | 527 | | | |
| | 101 | 39.519 | | | 31529 | 3562 | | | |
| | 102 | 39.847 | | | 2500 | 334 | | | |

Flags:
A - Peak quantitates above calibration range
a - Peak quantitates below reporting limit
H - User selected alternate compound hit
M - Peak manually integrated or manually identified
R - Peak fails recovery
U - User disabled peak ID: either peak quantitates below reporting limit or peak identification not confirmed on second column

## Target Compounds

| Peak RT | Expected RT | Target Compound |
|---|---|---|
| 5.380 | 5.391 | Tetrachloro-meta-xylene |
| | 6.592 | BZ#8 |
| | 7.698 | BZ#18 |
| | 9.137 | BZ#28 |
| | 10.341 | BZ#52 |
| | 11.312 | BZ#44 |
| 13.007 | 13.056 | BZ#66 |
| | 13.914 | BZ#101 |

```
              STL Burlington - Target GC Injection Report

  Peak       Expected
   RT           RT                  Target Compound
========     ========    ===================================
             16.080    BZ#77
             17.075    BZ#118
             17.995    BZ#153
             18.720    BZ#105
             19.713    BZ#138
             20.225    BZ#126
             21.462    BZ#128
  23.069     23.115    BZ#180
  24.652     24.678    BZ#198
  24.980     25.004    BZ#170
             27.203    BZ#195
             29.805    BZ#206
             30.754    BZ#209
```

# FORM 1
# OTHER ORGANICS ANALYSIS DATA SHEET

ENVNET SAMPLE NO.

F01009LS61

Lab Name: STL BURLINGTON Contract: 22000

Lab Code: STLVT Case No.: 22000 SAS No.: SDG No.: 89891

Matrix: (soil/water) SOIL Lab Sample ID: 502121

Sample wt/vol: 30.1 (g/mL) G Lab File ID: 03OCT021608-R241

% Moisture: 34 decanted: (Y/N) N Date Received: 09/25/02

Extraction: (SepF/Cont/Sonc) SOXH Date Extracted: 09/26/02

Concentrated Extract Volume: 10(mL) Date Analyzed: 10/04/02

Injection Volume: 1.0(uL) Dilution Factor: 1.0

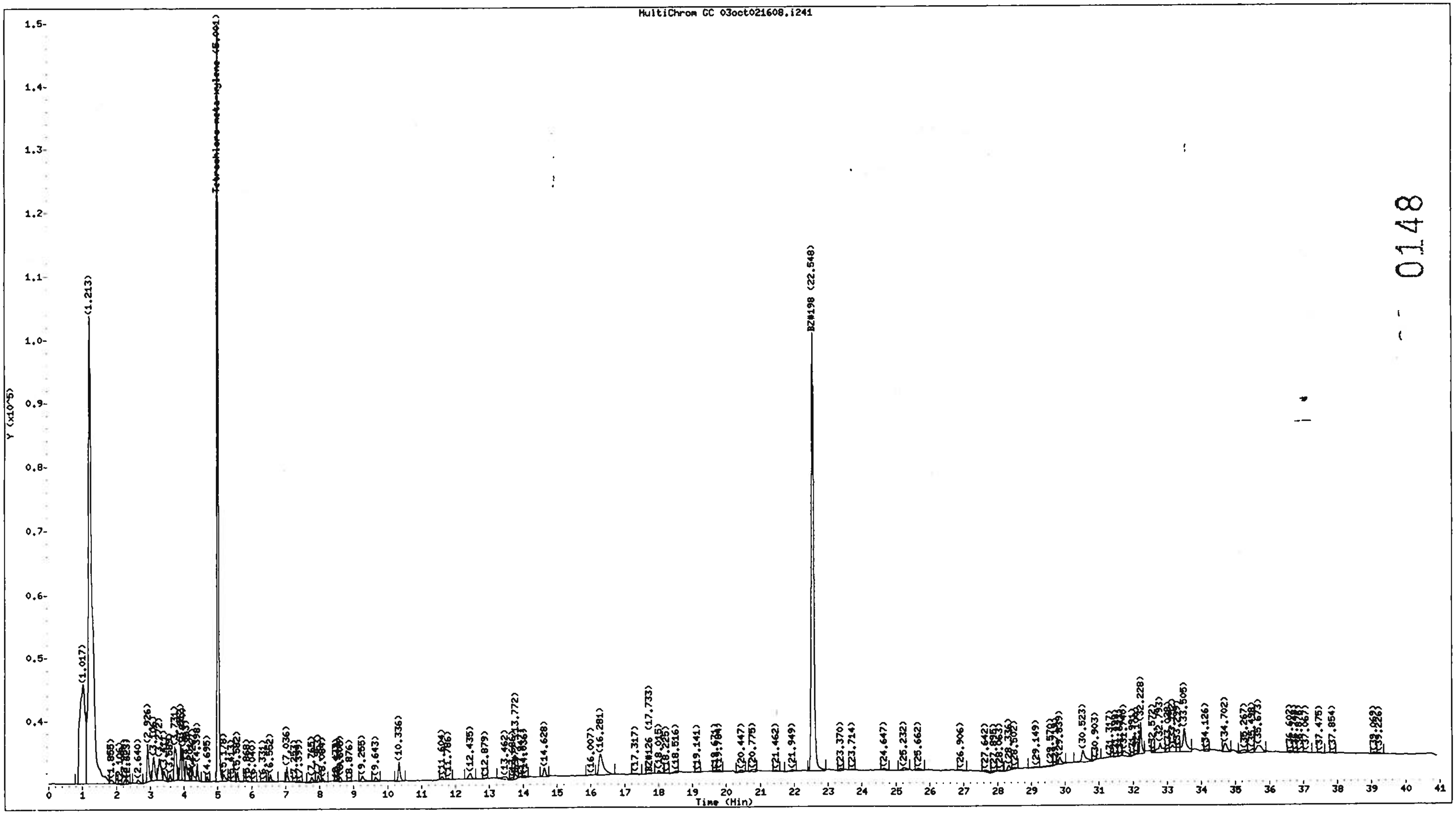
GPC Cleanup: (Y/N) N pH: ___ Sulfur Cleanup: (Y/N) Y

| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG | Q |
|---|---|---|---|
| 34883-43-7 | BZ#8 | 2.5 | U |
| 37680-65-2 | BZ#18 | 2.5 | U |
| 7012-37-5 | BZ#28 | 2.5 | U |
| 41464-39-5 | BZ#44 | 2.5 | U |
| 35693-99-3 | BZ#52 | 2.5 | U |
| 32598-10-0 | BZ#66 | 2.5 | U |
| 32598-13-3 | BZ#77 | 2.5 | U |
| 37680-73-2 | BZ#101 | 2.5 | U |
| 32598-14-4 | BZ#105 | 2.5 | U |
| 31508-00-6 | BZ#118 | 2.5 | U |
| 57465-28-8 | BZ#126 | 2.5 | U |
| 38380-07-3 | BZ#128 | 2.5 | U |
| 35065-28-2 | BZ#138 | 2.5 | U |
| 35065-27-1 | BZ#153 | 2.5 | U |
| 35065-30-6 | BZ#170 | 2.5 | U |
| 35065-29-3 | BZ#180 | 2.5 | U |
| 52663-68-0 | BZ#187 | 2.5 | U |
| 52663-78-2 | BZ#195 | 2.5 | U |
| 40186-72-9 | BZ#206 | 2.5 | U |
| 2051-24-3 | BZ#209 | 2.5 | U |

## STL Burlington - Target GC Chromatogram

| Lab Sample ID: 502121 | Client Sample ID: F01009LS61 |
|---|---|

```
Matrix       : SOIL                   Sample Type      : SAMPLE
Analyst      :                        Injection Date   : 04-OCT-2002 17:11
Instrument   : 3327_1.i               Dilution Factor  : 1.00
Column       : RTX-5                  Data File        : 03oct021608-r241.d
Integrator   : Falcon                 Compound Sublist: ENVNET
Method       : /var/chem/3327_1.i/100302_1/03OCT021608.b/32CONG_3327RTX5_RAW.m
Reported     : 17-Oct-2002 09:46 rrm
```



# STL Burlington - Target GC Injection Report

| | | | |
|---|---|---|---|
| Lab Sample ID: | 502121 | Client Sample ID: | F01009LS61 |
| Matrix | : SOIL | Sample Type | : SAMPLE |
| Analyst | : | Injection Date | : 04-OCT-2002 17:11 |
| Instrument | : 3327_1.i | Dilution Factor | : 1.00 |
| Column | : RTX-5 | Data File | : 03oct021608-r241.d |
| Integrator | : Falcon | Compound Sublist | : ENVNET |
| Method | : /var/chem/3327_1.i/100302_1/03OCT021608.b/32CONG_3327RTX5_RAW.m | | |
| Reported | : 17-Oct-2002 09:46 rrm | | |

## Peaks

| | Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 1.017 | | | 169328 | 15552 | | | |
| | 2 | 1.213 | | | 554992 | 73576 | | | |
| | 3 | 1.855 | | | 3235 | 556 | | | |
| | 4 | 2.106 | | | 539 | 172 | | | |
| | 5 | 2.250 | | | 2497 | 707 | | | |
| | 6 | 2.323 | | | 2363 | 628 | | | |
| | 7 | 2.640 | | | 3068 | 579 | | | |
| | 8 | 2.926 | | | 21754 | 5867 | | | |
| | 9 | 3.106 | | | 17120 | 3691 | | | |
| | 10 | 3.272 | | | 18577 | 3333 | | | |
| | 11 | 3.411 | | | 6194 | 1471 | | | |
| | 12 | 3.589 | | | 3773 | 1095 | | | |
| | 13 | 3.731 | | | 25120 | 5238 | | | |
| | 14 | 3.912 | | | 17161 | 5605 | | | |
| | 15 | 3.970 | | | 15085 | 5005 | | | |
| | 16 | 4.063 | | | 12071 | 3046 | | | |
| | 17 | 4.201 | | | 727 | 335 | | | |
| | 18 | 4.267 | | | 6425 | 1762 | | | |
| | 19 | 4.398 | | | 7012 | 2722 | | | |
| | 20 | 4.695 | | | 2018 | 821 | | | |
| $ | 21 | 5.001 | 5.001 | 0.000 | 364557 | 145766 | 46.2426 | | Tetrachloro-meta-xylene |
| | 22 | 5.178 | | | 5109 | 1070 | | | |
| | 23 | 5.413 | | | 811 | 153 | | | |
| | 24 | 5.582 | | | 4677 | 1485 | | | |
| | 25 | 5.868 | | | 1021 | 305 | | | |
| | 26 | 6.040 | | | 494 | 173 | | | |
| | 27 | 6.331 | | | 724 | 166 | | | |
| | 28 | 6.552 | | | 4175 | 1163 | | | |
| | 29 | 7.036 | | | 7551 | 2353 | | | |
| | 30 | 7.253 | | | 594 | 173 | | | |
| | 31 | 7.399 | | | 921 | 313 | | | |
| | 32 | 7.765 | | | 4389 | 832 | | | |
| | 33 | 7.953 | | | 3546 | 1025 | | | |
| | 34 | 8.084 | | | 2089 | 588 | | | |
| | 35 | 8.477 | | | 972 | 326 | | | |
| | 36 | 8.543 | | | 1428 | 476 | | | |
| | 37 | 8.605 | | | 2898 | 732 | | | |
| | 38 | 8.876 | | | 544 | 106 | | | |
| | 39 | 9.255 | | | 5354 | 820 | | | |
| | 40 | 9.643 | | | 3304 | 657 | | | |
| | 41 | 10.336 | | | 12064 | 2952 | | | |
| | 42 | 11.604 | | | 2471 | 578 | | | |
| | 43 | 11.786 | | | 967 | 253 | | | |
| | 44 | 12.435 | | | 5335 | 943 | | | |
| | 45 | 12.879 | | | 487 | 116 | | | |
| | 46 | 13.462 | | | 5111 | 445 | | | |
| | 47 | 13.686 | | | 1776 | 354 | | | |
| | 48 | 13.772 | 13.752 | 0.020 | 3494 | 744 | 3.39925 | a | BZ#77 |
| | 49 | 13.947 | | | 1019 | 192 | | | |
| | 50 | 14.036 | | | 1695 | 267 | | | |
| | 51 | 14.628 | | | 7076 | 1399 | | | |
| | 52 | 16.007 | | | 1527 | 159 | | | |
| | 53 | 16.281 | | | 31760 | 3250 | | | |
| | 54 | 17.317 | | | 1432 | 172 | | | |
| | 55 | 17.733 | 17.762 | -0.029 | 1131 | 143 | 1.87091 | a | BZ#126 |

# STL Burlington - Target GC Injection Report

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| 56 | 18.015 | | | 2907 | 466 | | | |
| 57 | 18.225 | | | 484 | 114 | | | |
| 58 | 18.516 | | | 2101 | 250 | | | |
| 59 | 19.141 | | | 874 | 147 | | | |
| 60 | 19.671 | | | 1067 | 205 | | | |
| 61 | 19.784 | | | 1944 | 310 | | | |
| 62 | 20.447 | | | 2948 | 321 | | | |
| 63 | 20.775 | | | 2773 | 269 | | | |
| 64 | 21.462 | | | 1003 | 201 | | | |
| 65 | 21.949 | | | 2053 | 217 | | | |
| $ 66 | 22.548 | 22.559 | -0.011 | 350184 | 69002 | 46.3517 | | BZ#198 |
| 67 | 23.370 | | | 1774 | 349 | | | |
| 68 | 23.714 | | | 1053 | 152 | | | |
| 69 | 24.647 | | | 1738 | 296 | | | |
| 70 | 25.232 | | | 3903 | 389 | | | |
| 71 | 25.662 | | | 2138 | 258 | | | |
| 72 | 26.906 | | | 1238 | 165 | | | |
| 73 | 27.642 | | | 2587 | 271 | | | |
| 74 | 27.895 | | | 1358 | 235 | | | |
| 75 | 28.063 | | | 849 | 159 | | | |
| 76 | 28.336 | | | 3545 | 697 | | | |
| 77 | 28.502 | | | 1359 | 239 | | | |
| 78 | 29.149 | | | 2556 | 206 | | | |
| 79 | 29.570 | | | 2498 | 142 | | | |
| 80 | 29.719 | | | 269 | 38 | | | |
| 81 | 29.839 | | | 6375 | 1061 | | | |
| 82 | 30.523 | | | 15001 | 1802 | | | |
| 83 | 30.903 | | | 753 | 75 | | | |
| 84 | 31.317 | | | 558 | 25 | | | |
| 85 | 31.499 | | | 429 | 98 | | | |
| 86 | 31.623 | | | 359 | 102 | | | |
| 87 | 31.740 | | | 7637 | 896 | | | |
| 88 | 31.991 | | | 344 | 93 | | | |
| 89 | 32.100 | | | 649 | 142 | | | |
| 90 | 32.228 | | | 17341 | 4856 | | | |
| 91 | 32.572 | | | 1542 | 335 | | | |
| 92 | 32.793 | | | 12567 | 1497 | | | |
| 93 | 33.028 | | | 3506 | 612 | | | |
| 94 | 33.152 | | | 8439 | 1045 | | | |
| 95 | 33.299 | | | 4942 | 731 | | | |
| 96 | 33.505 | | | 25862 | 3628 | | | |
| 97 | 34.126 | | | 3020 | 379 | | | |
| 98 | 34.702 | | | 9828 | 1339 | | | |
| 99 | 35.267 | | | 5023 | 476 | | | |
| 100 | 35.498 | | | 4678 | 573 | | | |
| 101 | 35.673 | | | 12541 | 1077 | | | |
| 102 | 36.602 | | | 1910 | 319 | | | |
| 103 | 36.748 | | | 1142 | 208 | | | |
| 104 | 36.876 | | | 1081 | 152 | | | |
| 105 | 37.067 | | | 1503 | 208 | | | |
| 106 | 37.475 | | | 1052 | 185 | | | |
| 107 | 37.854 | | | 927 | 171 | | | |
| 108 | 39.069 | | | 1745 | 286 | | | |
| 109 | 39.226 | | | 1161 | 189 | | | |

Flags: A - Peak quantitates above calibration range
a - Peak quantitates below reporting limit
H - User selected alternate compound hit
M - Peak manually integrated or manually identified
R - Peak fails recovery
U - User disabled peak ID: either peak quantitates below reporting limit or peak identification not confirmed on second column

# STL Burlington - Target GC Injection Report

```
  Peak      Expected
   RT          RT                 Target Compound
========    ========    ======================================
```

## Target Compounds

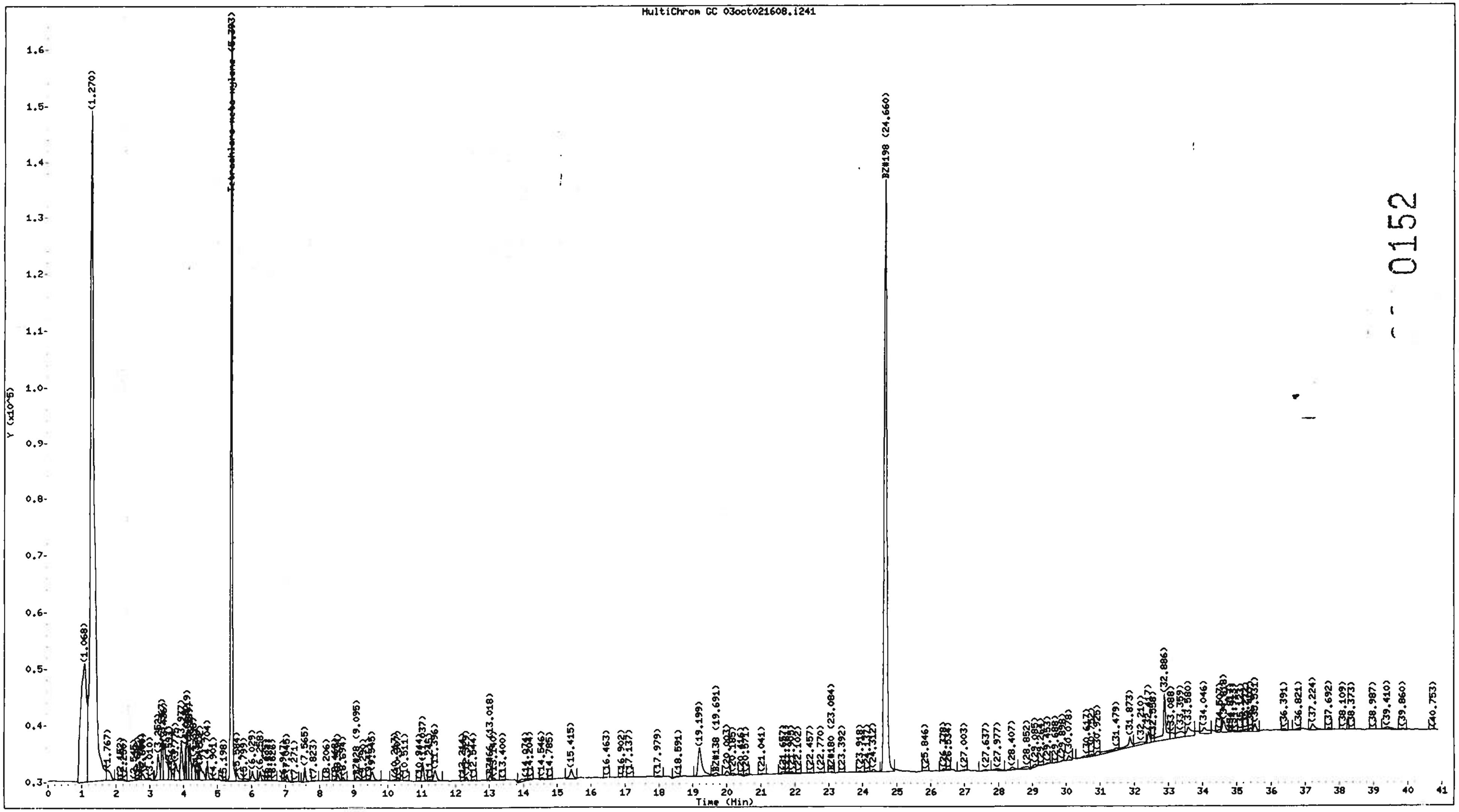
```
  Peak      Expected
   RT          RT                 Target Compound
========    ========    ======================================
   5.001       5.001    Tetrachloro-meta-xylene
               5.761    BZ#8
               6.701    BZ#18
               7.925    BZ#28
               8.984    BZ#52
               9.667    BZ#44
              11.243    BZ#66
              12.207    BZ#101
  13.772      13.752    BZ#77
              14.938    BZ#118
              15.993    BZ#153
              16.155    BZ#105
              17.328    BZ#138
  17.733      17.762    BZ#126
              18.647    BZ#128
              20.781    BZ#180
              22.271    BZ#170
  22.548      22.559    BZ#198
              24.552    BZ#195
              27.655    BZ#206
              29.180    BZ#209
```

# STL Burlington - Target GC Chromatogram

| | |
|---|---|
| Lab Sample ID: 502121 | Client Sample ID: F01009LS61 |

Matrix : SOIL
Analyst :
Instrument : 3327_2.i
Column : RTX-CLPII
Integrator : Falcon
Method : /var/chem/3327_2.i/100302_1/03OCT021608.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 09:57 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 17:11
Dilution Factor : 1.00
Data File : 03oct021608-r241.d
Compound Sublist: ENVNET



# STL Burlington - Target GC Injection Report

**Lab Sample ID: 502121** **Client Sample ID: F01009LS61**

| | | | |
|---|---|---|---|
| Matrix | : SOIL | Sample Type | : SAMPLE |
| Analyst | : | Injection Date | : 04-OCT-2002 17:11 |
| Instrument | : 3327_2.i | Dilution Factor | : 1.00 |
| Column | : RTX-CLPII | Data File | : 03oct021608-r241.d |
| Integrator | : Falcon | Compound Sublist | : ENVNET |

Method : /var/chem/3327_2.i/100302_1/03OCT021608.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 09:57 rrm

## Peaks

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| 1 | 1.068 | | | 250003 | 20948 | | | |
| 2 | 1.270 | | | 953092 | 119057 | | | |
| 3 | 1.767 | | | 14977 | 1836 | | | |
| 4 | 2.152 | | | 1587 | 362 | | | |
| 5 | 2.250 | | | 951 | 255 | | | |
| 6 | 2.545 | | | 641 | 63 | | | |
| 7 | 2.642 | | | 1495 | 417 | | | |
| 8 | 2.744 | | | 2506 | 879 | | | |
| 9 | 2.800 | | | 6389 | 1078 | | | |
| 10 | 3.010 | | | 1474 | 342 | | | |
| 11 | 3.252 | | | 21437 | 4512 | | | |
| 12 | 3.367 | | | 25298 | 7136 | | | |
| 13 | 3.436 | | | 37782 | 6420 | | | |
| 14 | 3.593 | | | 11195 | 2336 | | | |
| 15 | 3.677 | | | 4432 | 1300 | | | |
| 16 | 3.775 | | | 16412 | 2891 | | | |
| 17 | 3.937 | | | 27397 | 6940 | | | |
| 18 | 4.068 | | | 13877 | 6020 | | | |
| 19 | 4.119 | | | 27831 | 8723 | | | |
| 20 | 4.189 | | | 19712 | 6464 | | | |
| 21 | 4.298 | | | 15390 | 3776 | | | |
| 22 | 4.378 | | | 5428 | 1842 | | | |
| 23 | 4.471 | | | 2437 | 1033 | | | |
| 24 | 4.502 | | | 14833 | 2436 | | | |
| 25 | 4.704 | | | 10416 | 3396 | | | |
| 26 | 4.901 | | | 2194 | 331 | | | |
| 27 | 5.198 | | | 725 | 191 | | | |
| $ 28 | 5.393 | 5.391 | 0.002 | 506472 | 171401 | 45.4367 | | Tetrachloro-meta-xylene |
| 29 | 5.584 | | | 7310 | 1384 | | | |
| 30 | 5.799 | | | 3955 | 445 | | | |
| 31 | 6.029 | | | 8362 | 1803 | | | |
| 32 | 6.258 | | | 6324 | 1731 | | | |
| 33 | 6.435 | | | 501 | 140 | | | |
| 34 | 6.524 | | | 738 | 215 | | | |
| 35 | 6.626 | | | 984 | 181 | | | |
| 36 | 6.947 | | | 212 | 75 | | | |
| 37 | 7.045 | | | 4954 | 1286 | | | |
| 38 | 7.271 | | | 794 | 134 | | | |
| 39 | 7.565 | | | 8884 | 2628 | | | |
| 40 | 7.823 | | | 1296 | 209 | | | |
| 41 | 8.206 | | | 1426 | 190 | | | |
| 42 | 8.468 | | | 1359 | 329 | | | |
| 43 | 8.534 | | | 4879 | 1126 | | | |
| 44 | 8.694 | | | 2297 | 648 | | | |
| 45 | 9.095 | 9.137 | -0.042 | 5044 | 856 | 1.56556 | a | BZ#28 |
| 46 | 9.290 | | | 1052 | 192 | | | |
| 47 | 9.461 | | | 1967 | 441 | | | |
| 48 | 9.545 | | | 9477 | 1549 | | | |
| 49 | 10.217 | | | 1624 | 253 | | | |
| 50 | 10.307 | | | 2384 | 649 | | | |
| 51 | 10.511 | | | 1062 | 136 | | | |
| 52 | 10.944 | | | 538 | 169 | | | |
| 53 | 11.037 | | | 12327 | 3244 | | | |
| 54 | 11.245 | | | 1237 | 237 | | | |
| 55 | 11.396 | | | 11113 | 1884 | | | |

0153

# STL Burlington - Target GC Injection Report

```
                                                               Extract
 Peak     Peak    Expected   Delta                              Conc.
  No.      RT        RT        RT       Area      Height        (ppb)     Flags              Peak Identification
=====  ========  ========  ========  ========  ========  ==========  =====  ====================================
   56    12.214                            472       122
   57    12.329                           2397       608
   58    12.544                            845       226
   59    13.018    13.056    -0.038       4104       942     2.24916   a       BZ#66
   60    13.140                           1945       435
   61    13.400                           1197       186
   62    14.074                           5269       304
   63    14.204                           2135       271
   64    14.546                           2877       367
   65    14.785                           1265       188
   66    15.415                          10913      1668
   67    16.463                            481       100
   68    16.902                            569       116
   69    17.137                           1309       189
   70    17.979                           2175       253
   71    18.591                           1454        75
   72    19.199                          40554      4938
   73    19.691    19.713    -0.022       5203       461     0.468848  a       BZ#138
   74    20.003                           4970       758
   75    20.185                           3109       354
   76    20.416                           1777       348
   77    20.571                           2082       393
   78    21.041                           1144       162
   79    21.657                           2765       376
   80    21.761                           1876       324
   81    21.905                           2595       385
   82    22.102                           1099       164
   83    22.457                           1094       215
   84    22.770                           1832       194
   85    23.084    23.115    -0.031       1107       228     0.544203  a       BZ#180
   86    23.392                            509        94
   87    23.918                           1271       232
   88    24.137                            803       186
   89    24.312                           3345       491
$  90    24.660    24.678    -0.018     564167    105087    44.1377            BZ#198
   91    25.846                            556        97
   92    26.378                           1752       356
   93    26.534                           1194       225
   94    27.003                           2195       204
   95    27.637                           2582       235
   96    27.977                           4612       355
   97    28.407                           4980       488
   98    28.852                           5643       452
   99    29.085                           3477       448
  100    29.264                            588       119
  101    29.453                           1095       200
  102    29.688                            342        74
  103    29.898                           1107       209
  104    30.078                           5565       855
  105    30.617                           3847       332
  106    30.752                           2175       365
  107    30.925                           5273       715
  108    31.479                          11373       436
  109    31.873                          13171      1805
  110    32.210                           9196       498
  111    32.417                           8394      2090
  112    32.558                           3822       650
  113    32.886                          45424      8097
  114    33.088                           9468      1140
  115    33.359                          15160      1036
  116    33.580                          17552      1599
  117    34.046                          12983      1125
  118    34.507                           3380       461
  119    34.618                          12988      2003
  120    34.817                           1800       347
  121    34.913                           2104       314
  122    35.123                           1572       259
  123    35.272                           3267       411
  124    35.407                           3416       622
  125    35.531                           7126      1342
  126    36.391                           2323       359
```

# STL Burlington - Target GC Injection Report

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| 127 | 36.821 | | | 2675 | 321 | | | |
| 128 | 37.224 | | | 8603 | 1003 | | | |
| 129 | 37.692 | | | 2094 | 377 | | | |
| 130 | 38.109 | | | 1027 | 181 | | | |
| 131 | 38.373 | | | 557 | 108 | | | |
| 132 | 38.987 | | | 654 | 116 | | | |
| 133 | 39.410 | | | 5737 | 384 | | | |
| 134 | 39.860 | | | 1180 | 190 | | | |
| 135 | 40.753 | | | 510 | 92 | | | |

Flags:
A - Peak quantitates above calibration range
a - Peak quantitates below reporting limit
H - User selected alternate compound hit
M - Peak manually integrated or manually identified
R - Peak fails recovery
U - User disabled peak ID: either peak quantitates below reporting limit or peak identification not confirmed on second column

## Target Compounds

| Peak RT | Expected RT | Target Compound |
|---|---|---|
| 5.393 | 5.391 | Tetrachloro-meta-xylene |
| | 6.592 | BZ#8 |
| | 7.698 | BZ#18 |
| 9.095 | 9.137 | BZ#28 |
| | 10.341 | BZ#52 |
| | 11.312 | BZ#44 |
| 13.018 | 13.056 | BZ#66 |
| | 13.914 | BZ#101 |
| | 16.080 | BZ#77 |
| | 17.075 | BZ#118 |
| | 17.995 | BZ#153 |
| | 18.720 | BZ#105 |
| 19.691 | 19.713 | BZ#138 |
| | 20.225 | BZ#126 |
| | 21.462 | BZ#128 |
| 23.084 | 23.115 | BZ#180 |
| 24.660 | 24.678 | BZ#198 |
| | 25.004 | BZ#170 |
| | 27.203 | BZ#195 |
| | 29.805 | BZ#206 |
| | 30.754 | BZ#209 |

# FORM 1
# OTHER ORGANICS ANALYSIS DATA SHEET

ENVNET SAMPLE NO.

F01009LS62

Lab Name: STL BURLINGTON Contract: 22000

Lab Code: STLVT Case No.: 22000 SAS No.: SDG No.: 89891

Matrix: (soil/water) SOIL Lab Sample ID: 502120

Sample wt/vol: 30.0 (g/mL) G Lab File ID: 03OCT021608-R231

% Moisture: 33 decanted: (Y/N) N Date Received: 09/25/02

Extraction: (SepF/Cont/Sonc) SOXH Date Extracted: 09/26/02

Concentrated Extract Volume: 10(mL) Date Analyzed: 10/04/02

Injection Volume: 1.0(uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: ____ Sulfur Cleanup: (Y/N) Y

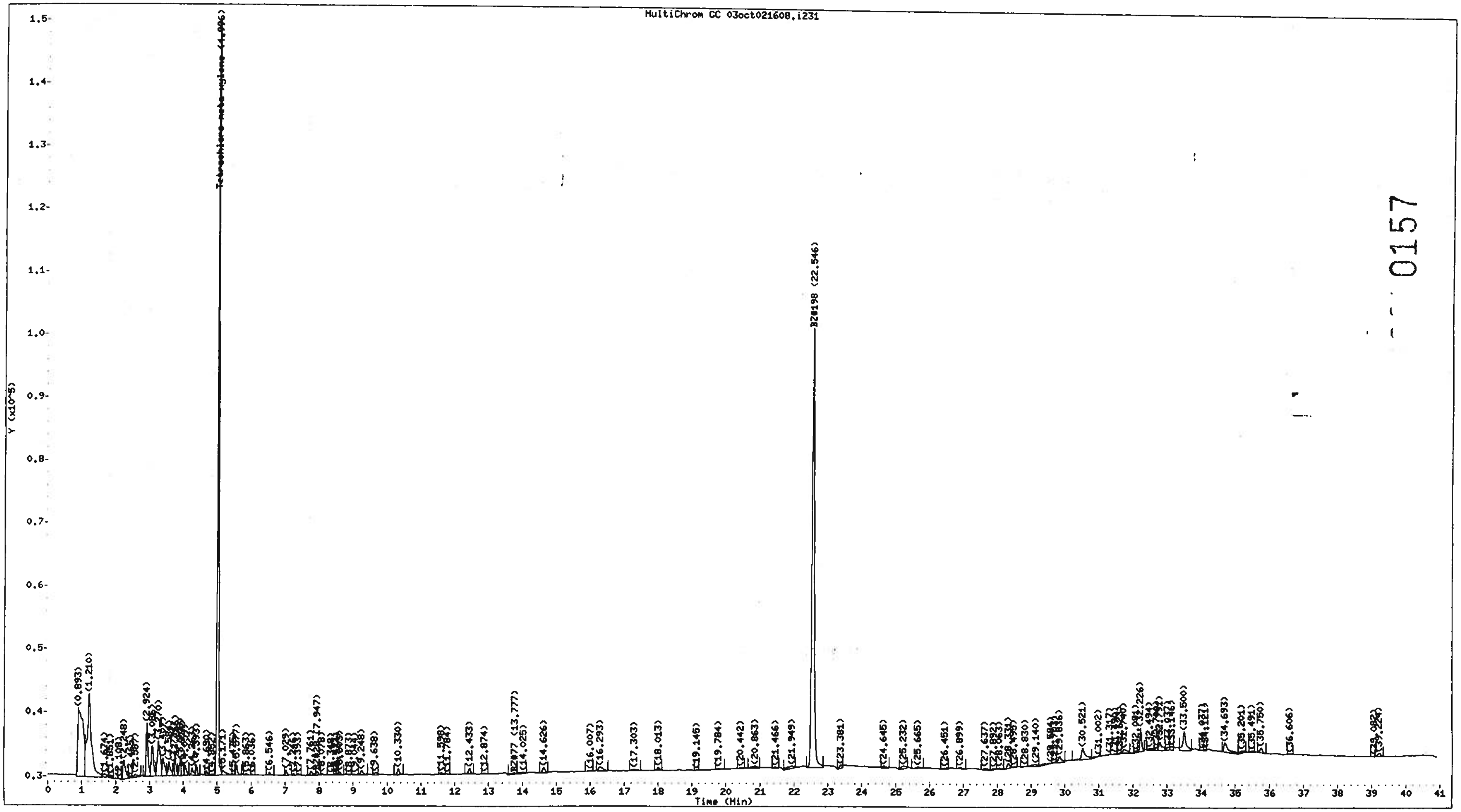
| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG | Q |
|---|---|---|---|
| 34883-43-7 | ------BZ#8 | 2.5 | U |
| 37680-65-2 | ------BZ#18 | 2.5 | U |
| 7012-37-5 | -------BZ#28 | 2.5 | U |
| 41464-39-5 | ------BZ#44 | 2.5 | U |
| 35693-99-3 | ------BZ#52 | 2.5 | U |
| 32598-10-0 | ------BZ#66 | 2.5 | U |
| 32598-13-3 | ------BZ#77 | 2.5 | U |
| 37680-73-2 | ------BZ#101 | 2.5 | U |
| 32598-14-4 | ------BZ#105 | 2.5 | U |
| 31508-00-6 | ------BZ#118 | 2.5 | U |
| 57465-28-8 | ------BZ#126 | 2.5 | U |
| 38380-07-3 | ------BZ#128 | 2.5 | U |
| 35065-28-2 | ------BZ#138 | 2.5 | U |
| 35065-27-1 | ------BZ#153 | 2.5 | U |
| 35065-30-6 | ------BZ#170 | 2.5 | U |
| 35065-29-3 | ------BZ#180 | 2.5 | U |
| 52663-68-0 | ------BZ#187 | 2.5 | U |
| 52663-78-2 | ------BZ#195 | 2.5 | U |
| 40186-72-9 | ------BZ#206 | 2.5 | U |
| 2051-24-3 | -------BZ#209 | 2.5 | U |

STL Burlington - Target GC Chromatogram

| Lab Sample ID: 502120 | Client Sample ID: F01009LS62 |
|---|---|

Matrix : SOIL
Analyst :
Instrument : 3327_1.i
Column : RTX-5
Integrator : Falcon
Method : /var/chem/3327_1.i/100302_1/03OCT021608.b/32CONG_3327RTX5_RAW.m
Reported : 17-Oct-2002 09:46 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 16:26
Dilution Factor : 1.00
Data File : 03oct021608-r231.d
Compound Sublist: ENVNET



# STL Burlington - Target GC Injection Report

| | |
|---|---|
| Lab Sample ID: 502120 | Client Sample ID: F01009LS62 |

| | | | |
|---|---|---|---|
| Matrix | : SOIL | Sample Type | : SAMPLE |
| Analyst | : | Injection Date | : 04-OCT-2002 16:26 |
| Instrument | : 3327_1.i | Dilution Factor | : 1.00 |
| Column | : RTX-5 | Data File | : 03oct021608-r231.d |
| Integrator | : Falcon | Compound Sublist | : ENVNET |

Method : /var/chem/3327_1.i/100302_1/03OCT021608.b/32CONG_3327RTX5_RAW.m
Reported : 17-Oct-2002 09:46 rrm

## Peaks

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.893 | | | 117649 | 10735 | | | |
| 2 | 1.210 | | | 117690 | 13056 | | | |
| 3 | 1.674 | | | 3845 | 531 | | | |
| 4 | 1.851 | | | 2216 | 412 | | | |
| 5 | 2.108 | | | 552 | 140 | | | |
| 6 | 2.248 | | | 15678 | 2925 | | | |
| 7 | 2.465 | | | 1455 | 257 | | | |
| 8 | 2.587 | | | 3782 | 421 | | | |
| 9 | 2.924 | | | 32605 | 8264 | | | |
| 10 | 3.086 | | | 21406 | 4736 | | | |
| 11 | 3.270 | | | 31468 | 5387 | | | |
| 12 | 3.407 | | | 13955 | 2748 | | | |
| 13 | 3.584 | | | 10518 | 2213 | | | |
| 14 | 3.724 | | | 4260 | 1951 | | | |
| 15 | 3.766 | | | 9728 | 3019 | | | |
| 16 | 3.908 | | | 7678 | 2504 | | | |
| 17 | 3.974 | | | 7058 | 2094 | | | |
| 18 | 4.059 | | | 6435 | 1503 | | | |
| 19 | 4.263 | | | 5057 | 1169 | | | |
| 20 | 4.393 | | | 5014 | 1645 | | | |
| 21 | 4.690 | | | 2057 | 668 | | | |
| 22 | 4.852 | | | 1201 | 197 | | | |
| $ 23 | 4.996 | 5.001 | -0.005 | 365888 | 146636 | 46.5179 | | Tetrachloro-meta-xylene |
| 24 | 5.171 | | | 6567 | 731 | | | |
| 25 | 5.475 | | | 850 | 221 | | | |
| 26 | 5.577 | | | 5509 | 1575 | | | |
| 27 | 5.863 | | | 1372 | 255 | | | |
| 28 | 6.036 | | | 571 | 191 | | | |
| 29 | 6.546 | | | 1753 | 483 | | | |
| 30 | 7.029 | | | 3000 | 911 | | | |
| 31 | 7.246 | | | 937 | 231 | | | |
| 32 | 7.393 | | | 722 | 246 | | | |
| 33 | 7.761 | | | 3041 | 604 | | | |
| 34 | 7.947 | 7.925 | 0.022 | 2177 | 589 | 0.581632 | a | BZ#28 |
| 35 | 8.078 | | | 1100 | 239 | | | |
| 36 | 8.348 | | | 669 | 115 | | | |
| 37 | 8.477 | | | 423 | 154 | | | |
| 38 | 8.534 | | | 788 | 239 | | | |
| 39 | 8.603 | | | 1869 | 457 | | | |
| 40 | 8.873 | | | 639 | 130 | | | |
| 41 | 9.044 | | | 637 | 100 | | | |
| 42 | 9.248 | | | 3983 | 687 | | | |
| 43 | 9.638 | | | 2172 | 319 | | | |
| 44 | 10.330 | | | 4623 | 980 | | | |
| 45 | 11.598 | | | 1343 | 284 | | | |
| 46 | 11.784 | | | 422 | 96 | | | |
| 47 | 12.433 | | | 4318 | 907 | | | |
| 48 | 12.874 | | | 706 | 153 | | | |
| 49 | 13.777 | 13.752 | 0.024 | 2640 | 226 | 2.55938 | a | BZ#77 |
| 50 | 14.025 | | | 2829 | 234 | | | |
| 51 | 14.626 | | | 4838 | 854 | | | |
| 52 | 16.007 | | | 1194 | 150 | | | |
| 53 | 16.293 | | | 6132 | 648 | | | |
| 54 | 17.303 | | | 1923 | 209 | | | |
| 55 | 18.013 | | | 2152 | 445 | | | |

# STL Burlington - Target GC Injection Report

| | Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|---|
| | 56 | 19.145 | | | 211 | 51 | | | |
| | 57 | 19.784 | | | 832 | 173 | | | |
| | 58 | 20.442 | | | 1079 | 188 | | | |
| | 59 | 20.863 | | | 3768 | 317 | | | |
| | 60 | 21.466 | | | 1041 | 164 | | | |
| | 61 | 21.949 | | | 5054 | 354 | | | |
| $ | 62 | 22.546 | 22.559 | -0.013 | 352660 | 69875 | 46.9591 | | BZ#198 |
| | 63 | 23.381 | | | 2533 | 434 | | | |
| | 64 | 24.645 | | | 2303 | 273 | | | |
| | 65 | 25.232 | | | 4154 | 417 | | | |
| | 66 | 25.665 | | | 2711 | 253 | | | |
| | 67 | 26.451 | | | 1221 | 124 | | | |
| | 68 | 26.899 | | | 1613 | 202 | | | |
| | 69 | 27.637 | | | 2334 | 255 | | | |
| | 70 | 27.892 | | | 1077 | 187 | | | |
| | 71 | 28.063 | | | 881 | 159 | | | |
| | 72 | 28.331 | | | 3698 | 717 | | | |
| | 73 | 28.495 | | | 580 | 115 | | | |
| | 74 | 28.830 | | | 889 | 125 | | | |
| | 75 | 29.140 | | | 3525 | 294 | | | |
| | 76 | 29.584 | | | 3499 | 97 | | | |
| | 77 | 29.703 | | | 655 | 126 | | | |
| | 78 | 29.836 | | | 7118 | 1013 | | | |
| | 79 | 30.521 | | | 15959 | 1802 | | | |
| | 80 | 31.002 | | | 2028 | 63 | | | |
| | 81 | 31.317 | | | 892 | 72 | | | |
| | 82 | 31.490 | | | 985 | 153 | | | |
| | 83 | 31.623 | | | 429 | 104 | | | |
| | 84 | 31.740 | | | 5467 | 622 | | | |
| | 85 | 32.091 | | | 1095 | 260 | | | |
| | 86 | 32.226 | | | 13138 | 3721 | | | |
| | 87 | 32.494 | | | 3361 | 346 | | | |
| | 88 | 32.700 | | | 2485 | 494 | | | |
| | 89 | 32.791 | | | 8696 | 1328 | | | |
| | 90 | 33.037 | | | 2727 | 501 | | | |
| | 91 | 33.146 | | | 3989 | 618 | | | |
| | 92 | 33.500 | | | 19834 | 2934 | | | |
| | 93 | 34.037 | | | 749 | 141 | | | |
| | 94 | 34.121 | | | 834 | 213 | | | |
| | 95 | 34.693 | | | 13927 | 1465 | | | |
| | 96 | 35.201 | | | 2757 | 304 | | | |
| | 97 | 35.491 | | | 1045 | 200 | | | |
| | 98 | 35.750 | | | 3822 | 789 | | | |
| | 99 | 36.606 | | | 510 | 105 | | | |
| | 100 | 39.082 | | | 496 | 101 | | | |
| | 101 | 39.224 | | | 3370 | 515 | | | |

Flags:
- A - Peak quantitates above calibration range
- a - Peak quantitates below reporting limit
- H - User selected alternate compound hit
- M - Peak manually integrated or manually identified
- R - Peak fails recovery
- U - User disabled peak ID: either peak quantitates below reporting limit or peak identification not confirmed on second column

## Target Compounds

| Peak RT | Expected RT | Target Compound |
|---|---|---|
| 4.996 | 5.001 | Tetrachloro-meta-xylene |
| | 5.761 | BZ#8 |
| | 6.701 | BZ#18 |
| 7.947 | 7.925 | BZ#28 |
| | 8.984 | BZ#52 |
| | 9.667 | BZ#44 |
| | 11.243 | BZ#66 |
| | 12.207 | BZ#101 |
| 13.777 | 13.752 | BZ#77 |

0159

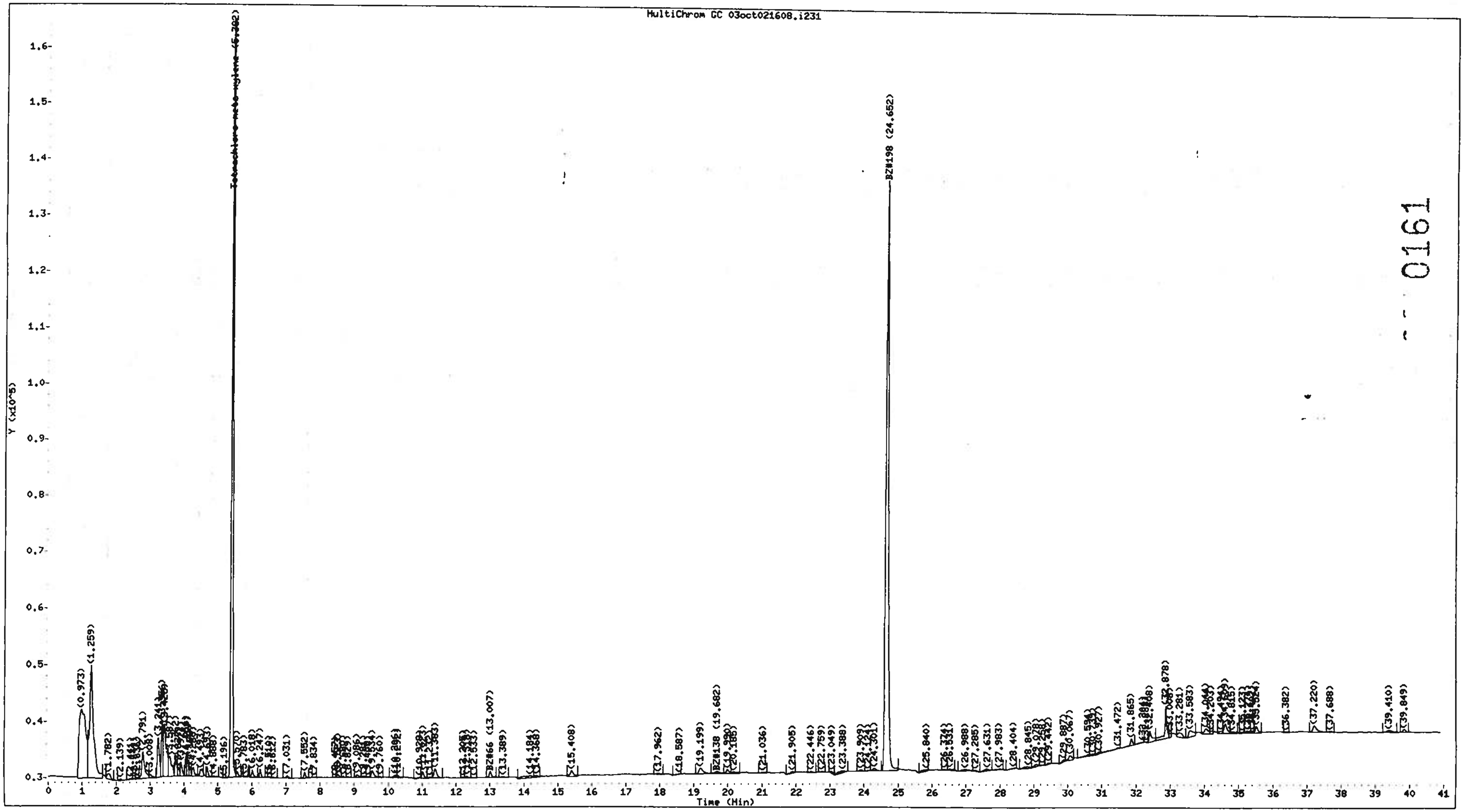
```
  Peak       Expected
   RT           RT                   Target Compound
========     ========     ====================================
               14.938     BZ#118
               15.993     BZ#153
               16.155     BZ#105
               17.328     BZ#138
               17.762     BZ#126
               18.647     BZ#128
               20.781     BZ#180
               22.271     BZ#170
  22.546       22.559     BZ#198
               24.552     BZ#195
               27.655     BZ#206
               29.180     BZ#209
```

## STL Burlington - Target GC Chromatogram

| Lab Sample ID: 502120 | Client Sample ID: F01009LS62 |
|---|---|

Matrix : SOIL
Analyst :
Instrument : 3327_2.i
Column : RTX-CLPII
Integrator : Falcon
Method : /var/chem/3327_2.i/100302_1/03OCT021608.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 09:57 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 16:26
Dilution Factor : 1.00
Data File : 03oct021608-r231.d
Compound Sublist: ENVNET



# STL Burlington - Target GC Injection Report

**Lab Sample ID: 502120** **Client Sample ID: F01009LS62**

Matrix : SOIL
Analyst :
Instrument : 3327_2.i
Column : RTX-CLPII
Integrator : Falcon
Method : /var/chem/3327_2.i/100302_1/03OCT021608.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 09:57 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 16:26
Dilution Factor : 1.00
Data File : 03oct021608-r231.d
Compound Sublist: ENVNET

## Peaks

| | Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0.973 | | | 163048 | 12133 | | | |
| | 2 | 1.259 | | | 168260 | 19918 | | | |
| | 3 | 1.782 | | | 6806 | 957 | | | |
| | 4 | 2.139 | | | 1717 | 296 | | | |
| | 5 | 2.441 | | | 1517 | 218 | | | |
| | 6 | 2.549 | | | 701 | 152 | | | |
| | 7 | 2.636 | | | 1415 | 302 | | | |
| | 8 | 2.791 | | | 28029 | 4705 | | | |
| | 9 | 3.008 | | | 3886 | 634 | | | |
| | 10 | 3.241 | | | 29770 | 6995 | | | |
| | 11 | 3.356 | | | 33852 | 9972 | | | |
| | 12 | 3.425 | | | 55887 | 9284 | | | |
| | 13 | 3.587 | | | 23096 | 3525 | | | |
| | 14 | 3.762 | | | 12818 | 3464 | | | |
| | 15 | 3.837 | | | 5112 | 1535 | | | |
| | 16 | 3.924 | | | 8191 | 2381 | | | |
| | 17 | 4.056 | | | 8646 | 3461 | | | |
| | 18 | 4.107 | | | 9850 | 3355 | | | |
| | 19 | 4.178 | | | 5157 | 1737 | | | |
| | 20 | 4.280 | | | 7643 | 1512 | | | |
| | 21 | 4.493 | | | 7426 | 1191 | | | |
| | 22 | 4.693 | | | 4953 | 1720 | | | |
| | 23 | 4.888 | | | 985 | 194 | | | |
| | 24 | 5.196 | | | 345 | 108 | | | |
| $ | 25 | 5.382 | 5.391 | -0.009 | 503937 | 171442 | 45.4474 | | Tetrachloro-meta-xylene |
| | 26 | 5.570 | | | 3911 | 943 | | | |
| | 27 | 5.783 | | | 1566 | 201 | | | |
| | 28 | 6.018 | | | 4766 | 1254 | | | |
| | 29 | 6.247 | | | 4697 | 1510 | | | |
| | 30 | 6.510 | | | 618 | 202 | | | |
| | 31 | 6.612 | | | 612 | 145 | | | |
| | 32 | 7.031 | | | 2546 | 477 | | | |
| | 33 | 7.552 | | | 3454 | 1021 | | | |
| | 34 | 7.834 | | | 506 | 98 | | | |
| | 35 | 8.457 | | | 442 | 130 | | | |
| | 36 | 8.523 | | | 2685 | 595 | | | |
| | 37 | 8.680 | | | 1005 | 297 | | | |
| | 38 | 8.829 | | | 643 | 169 | | | |
| | 39 | 9.086 | | | 2994 | 540 | | | |
| | 40 | 9.281 | | | 1454 | 266 | | | |
| | 41 | 9.405 | | | 1194 | 211 | | | |
| | 42 | 9.534 | | | 7211 | 1212 | | | |
| | 43 | 9.760 | | | 1206 | 226 | | | |
| | 44 | 10.206 | | | 2850 | 443 | | | |
| | 45 | 10.292 | | | 2260 | 402 | | | |
| | 46 | 10.928 | | | 1603 | 244 | | | |
| | 47 | 11.023 | | | 5092 | 1106 | | | |
| | 48 | 11.232 | | | 1475 | 235 | | | |
| | 49 | 11.383 | | | 9949 | 1612 | | | |
| | 50 | 12.205 | | | 485 | 119 | | | |
| | 51 | 12.318 | | | 1370 | 317 | | | |
| | 52 | 12.533 | | | 525 | 113 | | | |
| | 53 | 13.007 | 13.056 | -0.049 | 5808 | 1048 | 2.31330 | a | BZ#66 |
| | 54 | 13.389 | | | 1936 | 189 | | | |
| | 55 | 14.184 | | | 7053 | 283 | | | |

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| 56 | 14.368 | | | 2488 | 310 | | | |
| 57 | 15.408 | | | 8031 | 1057 | | | |
| 58 | 17.962 | | | 1252 | 190 | | | |
| 59 | 18.587 | | | 915 | 67 | | | |
| 60 | 19.199 | | | 9207 | 1015 | | | |
| 61 | 19.682 | 19.713 | -0.031 | 3858 | 371 | 0.424244 | a | BZ#138 |
| 62 | 19.990 | | | 3816 | 670 | | | |
| 63 | 20.185 | | | 2624 | 249 | | | |
| 64 | 21.036 | | | 1622 | 192 | | | |
| 65 | 21.905 | | | 2588 | 299 | | | |
| 66 | 22.446 | | | 1087 | 208 | | | |
| 67 | 22.759 | | | 840 | 139 | | | |
| 68 | 23.049 | | | 1843 | 365 | | | |
| 69 | 23.388 | | | 5364 | 319 | | | |
| 70 | 23.909 | | | 1508 | 266 | | | |
| 71 | 24.124 | | | 603 | 138 | | | |
| 72 | 24.301 | | | 3124 | 453 | | | |
| $ 73 | 24.652 | 24.678 | -0.027 | 566521 | 105575 | 44.3434 | | BZ#198 |
| 74 | 25.840 | | | 3648 | 242 | | | |
| 75 | 26.374 | | | 1504 | 232 | | | |
| 76 | 26.531 | | | 2764 | 276 | | | |
| 77 | 26.988 | | | 4858 | 323 | | | |
| 78 | 27.285 | | | 1429 | 202 | | | |
| 79 | 27.631 | | | 3620 | 305 | | | |
| 80 | 27.983 | | | 1755 | 149 | | | |
| 81 | 28.404 | | | 1296 | 168 | | | |
| 82 | 28.845 | | | 4644 | 344 | | | |
| 83 | 29.078 | | | 3238 | 417 | | | |
| 84 | 29.258 | | | 740 | 152 | | | |
| 85 | 29.442 | | | 1237 | 219 | | | |
| 86 | 29.887 | | | 2876 | 426 | | | |
| 87 | 30.067 | | | 7181 | 968 | | | |
| 88 | 30.594 | | | 3130 | 325 | | | |
| 89 | 30.739 | | | 2334 | 386 | | | |
| 90 | 30.927 | | | 2685 | 378 | | | |
| 91 | 31.472 | | | 3975 | 227 | | | |
| 92 | 31.865 | | | 6184 | 1231 | | | |
| 93 | 32.204 | | | 1702 | 90 | | | |
| 94 | 32.288 | | | 504 | 124 | | | |
| 95 | 32.408 | | | 11518 | 2003 | | | |
| 96 | 32.878 | | | 27473 | 5831 | | | |
| 97 | 33.008 | | | 3518 | 734 | | | |
| 98 | 33.281 | | | 7277 | 786 | | | |
| 99 | 33.583 | | | 11215 | 1167 | | | |
| 100 | 34.044 | | | 8031 | 939 | | | |
| 101 | 34.203 | | | 3035 | 525 | | | |
| 102 | 34.494 | | | 3446 | 462 | | | |
| 103 | 34.609 | | | 11451 | 1763 | | | |
| 104 | 34.815 | | | 3488 | 346 | | | |
| 105 | 35.123 | | | 1632 | 262 | | | |
| 106 | 35.274 | | | 3406 | 363 | | | |
| 107 | 35.402 | | | 2173 | 382 | | | |
| 108 | 35.524 | | | 6947 | 1241 | | | |
| 109 | 36.382 | | | 1549 | 213 | | | |
| 110 | 37.220 | | | 10910 | 1197 | | | |
| 111 | 37.688 | | | 1487 | 213 | | | |
| 112 | 39.410 | | | 3751 | 320 | | | |
| 113 | 39.849 | | | 3069 | 538 | | | |

Flags:
A - Peak quantitates above calibration range
a - Peak quantitates below reporting limit
H - User selected alternate compound hit
M - Peak manually integrated or manually identified
R - Peak fails recovery
U - User disabled peak ID: either peak quantitates below reporting limit or peak identification not confirmed on second column

```
  Peak      Expected
   RT          RT                      Target Compound
========    ========    ======================================
______________________________ Target Compounds ______________________________

  Peak      Expected
   RT          RT                      Target Compound
========    ========    ======================================
   5.382       5.391    Tetrachloro-meta-xylene
               6.592    BZ#8
               7.698    BZ#18
               9.137    BZ#28
              10.341    BZ#52
              11.312    BZ#44
  13.007      13.056    BZ#66
              13.914    BZ#101
              16.080    BZ#77
              17.075    BZ#118
              17.995    BZ#153
              18.720    BZ#105
  19.682      19.713    BZ#138
              20.225    BZ#126
              21.462    BZ#128
              23.115    BZ#180
  24.652      24.678    BZ#198
              25.004    BZ#170
              27.203    BZ#195
              29.805    BZ#206
              30.754    BZ#209
```

FORM 1
OTHER ORGANICS ANALYSIS DATA SHEET

ENVNET SAMPLE NO.

F01009LS63

Lab Name: STL BURLINGTON Contract: 22000

Lab Code: STLVT Case No.: 22000 SAS No.: SDG No.: 89891

Matrix: (soil/water) SOIL Lab Sample ID: 502119

Sample wt/vol: 30.1 (g/mL) G Lab File ID: 03OCT021608-R221

% Moisture: 24 decanted: (Y/N) N Date Received: 09/25/02

Extraction: (SepF/Cont/Sonc) SOXH Date Extracted: 09/26/02

Concentrated Extract Volume: 10(mL) Date Analyzed: 10/04/02

Injection Volume: 1.0(uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: ___ Sulfur Cleanup: (Y/N) Y

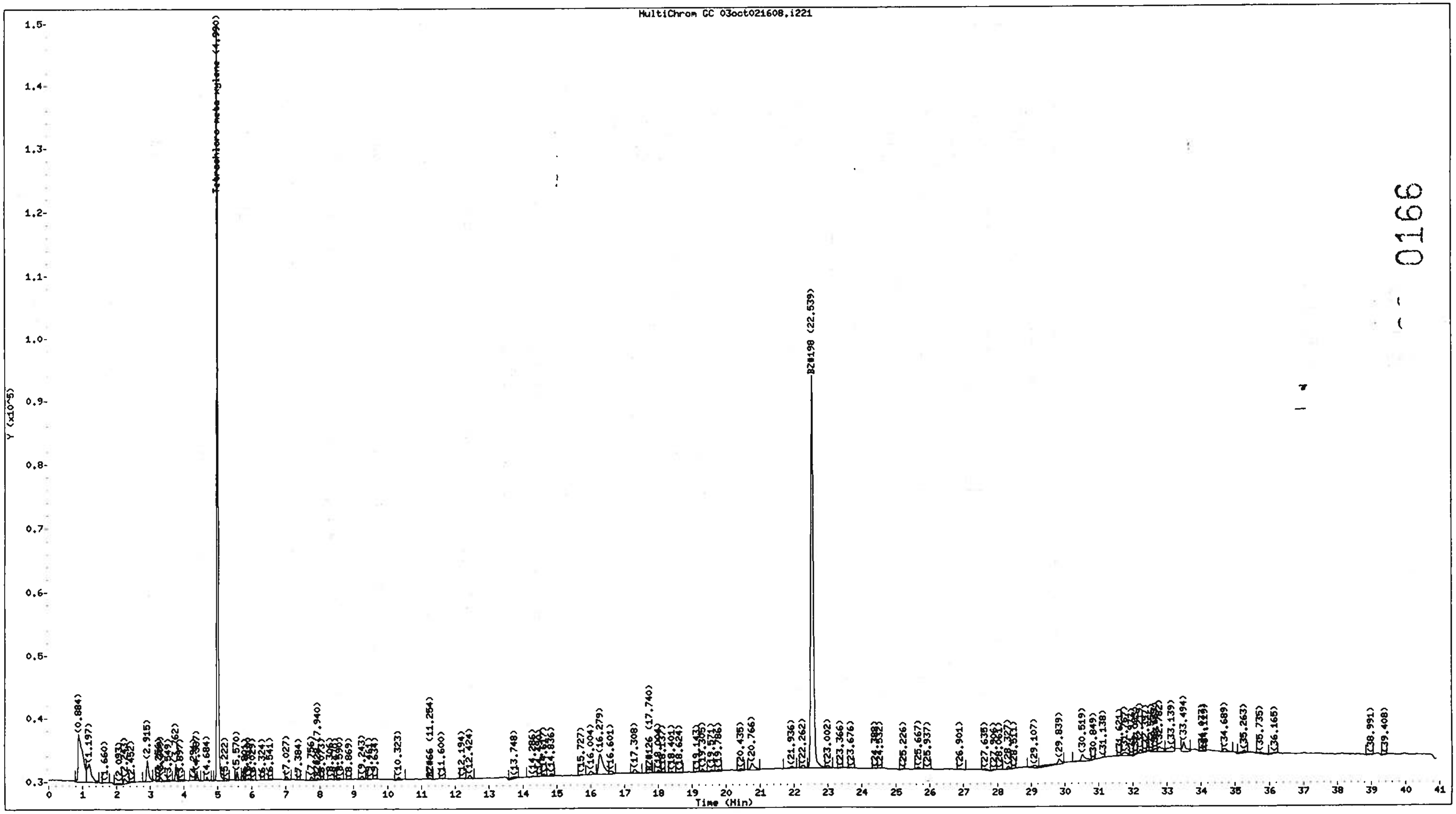
| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG | Q |
|---|---|---|---|
| 34883-43-7 | BZ#8 | 2.2 | U |
| 37680-65-2 | BZ#18 | 2.2 | U |
| 7012-37-5 | BZ#28 | 2.2 | U |
| 41464-39-5 | BZ#44 | 2.2 | U |
| 35693-99-3 | BZ#52 | 2.2 | U |
| 32598-10-0 | BZ#66 | 2.2 | U |
| 32598-13-3 | BZ#77 | 2.2 | U |
| 37680-73-2 | BZ#101 | 2.2 | U |
| 32598-14-4 | BZ#105 | 2.2 | U |
| 31508-00-6 | BZ#118 | 2.2 | U |
| 57465-28-8 | BZ#126 | 2.2 | U |
| 38380-07-3 | BZ#128 | 2.2 | U |
| 35065-28-2 | BZ#138 | 2.2 | U |
| 35065-27-1 | BZ#153 | 2.2 | U |
| 35065-30-6 | BZ#170 | 2.2 | U |
| 35065-29-3 | BZ#180 | 2.2 | U |
| 52663-68-0 | BZ#187 | 2.2 | U |
| 52663-78-2 | BZ#195 | 2.2 | U |
| 40186-72-9 | BZ#206 | 2.2 | U |
| 2051-24-3 | BZ#209 | 2.2 | U |

FORM I OTHER

## STL Burlington - Target GC Chromatogram

| | |
|---|---|
| Lab Sample ID: 502119 | Client Sample ID: F01009LS63 |

```
Matrix        : SOIL                  Sample Type     : SAMPLE
Analyst       :                       Injection Date  : 04-OCT-2002 15:41
Instrument    : 3327_1.i              Dilution Factor : 1.00
Column        : RTX-5                 Data File       : 03oct021608-r221.d
Integrator    : Falcon                Compound Sublist: ENVNET
Method        : /var/chem/3327_1.i/100302_1/03OCT021608.b/32CONG_3327RTX5_RAW.m
Reported      : 17-Oct-2002 09:45 rrm
```



# STL Burlington - Target GC Injection Report

Lab Sample ID: 502119 Client Sample ID: F01009LS63

Matrix : SOIL
Analyst :
Instrument : 3327_1.i
Column : RTX-5
Integrator : Falcon
Method : /var/chem/3327_1.i/100302_1/03OCT021608.b/32CONG_3327RTX5_RAW.m
Reported : 17-Oct-2002 09:45 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 15:41
Dilution Factor : 1.00
Data File : 03oct021608-r221.d
Compound Sublist: ENVNET

## Peaks

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.884 | | | 71601 | 7577 | | | |
| 2 | 1.197 | | | 27537 | 2852 | | | |
| 3 | 1.660 | | | 614 | 118 | | | |
| 4 | 2.093 | | | 1564 | 197 | | | |
| 5 | 2.243 | | | 5074 | 877 | | | |
| 6 | 2.452 | | | 1093 | 186 | | | |
| 7 | 2.915 | | | 16007 | 3368 | | | |
| 8 | 3.256 | | | 1330 | 338 | | | |
| 9 | 3.309 | | | 3314 | 628 | | | |
| 10 | 3.549 | | | 1370 | 304 | | | |
| 11 | 3.762 | | | 8266 | 2721 | | | |
| 12 | 3.897 | | | 1916 | 252 | | | |
| 13 | 4.291 | | | 916 | 152 | | | |
| 14 | 4.387 | | | 4117 | 1459 | | | |
| 15 | 4.684 | | | 1843 | 620 | | | |
| $ 16 | 4.990 | 5.001 | -0.011 | 326795 | 130361 | 41.3674 | | Tetrachloro-meta-xylene |
| 17 | 5.222 | | | 2224 | 382 | | | |
| 18 | 5.570 | | | 4190 | 1375 | | | |
| 19 | 5.801 | | | 244 | 87 | | | |
| 20 | 5.910 | | | 1326 | 326 | | | |
| 21 | 6.029 | | | 464 | 166 | | | |
| 22 | 6.324 | | | 364 | 88 | | | |
| 23 | 6.541 | | | 958 | 266 | | | |
| 24 | 7.027 | | | 2329 | 557 | | | |
| 25 | 7.384 | | | 201 | 81 | | | |
| 26 | 7.756 | | | 2828 | 578 | | | |
| 27 | 7.940 | 7.925 | 0.016 | 1224 | 322 | 0.379205 | a | BZ#28 |
| 28 | 8.073 | | | 247 | 77 | | | |
| 29 | 8.306 | | | 971 | 179 | | | |
| 30 | 8.470 | | | 279 | 107 | | | |
| 31 | 8.590 | | | 1704 | 265 | | | |
| 32 | 8.869 | | | 375 | 79 | | | |
| 33 | 9.243 | | | 2772 | 518 | | | |
| 34 | 9.461 | | | 614 | 131 | | | |
| 35 | 9.634 | | | 733 | 149 | | | |
| 36 | 10.323 | | | 2622 | 416 | | | |
| 37 | 11.254 | 11.243 | 0.011 | 470 | 107 | 0.964451 | a | BZ#66 |
| 38 | 11.600 | | | 557 | 113 | | | |
| 39 | 12.194 | | | 692 | 111 | | | |
| 40 | 12.424 | | | 3047 | 559 | | | |
| 41 | 13.748 | | | 2728 | 254 | | | |
| 42 | 14.286 | | | 1548 | 206 | | | |
| 43 | 14.490 | | | 308 | 81 | | | |
| 44 | 14.617 | | | 1625 | 379 | | | |
| 45 | 14.836 | | | 2308 | 413 | | | |
| 46 | 15.727 | | | 901 | 177 | | | |
| 47 | 16.004 | | | 4509 | 587 | | | |
| 48 | 16.279 | | | 31944 | 3152 | | | |
| 49 | 16.601 | | | 3764 | 470 | | | |
| 50 | 17.308 | | | 4608 | 625 | | | |
| 51 | 17.740 | 17.762 | -0.022 | 390 | 89 | 1.79220 | a | BZ#126 |
| 52 | 18.004 | | | 2021 | 434 | | | |
| 53 | 18.137 | | | 762 | 185 | | | |
| 54 | 18.401 | | | 1049 | 210 | | | |
| 55 | 18.624 | | | 570 | 112 | | | |

0167

```
                                                              Extract
 Peak     Peak    Expected   Delta                             Conc.
  No.      RT        RT        RT       Area     Height        (ppb)    Flags              Peak Identification
=====  ========  ========  ========  ========  ========  ==========  =====  ======================================
   56    19.143                            547       108
   57    19.305                           2222       423
   58    19.571                           1916       298
   59    19.786                           2230       296
   60    20.435                           2339       313
   61    20.766                           8990      1074
   62    21.936                           3271       329
   63    22.262                           3250       488
$  64    22.539    22.559    -0.020     322854     62058     41.5206          BZ#198
   65    23.002                           2828       377
   66    23.366                            849       157
   67    23.676                            738       122
   68    24.388                            575       119
   69    24.532                            593       118
   70    25.226                            620       104
   71    25.667                           1851       325
   72    25.937                            900       127
   73    26.901                           1086       141
   74    27.635                           1845       225
   75    27.906                            940       142
   76    28.061                            386        81
   77    28.327                           2212       429
   78    28.511                            398        73
   79    29.107                           3684       337
   80    29.839                          10521       761
   81    30.519                          10912      1078
   82    30.849                            506       105
   83    31.138                            681        88
   84    31.621                            473       101
   85    31.767                           4499       445
   86    31.973                            604       189
   87    32.093                            829       186
   88    32.219                           2541       607
   89    32.397                           1222       192
   90    32.556                           1549       290
   91    32.667                           3216       489
   92    32.782                           7213       846
   93    33.139                           9338       855
   94    33.494                          10192      1510
   95    34.037                           1046       171
   96    34.119                           1108       257
   97    34.689                           4398       563
   98    35.263                           3415       406
   99    35.735                           3227       234
  100    36.165                           1819       138
  101    38.991                           1182       121
  102    39.408                            850       126

Flags:  A - Peak quantitates above calibration range
        a - Peak quantitates below reporting limit
        H - User selected alternate compound hit
        M - Peak manually integrated or manually identified
        R - Peak fails recovery
        U - User disabled peak ID: either peak quantitates below reporting limit or
            peak identification not confirmed on second column
```

## Target Compounds

```
      Peak     Expected
       RT         RT                 Target Compound
   ========   ========   ======================================
      4.990      5.001   Tetrachloro-meta-xylene
                 5.761   BZ#8
                 6.701   BZ#18
      7.940      7.925   BZ#28
                 8.984   BZ#52
                 9.667   BZ#44
     11.254     11.243   BZ#66
                12.207   BZ#101
```

# STL Burlington - Target GC Injection Report

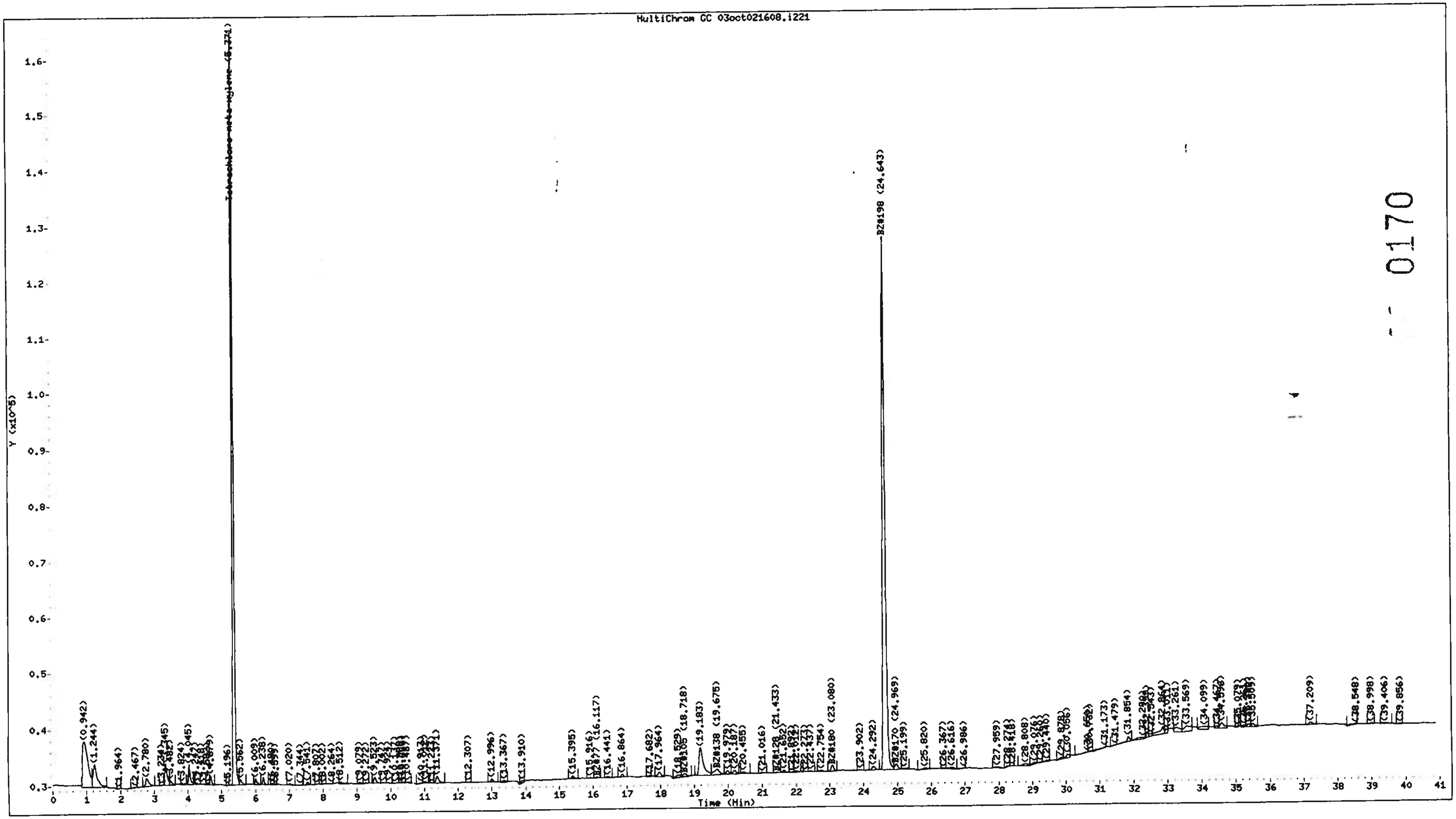
| Peak RT | Expected RT | Target Compound |
|---|---|---|
| | 13.752 | BZ#77 |
| | 14.938 | BZ#118 |
| | 15.993 | BZ#153 |
| | 16.155 | BZ#105 |
| | 17.328 | BZ#138 |
| 17.740 | 17.762 | BZ#126 |
| | 18.647 | BZ#128 |
| | 20.781 | BZ#180 |
| | 22.271 | BZ#170 |
| 22.539 | 22.559 | BZ#198 |
| | 24.552 | BZ#195 |
| | 27.655 | BZ#206 |
| | 29.180 | BZ#209 |

## STL Burlington - Target GC Chromatogram

**Lab Sample ID: 502119** **Client Sample ID: F01009LS63**

Matrix : SOIL
Analyst :
Instrument : 3327_2.i
Column : RTX-CLPII
Integrator : Falcon
Method : /var/chem/3327_2.i/100302_1/03OCT021608.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 09:57 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 15:41
Dilution Factor : 1.00
Data File : 03oct021608-r221.d
Compound Sublist: ENVNET



0170

# STL Burlington - Target GC Injection Report

Lab Sample ID: 502119 Client Sample ID: F01009LS63

Matrix : SOIL
Analyst :
Instrument : 3327_2.i
Column : RTX-CLPII
Integrator : Falcon
Method : /var/chem/3327_2.i/100302_1/03OCT021608.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 09:57 rrm

Sample Type : SAMPLE
Injection Date : 04-OCT-2002 15:41
Dilution Factor : 1.00
Data File : 03oct021608-r221.d
Compound Sublist: ENVNET

## Peaks

| | Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0.942 | | | 88161 | 8064 | | | |
| | 2 | 1.244 | | | 34858 | 4065 | | | |
| | 3 | 1.964 | | | 244 | 47 | | | |
| | 4 | 2.467 | | | 500 | 36 | | | |
| | 5 | 2.780 | | | 9787 | 1434 | | | |
| | 6 | 3.234 | | | 560 | 134 | | | |
| | 7 | 3.345 | | | 16581 | 3833 | | | |
| | 8 | 3.482 | | | 4144 | 854 | | | |
| | 9 | 3.824 | | | 2177 | 351 | | | |
| | 10 | 4.045 | | | 12174 | 3603 | | | |
| | 11 | 4.247 | | | 2116 | 334 | | | |
| | 12 | 4.418 | | | 1324 | 174 | | | |
| | 13 | 4.582 | | | 1504 | 348 | | | |
| | 14 | 4.679 | | | 5075 | 1703 | | | |
| | 15 | 5.196 | | | 490 | 125 | | | |
| $ | 16 | 5.371 | 5.391 | -0.020 | 445698 | 153489 | 40.7547 | | Tetrachloro-meta-xylene |
| | 17 | 5.562 | | | 4745 | 1006 | | | |
| | 18 | 6.009 | | | 4622 | 1110 | | | |
| | 19 | 6.238 | | | 4392 | 1339 | | | |
| | 20 | 6.490 | | | 1061 | 331 | | | |
| | 21 | 6.599 | | | 348 | 135 | | | |
| | 22 | 7.020 | | | 1635 | 288 | | | |
| | 23 | 7.344 | | | 1256 | 140 | | | |
| | 24 | 7.541 | | | 1774 | 506 | | | |
| | 25 | 7.807 | | | 343 | 83 | | | |
| | 26 | 8.002 | | | 524 | 136 | | | |
| | 27 | 8.264 | | | 1111 | 125 | | | |
| | 28 | 8.512 | | | 2431 | 355 | | | |
| | 29 | 9.079 | | | 1236 | 256 | | | |
| | 30 | 9.272 | | | 707 | 127 | | | |
| | 31 | 9.523 | | | 5329 | 1055 | | | |
| | 32 | 9.747 | | | 452 | 105 | | | |
| | 33 | 9.924 | | | 658 | 173 | | | |
| | 34 | 10.137 | | | 556 | 80 | | | |
| | 35 | 10.288 | | | 422 | 133 | | | |
| | 36 | 10.365 | | | 913 | 231 | | | |
| | 37 | 10.487 | | | 1453 | 188 | | | |
| | 38 | 10.913 | | | 1138 | 139 | | | |
| | 39 | 11.012 | | | 1640 | 375 | | | |
| | 40 | 11.223 | | | 472 | 95 | | | |
| | 41 | 11.371 | | | 7327 | 1150 | | | |
| | 42 | 12.307 | | | 559 | 128 | | | |
| | 43 | 12.996 | | | 3428 | 592 | | | |
| | 44 | 13.367 | | | 2194 | 285 | | | |
| | 45 | 13.910 | | | 2256 | 376 | | | |
| | 46 | 15.395 | | | 3000 | 512 | | | |
| | 47 | 15.916 | | | 746 | 136 | | | |
| | 48 | 16.117 | 16.080 | 0.038 | 968 | 184 | 2.70230 | a | BZ#77 |
| | 49 | 16.441 | | | 1152 | 217 | | | |
| | 50 | 16.864 | | | 3157 | 525 | | | |
| | 51 | 17.682 | | | 1126 | 191 | | | |
| | 52 | 17.964 | | | 5598 | 795 | | | |
| | 53 | 18.529 | | | 4489 | 477 | | | |
| | 54 | 18.718 | 18.720 | -0.002 | 4985 | 577 | 3.05065 | a | BZ#105 |
| | 55 | 19.183 | | | 43843 | 4905 | | | |

# STL Burlington - Target GC Injection Report

```
                                                         Extract
 Peak      Peak   Expected    Delta                       Conc.
  No.       RT       RT         RT      Area    Height    (ppb)     Flags        Peak Identification
=====  ========  ========  ========  ========  ========  ==========  =====  ====================================
   56    19.675    19.713    -0.038     11762      1024    0.747875   a      BZ#138
   57    19.979                          4207       667
   58    20.187                          4608       675
   59    20.455                          2654       336
   60    21.016                          1040       136
   61    21.433    21.462    -0.029       641       117    1.03000   a      BZ#128
   62    21.652                          2219       488
   63    21.892                           448        98
   64    22.012                          1473       231
   65    22.273                           360        90
   66    22.437                          1173       217
   67    22.754                          2136       250
   68    23.080    23.115    -0.035      6419      1119    0.936328   a      BZ#180
   69    23.902                           881       166
   70    24.292                          4532       683
$  71    24.643    24.678    -0.035    514924     95436    40.0695           BZ#198
   72    24.969    25.004    -0.035      6738       997    1.18793   a      BZ#170
   73    25.199                          2448       247
   74    25.820                          2880       265
   75    26.367                           714       152
   76    26.616                          3022       297
   77    26.986                           901        71
   78    27.959                          2647       252
   79    28.274                          1334       282
   80    28.418                           219        46
   81    28.808                          4561       416
   82    29.076                          2416       308
   83    29.260                           506        88
   84    29.440                          1453       216
   85    29.878                          2839       354
   86    30.056                          4421       624
   87    30.650                          2185       180
   88    30.732                          1505       317
   89    31.173                          3421        89
   90    31.479                           504        60
   91    31.854                          5182       919
   92    32.290                          5185       301
   93    32.399                          3651      1002
   94    32.543                          2602       387
   95    32.864                         12630      1239
   96    33.011                          4007       742
   97    33.261                          9921       826
   98    33.569                         14038       987
   99    34.099                          8607       528
  100    34.467                          2743       362
  101    34.596                          7631       983
  102    35.079                           611       198
  103    35.261                          2357       290
  104    35.380                          3313       554
  105    35.509                          4276       614
  106    37.209                          4308       465
  107    38.548                          2611       133
  108    38.998                          1606       213
  109    39.406                          3308       237
  110    39.856                           958       136

Flags:  A - Peak quantitates above calibration range
        a - Peak quantitates below reporting limit
        H - User selected alternate compound hit
        M - Peak manually integrated or manually identified
        R - Peak fails recovery
        U - User disabled peak ID: either peak quantitates below reporting limit or
            peak identification not confirmed on second column
```

## STL Burlington - Target GC Injection Report

```
  Peak     Expected
   RT         RT                Target Compound
========   ========   ======================================
```

## Target Compounds

```
  Peak     Expected
   RT         RT                Target Compound
========   ========   ======================================
   5.371      5.391   Tetrachloro-meta-xylene
              6.592   BZ#8
              7.698   BZ#18
              9.137   BZ#28
             10.341   BZ#52
             11.312   BZ#44
             13.056   BZ#66
             13.914   BZ#101
  16.117     16.080   BZ#77
             17.075   BZ#118
             17.995   BZ#153
  18.718     18.720   BZ#105
  19.675     19.713   BZ#138
             20.225   BZ#126
  21.433     21.462   BZ#128
  23.080     23.115   BZ#180
  24.643     24.678   BZ#198
  24.969     25.004   BZ#170
             27.203   BZ#195
             29.805   BZ#206
             30.754   BZ#209
```

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# PCB CONGENERS

# STANDARDS

# FORM 6
# OTHER INITIAL CALIBRATION DATA

Lab Name: STL BURLINGTON Contract: 22000

Lab Code: STLVT Case No.: 22000 SAS No.: SDG No.: 89891

Instrument ID: 3327_1 Calibration Date(s): 10/03/02 10/03/02

Column: RTX-5 ID: 0.25 (mm) Calibration Time(s): 1840 2140

LAB FILE ID: RF5: 03OCT021607-RRF25: 03OCT021607-RF50: 03OCT021607-
RF100: 03OCT021607RF200: 03OCT021607

| COMPOUND | RF5 | RF25 | RF50 | RF100 | RF200 |
|---|---|---|---|---|---|
| BZ#8 | 4361 | 19673 | 37982 | 71253 | 133093 |
| BZ#18 | 5485 | 23391 | 43896 | 79801 | 146005 |
| BZ#28 | 6346 | 32383 | 67104 | 133381 | 261113 |
| BZ#44 | 7169 | 32862 | 64075 | 119217 | 223407 |
| BZ#49 | 6883 | 30625 | 58916 | 107569 | 200601 |
| BZ#52 | 6267 | 27167 | 51494 | 93848 | 172909 |
| BZ#66 | 4874 | 26790 | 56883 | 114505 | 228856 |
| BZ#77 | 1793 | 13528 | 30027 | 60062 | 122197 |
| BZ#81 | 9573 | 52532 | 108105 | 206589 | 397093 |
| BZ#87 | 9573 | 52532 | 108105 | 206589 | 397093 |
| BZ#101 | 6418 | 29678 | 56841 | 104848 | 196433 |
| BZ#105 | 4932 | 30284 | 65716 | 134702 | 279070 |
| BZ#114 | 5813 | 34637 | 75046 | 155557 | 318063 |
| BZ#118 | 5223 | 27988 | 56824 | 109542 | 216245 |
| BZ#123 | 5173 | 28877 | 59725 | 115477 | 228158 |
| BZ#126 | 2383 | 15457 | 33598 | 66395 | 137164 |
| BZ#128 | 7163 | 37607 | 77683 | 150261 | 290932 |
| BZ#138 | 7081 | 35442 | 70198 | 135647 | 259588 |
| BZ#153 | 10078 | 47431 | 90887 | 169588 | 318510 |
| BZ#156 | 5487 | 30981 | 66753 | 135185 | 281219 |
| BZ#157 | 5768 | 31568 | 68103 | 134104 | 274322 |
| BZ#167 | 5848 | 30119 | 60027 | 115129 | 223579 |
| BZ#169 | 4338 | 23175 | 46713 | 90585 | 180982 |
| BZ#170 | 7654 | 38708 | 77513 | 149808 | 287305 |
| BZ#180 | 7726 | 37039 | 74182 | 140107 | 274674 |
| BZ#183 | 7632 | 35897 | 70353 | 130881 | 254098 |
| BZ#184 | 10078 | 47431 | 90887 | 169588 | 318510 |
| BZ#187 | 7520 | 34130 | 64933 | 120830 | 226089 |
| BZ#189 | 6905 | 34863 | 70565 | 136042 | 272731 |
| BZ#195 | 8894 | 41606 | 83155 | 156012 | 299152 |
| BZ#206 | 9085 | 40401 | 76390 | 142431 | 271038 |
| BZ#209 | 10693 | 45643 | 85234 | 152724 | 280082 |
| Tetrachloro-meta-xylene | 14229 | 80682 | 166684 | 321637 | 615745 |
| BZ#198 | 8851 | 40100 | 78261 | 149386 | 281488 |

# FORM 6
# OTHER INITIAL CALIBRATION DATA

Lab Name: STL BURLINGTON Contract: 22000

Lab Code: STLVT Case No.: 22000 SAS No.: SDG No.: 89891

Instrument ID: 3327_1 Calibration Date(s): 10/03/02 10/03/02

Column: RTX-5 ID: 0.25 (mm) Calibration Time(s): 1840 2140

| COMPOUND | CURVE | COEFFICENTS A0 | A1 | %RSD OR R^2 | MAX %RSD OR R^2 |
|---|---|---|---|---|---|
| BZ#8 | WLINR | -2.0446939 | 682.588365 | 0.9973245 | 0.9900000 |
| BZ#18 | WLINR | -3.2341308 | 753.660063 | 0.9947660 | 0.9900000 |
| BZ#28 | WLINR | 0.13508004 | 1318.99434 | 0.9997965 | 0.9900000 |
| BZ#44 | WLINR | -1.9215920 | 1146.61415 | 0.9971820 | 0.9900000 |
| BZ#49 | WLINR | -2.4802125 | 1031.07264 | 0.9961770 | 0.9900000 |
| BZ#52 | WLINR | -2.9260951 | 891.175472 | 0.9953648 | 0.9900000 |
| BZ#66 | WLINR | 0.87139001 | 1149.78302 | 0.9998809 | 0.9900000 |
| BZ#77 | WLINR | 2.19295530 | 616.762264 | 0.9998263 | 0.9900000 |
| BZ#81 | WLINR | -0.2188025 | 1016.81525 | 0.9986928 | 0.9900000 |
| BZ#87 | WLINR | -0.2188025 | 1016.81525 | 0.9986928 | 0.9900000 |
| BZ#101 | WLINR | -2.1369033 | 1009.04434 | 0.9965889 | 0.9900000 |
| BZ#105 | WLINR | 1.78495139 | 1387.06101 | 0.9994118 | 0.9900000 |
| BZ#114 | WLINR | 1.67832696 | 1585.31415 | 0.9994572 | 0.9900000 |
| BZ#118 | WLINR | -0.0257932 | 1093.89717 | 0.9995626 | 0.9900000 |
| BZ#123 | WLINR | 0.31286426 | 1155.83711 | 0.9995919 | 0.9900000 |
| BZ#126 | WLINR | 1.66247396 | 686.051887 | 0.9997411 | 0.9900000 |
| BZ#128 | WLINR | -0.1013709 | 1481.30314 | 0.9992628 | 0.9900000 |
| BZ#138 | WLINR | -0.7533738 | 1323.60566 | 0.9989088 | 0.9900000 |
| BZ#153 | WLINR | -3.7671586 | 817.237736 | 0.9970902 | 0.9900000 |
| BZ#156 | WLINR | 1.39830057 | 1393.06478 | 0.9993636 | 0.9900000 |
| BZ#157 | WLINR | 0.94374193 | 1369.27956 | 0.9997405 | 0.9900000 |
| BZ#167 | WLINR | -0.5230395 | 1136.13365 | 0.9991348 | 0.9900000 |
| BZ#169 | WLINR | 0.05400099 | 910.628616 | 0.9997830 | 0.9900000 |
| BZ#170 | WLINR | -0.5957342 | 1464.80220 | 0.9989973 | 0.9900000 |
| BZ#180 | WLINR | -0.9025673 | 1388.06289 | 0.9992336 | 0.9900000 |
| BZ#183 | WLINR | -1.4269143 | 1288.59843 | 0.9985368 | 0.9900000 |
| BZ#184 | WLINR | -3.7671586 | 817.237736 | 0.9970902 | 0.9900000 |
| BZ#187 | WLINR | -2.2239081 | 1159.49717 | 0.9969271 | 0.9900000 |
| BZ#189 | WLINR | -0.1895187 | 1367.92044 | 0.9998089 | 0.9900000 |
| BZ#195 | WLINR | -1.3001894 | 1523.46069 | 0.9985039 | 0.9900000 |
| BZ#206 | WLINR | -2.2314201 | 1378.84497 | 0.9978375 | 0.9900000 |
| BZ#209 | WLINR | -3.4343436 | 1446.16541 | 0.9940272 | 0.9900000 |
| Tetrachloro-meta-xylene | WLINR | 0.11217773 | 3159.86667 | 0.9987133 | 0.9900000 |
| BZ#198 | WLINR | -1.6543583 | 1437.35912 | 0.9983137 | 0.9900000 |

# FORM 6
# OTHER INITIAL CALIBRATION DATA

Lab Name: STL BURLINGTON Contract: 22000

Lab Code: STLVT Case No.: 22000 SAS No.: SDG No.: 89891

Instrument ID: 3327_2 Calibration Date(s): 10/03/02 10/03/02

Column: RTX-CLPII ID: 0.25 (mm) Calibration Time(s): 1840 2140

LAB FILE ID: RF5: 03OCT021607-RRF25: 03OCT021607-RF50: 03OCT021607-
RF100: 03OCT021607RF200: 03OCT021607

| COMPOUND | RF5 | RF25 | RF50 | RF100 | RF200 |
|---|---|---|---|---|---|
| BZ#8 | 4944 | 23838 | 46481 | 87494 | 165840 |
| BZ#18 | 6495 | 29235 | 55172 | 100369 | 186298 |
| BZ#28 | 7012 | 39745 | 85333 | 173210 | 343465 |
| BZ#44 | 8320 | 41791 | 83572 | 158622 | 301387 |
| BZ#49 | 8227 | 39204 | 76215 | 141280 | 267450 |
| BZ#52 | 7604 | 35213 | 67668 | 124213 | 230838 |
| BZ#66 | 6006 | 36028 | 78980 | 162454 | 330616 |
| BZ#77 | 2700 | 19896 | 44585 | 91982 | 190275 |
| BZ#81 | 10022 | 59978 | 130413 | 263128 | 521982 |
| BZ#87 | 10022 | 59978 | 130413 | 263128 | 521982 |
| BZ#101 | 8231 | 40794 | 80265 | 150679 | 284650 |
| BZ#105 | 6174 | 40415 | 94992 | 204453 | 424839 |
| BZ#114 | 7270 | 47772 | 109103 | 234109 | 482348 |
| BZ#118 | 6784 | 39268 | 83739 | 167479 | 333214 |
| BZ#123 | 6627 | 40501 | 86587 | 174308 | 345413 |
| BZ#126 | 10187 | 50351 | 100576 | 189311 | 361934 |
| BZ#128 | 9081 | 53427 | 113838 | 230090 | 447305 |
| BZ#138 | 9165 | 50057 | 104398 | 205712 | 394979 |
| BZ#153 | 8902 | 45139 | 89534 | 170112 | 321342 |
| BZ#156 | 7360 | 45457 | 102613 | 218167 | 456967 |
| BZ#157 | 7779 | 46641 | 103494 | 214633 | 442528 |
| BZ#167 | 7466 | 43165 | 91112 | 178798 | 352446 |
| BZ#169 | 6247 | 35861 | 75279 | 151041 | 308920 |
| BZ#170 | 9879 | 56258 | 119740 | 236160 | 466793 |
| BZ#180 | 10251 | 55007 | 114928 | 228735 | 449485 |
| BZ#183 | 10465 | 53003 | 106856 | 205341 | 396614 |
| BZ#184 | 10485 | 50157 | 98719 | 186931 | 352924 |
| BZ#187 | 10187 | 50351 | 100576 | 189311 | 361934 |
| BZ#189 | 9204 | 52430 | 113321 | 229338 | 467690 |
| BZ#195 | 11148 | 59628 | 126710 | 248523 | 486905 |
| BZ#206 | 15282 | 75265 | 151655 | 286941 | 552215 |
| BZ#209 | 17056 | 75639 | 146594 | 273462 | 507641 |
| Tetrachloro-meta-xylene | 15468 | 94788 | 198952 | 387043 | 745379 |
| BZ#198 | 11598 | 60886 | 123303 | 241368 | 466213 |

FORM VI OTHER

# FORM 6
# OTHER INITIAL CALIBRATION DATA

Lab Name: STL BURLINGTON Contract: 22000

Lab Code: STLVT Case No.: 22000 SAS No.: SDG No.: 89891

Instrument ID: 3327_2 Calibration Date(s): 10/03/02 10/03/0

Column: RTX-CLPII ID: 0.25 (mm) Calibration Time(s): 1840 2140

| COMPOUND | CURVE | COEFFICENTS | | %RSD OR R^2 | MAX %RSD OR R^2 |
|---|---|---|---|---|---|
| | | A0 | A1 | | |
| BZ#8 | WLINR | -1.4214587 | 848.852516 | 0.9978783 | 0.9900000 |
| BZ#18 | WLINR | -2.6845653 | 959.702830 | 0.9953822 | 0.9900000 |
| BZ#28 | WLINR | 1.07124155 | 1731.68491 | 0.9998020 | 0.9900000 |
| BZ#44 | WLINR | -0.8930076 | 1544.20283 | 0.9982354 | 0.9900000 |
| BZ#49 | WLINR | -1.6842815 | 1370.61447 | 0.9973020 | 0.9900000 |
| BZ#52 | WLINR | -2.2228234 | 1190.28176 | 0.9959369 | 0.9900000 |
| BZ#66 | WLINR | 1.67911801 | 1652.52075 | 0.9995409 | 0.9900000 |
| BZ#77 | WLINR | 2.50881279 | 950.965723 | 0.9994135 | 0.9900000 |
| BZ#81 | WLINR | 2.58861745 | 1319.20739 | 0.9997777 | 0.9900000 |
| BZ#87 | WLINR | 2.58861745 | 1319.20739 | 0.9997777 | 0.9900000 |
| BZ#101 | WLINR | -1.2560613 | 1461.68208 | 0.9975828 | 0.9900000 |
| BZ#105 | WLINR | 2.77661513 | 2105.53774 | 0.9977224 | 0.9900000 |
| BZ#114 | WLINR | 2.56519571 | 2398.32327 | 0.9983835 | 0.9900000 |
| BZ#118 | WLINR | 1.00263266 | 1681.34969 | 0.9998724 | 0.9900000 |
| BZ#123 | WLINR | 1.23199932 | 1747.90283 | 0.9998548 | 0.9900000 |
| BZ#126 | WLINR | -2.0287778 | 924.968711 | 0.9982880 | 0.9900000 |
| BZ#128 | WLINR | 0.97859446 | 2275.99308 | 0.9996336 | 0.9900000 |
| BZ#138 | WLINR | 0.24037330 | 2017.72642 | 0.9992523 | 0.9900000 |
| BZ#153 | WLINR | -0.9523131 | 1650.44811 | 0.9979354 | 0.9900000 |
| BZ#156 | WLINR | 2.37167259 | 2256.09906 | 0.9981078 | 0.9900000 |
| BZ#157 | WLINR | 1.89980484 | 2199.92673 | 0.9991218 | 0.9900000 |
| BZ#167 | WLINR | 0.70283497 | 1787.54937 | 0.9996965 | 0.9900000 |
| BZ#169 | WLINR | 1.09227404 | 1541.49119 | 0.9998596 | 0.9900000 |
| BZ#170 | WLINR | 0.76597763 | 2362.84057 | 0.9997629 | 0.9900000 |
| BZ#180 | WLINR | 0.44386159 | 2272.23365 | 0.9998146 | 0.9900000 |
| BZ#183 | WLINR | -0.5332644 | 2018.15252 | 0.9991111 | 0.9900000 |
| BZ#184 | WLINR | -1.3520420 | 1807.87987 | 0.9979966 | 0.9900000 |
| BZ#187 | WLINR | -2.0287778 | 924.968711 | 0.9982880 | 0.9900000 |
| BZ#189 | WLINR | 1.30453469 | 2334.76824 | 0.9996908 | 0.9900000 |
| BZ#195 | WLINR | 0.39995061 | 2468.02484 | 0.9996247 | 0.9900000 |
| BZ#206 | WLINR | -0.8529942 | 2814.09465 | 0.9987171 | 0.9900000 |
| BZ#209 | WLINR | -2.2265942 | 2608.81101 | 0.9969190 | 0.9900000 |
| Tetrachloro-meta-xylene | WLINR | 0.63386985 | 3825.67075 | 0.9989566 | 0.9900000 |
| BZ#198 | WLINR | -0.1600296 | 2372.28899 | 0.9993705 | 0.9900000 |

FORM VI OTHER

# FORM 7
# OTHER CALIBRATION VERIFICATION SUMMARY

Lab Name: STL BURLINGTON Contract: 22000

Lab Code: STLVT Case No.: 22000 SAS No.: SDG No.: 89891

Instrument ID: 3327_1 Calibration Date: 10/03/02 Time: 2310

Lab File ID: 03OCT021607-R1 Init. Calib. Date(s): 10/03/02 10/03/02

Init. Calib. Times: 1840 2140

GC Column: RTX-5 ID: 0.25 (mm)

| COMPOUND | SAMPLE AMOUNT | CAL50 AMOUNT | CURVE | %D | MAX %d | |
|---|---|---|---|---|---|---|
| BZ#8 | 51 | 50 | WLINR | 2.0 | 15.0 | |
| BZ#18 | 51 | 50 | WLINR | 2.0 | 15.0 | |
| BZ#28 | 48 | 50 | WLINR | 4.0 | 15.0 | |
| BZ#44 | 51 | 50 | WLINR | 2.0 | 15.0 | |
| BZ#52 | 52 | 50 | WLINR | 4.0 | 15.0 | |
| BZ#66 | 46 | 50 | WLINR | 8.0 | 15.0 | |
| BZ#77 | 39 | 50 | WLINR | 22.0 | 15.0 | <- |
| BZ#101 | 52 | 50 | WLINR | 4.0 | 15.0 | |
| BZ#105 | 44 | 50 | WLINR | 12.0 | 15.0 | |
| BZ#118 | 43 | 50 | WLINR | 14.0 | 15.0 | |
| BZ#126 | 44 | 50 | WLINR | 12.0 | 15.0 | |
| BZ#128 | 50 | 50 | WLINR | 0.0 | 15.0 | |
| BZ#138 | 48 | 50 | WLINR | 4.0 | 15.0 | |
| BZ#153 | 65 | 50 | WLINR | 30.0 | 15.0 | <- |
| BZ#170 | 50 | 50 | WLINR | 0.0 | 15.0 | |
| BZ#180 | 47 | 50 | WLINR | 6.0 | 15.0 | |
| BZ#187 | 50 | 50 | WLINR | 0.0 | 15.0 | |
| BZ#195 | 50 | 50 | WLINR | 0.0 | 15.0 | |
| BZ#206 | 52 | 50 | WLINR | 4.0 | 15.0 | |
| BZ#209 | 52 | 50 | WLINR | 4.0 | 15.0 | |
| Tetrachloro-meta-xylene | 49 | 50 | WLINR | 2.0 | 15.0 | |
| BZ#198 | 51 | 50 | WLINR | 2.0 | 15.0 | |

FORM 7
OTHER CALIBRATION VERIFICATION SUMMARY

Lab Name: STL BURLINGTON Contract: 22000

Lab Code: STLVT Case No.: 22000 SAS No.: SDG No.: 89891

Instrument ID: 3327_1 Calibration Date: 10/04/02 Time: 0855

Lab File ID: 03OCT021608-R1 Init. Calib. Date(s): 10/03/02 10/03/02

Init. Calib. Times: 1840 2140

GC Column: RTX-5 ID: 0.25 (mm)

| COMPOUND | SAMPLE AMOUNT | CAL50 AMOUNT | CURVE | %D | MAX %d | |
|---|---|---|---|---|---|---|
| BZ#8 | 54 | 50 | WLINR | 8.0 | 15.0 | |
| BZ#18 | 54 | 50 | WLINR | 8.0 | 15.0 | |
| BZ#28 | 51 | 50 | WLINR | 2.0 | 15.0 | |
| BZ#44 | 54 | 50 | WLINR | 8.0 | 15.0 | |
| BZ#49 | 54 | 50 | WLINR | 8.0 | 15.0 | |
| BZ#52 | 54 | 50 | WLINR | 8.0 | 15.0 | |
| BZ#66 | 50 | 50 | WLINR | 0.0 | 15.0 | |
| BZ#77 | 50 | 50 | WLINR | 0.0 | 15.0 | |
| BZ#81 | 110 | 100 | WLINR | 10.0 | 15.0 | |
| BZ#87 | 110 | 100 | WLINR | 10.0 | 15.0 | |
| BZ#101 | 55 | 50 | WLINR | 10.0 | 15.0 | |
| BZ#105 | 50 | 50 | WLINR | 0.0 | 15.0 | |
| BZ#114 | 49 | 50 | WLINR | 2.0 | 15.0 | |
| BZ#118 | 53 | 50 | WLINR | 6.0 | 15.0 | |
| BZ#123 | 52 | 50 | WLINR | 4.0 | 15.0 | |
| BZ#126 | 51 | 50 | WLINR | 2.0 | 15.0 | |
| BZ#128 | 54 | 50 | WLINR | 8.0 | 15.0 | |
| BZ#138 | 54 | 50 | WLINR | 8.0 | 15.0 | |
| BZ#153 | 110 | 100 | WLINR | 10.0 | 15.0 | |
| BZ#156 | 51 | 50 | WLINR | 2.0 | 15.0 | |
| BZ#157 | 51 | 50 | WLINR | 2.0 | 15.0 | |
| BZ#167 | 54 | 50 | WLINR | 8.0 | 15.0 | |
| BZ#169 | 53 | 50 | WLINR | 6.0 | 15.0 | |
| BZ#170 | 54 | 50 | WLINR | 8.0 | 15.0 | |
| BZ#180 | 54 | 50 | WLINR | 8.0 | 15.0 | |
| BZ#183 | 54 | 50 | WLINR | 8.0 | 15.0 | |
| BZ#184 | 110 | 100 | WLINR | 10.0 | 15.0 | |
| BZ#187 | 55 | 50 | WLINR | 10.0 | 15.0 | |
| BZ#189 | 53 | 50 | WLINR | 6.0 | 15.0 | |
| BZ#195 | 55 | 50 | WLINR | 10.0 | 15.0 | |
| BZ#206 | 56 | 50 | WLINR | 12.0 | 15.0 | |
| BZ#209 | 58 | 50 | WLINR | 16.0 | 15.0 | <- |
| Tetrachloro-meta-xylene | 52 | 50 | WLINR | 4.0 | 15.0 | |
| BZ#198 | 55 | 50 | WLINR | 10.0 | 15.0 | |

FORM VII OTHER

FORM 7
OTHER CALIBRATION VERIFICATION SUMMARY

Lab Name: STL BURLINGTON Contract: 22000

Lab Code: STLVT Case No.: 22000 SAS No.: SDG No.: 89891

Instrument ID: 3327_1 Calibration Date: 10/04/02 Time: 1841

Lab File ID: 03OCT021608-R2 Init. Calib. Date(s): 10/03/02 10/03/02

Init. Calib. Times: 1840 2140

GC Column: RTX-5 ID: 0.25 (mm)

| COMPOUND | SAMPLE AMOUNT | CAL50 AMOUNT | CURVE | %D | MAX %d |
|---|---|---|---|---|---|
| BZ#8 | 52 | 50 | WLINR | 4.0 | 15.0 |
| BZ#18 | 53 | 50 | WLINR | 6.0 | 15.0 |
| BZ#28 | 49 | 50 | WLINR | 2.0 | 15.0 |
| BZ#44 | 52 | 50 | WLINR | 4.0 | 15.0 |
| BZ#49 | 53 | 50 | WLINR | 6.0 | 15.0 |
| BZ#52 | 53 | 50 | WLINR | 6.0 | 15.0 |
| BZ#66 | 48 | 50 | WLINR | 4.0 | 15.0 |
| BZ#77 | 48 | 50 | WLINR | 4.0 | 15.0 |
| BZ#81 | 100 | 100 | WLINR | 0.0 | 15.0 |
| BZ#87 | 100 | 100 | WLINR | 0.0 | 15.0 |
| BZ#101 | 53 | 50 | WLINR | 6.0 | 15.0 |
| BZ#105 | 48 | 50 | WLINR | 4.0 | 15.0 |
| BZ#114 | 48 | 50 | WLINR | 4.0 | 15.0 |
| BZ#118 | 51 | 50 | WLINR | 2.0 | 15.0 |
| BZ#123 | 50 | 50 | WLINR | 0.0 | 15.0 |
| BZ#126 | 48 | 50 | WLINR | 4.0 | 15.0 |
| BZ#128 | 52 | 50 | WLINR | 4.0 | 15.0 |
| BZ#138 | 52 | 50 | WLINR | 4.0 | 15.0 |
| BZ#153 | 100 | 100 | WLINR | 0.0 | 15.0 |
| BZ#156 | 48 | 50 | WLINR | 4.0 | 15.0 |
| BZ#157 | 50 | 50 | WLINR | 0.0 | 15.0 |
| BZ#167 | 52 | 50 | WLINR | 4.0 | 15.0 |
| BZ#169 | 50 | 50 | WLINR | 0.0 | 15.0 |
| BZ#170 | 52 | 50 | WLINR | 4.0 | 15.0 |
| BZ#180 | 52 | 50 | WLINR | 4.0 | 15.0 |
| BZ#183 | 52 | 50 | WLINR | 4.0 | 15.0 |
| BZ#184 | 100 | 100 | WLINR | 0.0 | 15.0 |
| BZ#187 | 54 | 50 | WLINR | 8.0 | 15.0 |
| BZ#189 | 51 | 50 | WLINR | 2.0 | 15.0 |
| BZ#195 | 53 | 50 | WLINR | 6.0 | 15.0 |
| BZ#206 | 53 | 50 | WLINR | 6.0 | 15.0 |
| BZ#209 | 55 | 50 | WLINR | 10.0 | 15.0 |
| Tetrachloro-meta-xylene | 51 | 50 | WLINR | 2.0 | 15.0 |
| BZ#198 | 53 | 50 | WLINR | 6.0 | 15.0 |

FORM VII OTHER

FORM 7
OTHER CALIBRATION VERIFICATION SUMMARY

Lab Name: STL BURLINGTON Contract: 22000

Lab Code: STLVT Case No.: 22000 SAS No.: SDG No.: 89891

Instrument ID: 3327_2 Calibration Date: 10/03/02 Time: 2310

Lab File ID: 03OCT021607-R1 Init. Calib. Date(s): 10/03/02 10/03/02

Init. Calib. Times: 1840 2140

GC Column: RTX-CLPII ID: 0.25 (mm)

| COMPOUND | SAMPLE AMOUNT | CAL50 AMOUNT | CURVE | %D | MAX %d | |
|---|---|---|---|---|---|---|
| BZ#8 | 50 | 50 | WLINR | 0.0 | 15.0 | |
| BZ#18 | 51 | 50 | WLINR | 2.0 | 15.0 | |
| BZ#28 | 48 | 50 | WLINR | 4.0 | 15.0 | |
| BZ#44 | 50 | 50 | WLINR | 0.0 | 15.0 | |
| BZ#52 | 52 | 50 | WLINR | 4.0 | 15.0 | |
| BZ#66 | 46 | 50 | WLINR | 8.0 | 15.0 | |
| BZ#77 | 40 | 50 | WLINR | 20.0 | 15.0 | <- |
| BZ#101 | 51 | 50 | WLINR | 2.0 | 15.0 | |
| BZ#105 | 43 | 50 | WLINR | 14.0 | 15.0 | |
| BZ#118 | 42 | 50 | WLINR | 16.0 | 15.0 | <- |
| BZ#126 | 96 | 100 | WLINR | 4.0 | 15.0 | |
| BZ#128 | 49 | 50 | WLINR | 2.0 | 15.0 | |
| BZ#138 | 48 | 50 | WLINR | 4.0 | 15.0 | |
| BZ#153 | 50 | 50 | WLINR | 0.0 | 15.0 | |
| BZ#170 | 49 | 50 | WLINR | 2.0 | 15.0 | |
| BZ#180 | 46 | 50 | WLINR | 8.0 | 15.0 | |
| BZ#187 | 96 | 100 | WLINR | 4.0 | 15.0 | |
| BZ#195 | 47 | 50 | WLINR | 6.0 | 15.0 | |
| BZ#206 | 51 | 50 | WLINR | 2.0 | 15.0 | |
| BZ#209 | 51 | 50 | WLINR | 2.0 | 15.0 | |
| Tetrachloro-meta-xylene | 48 | 50 | WLINR | 4.0 | 15.0 | |
| BZ#198 | 50 | 50 | WLINR | 0.0 | 15.0 | |

FORM 7
OTHER CALIBRATION VERIFICATION SUMMARY

Lab Name: STL BURLINGTON Contract: 22000

Lab Code: STLVT Case No.: 22000 SAS No.: SDG No.: 89891

Instrument ID: 3327_2 Calibration Date: 10/04/02 Time: 0855

Lab File ID: 03OCT021608-R1 Init. Calib. Date(s): 10/03/02 10/03/02

Init. Calib. Times: 1840 2140

GC Column: RTX-CLPII ID: 0.25 (mm)

| COMPOUND | SAMPLE AMOUNT | CAL50 AMOUNT | CURVE | %D | MAX %d |
|---|---|---|---|---|---|
| BZ#8 | 53 | 50 | WLINR | 6.0 | 15.0 |
| BZ#18 | 54 | 50 | WLINR | 8.0 | 15.0 |
| BZ#28 | 50 | 50 | WLINR | 0.0 | 15.0 |
| BZ#44 | 52 | 50 | WLINR | 4.0 | 15.0 |
| BZ#49 | 53 | 50 | WLINR | 6.0 | 15.0 |
| BZ#52 | 54 | 50 | WLINR | 8.0 | 15.0 |
| BZ#66 | 49 | 50 | WLINR | 2.0 | 15.0 |
| BZ#77 | 49 | 50 | WLINR | 2.0 | 15.0 |
| BZ#81 | 100 | 100 | WLINR | 0.0 | 15.0 |
| BZ#87 | 100 | 100 | WLINR | 0.0 | 15.0 |
| BZ#101 | 53 | 50 | WLINR | 6.0 | 15.0 |
| BZ#105 | 48 | 50 | WLINR | 4.0 | 15.0 |
| BZ#114 | 48 | 50 | WLINR | 4.0 | 15.0 |
| BZ#118 | 51 | 50 | WLINR | 2.0 | 15.0 |
| BZ#123 | 51 | 50 | WLINR | 2.0 | 15.0 |
| BZ#126 | 100 | 100 | WLINR | 0.0 | 15.0 |
| BZ#128 | 52 | 50 | WLINR | 4.0 | 15.0 |
| BZ#138 | 52 | 50 | WLINR | 4.0 | 15.0 |
| BZ#153 | 53 | 50 | WLINR | 6.0 | 15.0 |
| BZ#156 | 48 | 50 | WLINR | 4.0 | 15.0 |
| BZ#157 | 50 | 50 | WLINR | 0.0 | 15.0 |
| BZ#167 | 53 | 50 | WLINR | 6.0 | 15.0 |
| BZ#169 | 52 | 50 | WLINR | 4.0 | 15.0 |
| BZ#170 | 51 | 50 | WLINR | 2.0 | 15.0 |
| BZ#180 | 51 | 50 | WLINR | 2.0 | 15.0 |
| BZ#183 | 53 | 50 | WLINR | 6.0 | 15.0 |
| BZ#184 | 53 | 50 | WLINR | 6.0 | 15.0 |
| BZ#187 | 100 | 100 | WLINR | 0.0 | 15.0 |
| BZ#189 | 51 | 50 | WLINR | 2.0 | 15.0 |
| BZ#195 | 52 | 50 | WLINR | 4.0 | 15.0 |
| BZ#206 | 55 | 50 | WLINR | 10.0 | 15.0 |
| BZ#209 | 56 | 50 | WLINR | 12.0 | 15.0 |
| ============================ | ========= | ========= | ======== | ====== | ==== |
| Tetrachloro-meta-xylene | 52 | 50 | WLINR | 4.0 | 15.0 |
| BZ#198 | 53 | 50 | WLINR | 6.0 | 15.0 |

# FORM 7
# OTHER CALIBRATION VERIFICATION SUMMARY

Lab Name: STL BURLINGTON Contract: 22000

Lab Code: STLVT Case No.: 22000 SAS No.: SDG No.: 89891

Instrument ID: 3327_2 Calibration Date: 10/04/02 Time: 1841

Lab File ID: 03OCT021608-R2 Init. Calib. Date(s): 10/03/02 10/03/02

Init. Calib. Times: 1840 2140

GC Column: RTX-CLPII ID: 0.25 (mm)

| COMPOUND | SAMPLE AMOUNT | CAL50 AMOUNT | CURVE | %D | MAX %d |
|---|---|---|---|---|---|
| BZ#8 | 52 | 50 | WLINR | 4.0 | 15.0 |
| BZ#18 | 53 | 50 | WLINR | 6.0 | 15.0 |
| BZ#28 | 48 | 50 | WLINR | 4.0 | 15.0 |
| BZ#44 | 51 | 50 | WLINR | 2.0 | 15.0 |
| BZ#49 | 52 | 50 | WLINR | 4.0 | 15.0 |
| BZ#52 | 52 | 50 | WLINR | 4.0 | 15.0 |
| BZ#66 | 48 | 50 | WLINR | 4.0 | 15.0 |
| BZ#77 | 47 | 50 | WLINR | 6.0 | 15.0 |
| BZ#81 | 97 | 100 | WLINR | 3.0 | 15.0 |
| BZ#87 | 97 | 100 | WLINR | 3.0 | 15.0 |
| BZ#101 | 52 | 50 | WLINR | 4.0 | 15.0 |
| BZ#105 | 46 | 50 | WLINR | 8.0 | 15.0 |
| BZ#114 | 47 | 50 | WLINR | 6.0 | 15.0 |
| BZ#118 | 50 | 50 | WLINR | 0.0 | 15.0 |
| BZ#123 | 50 | 50 | WLINR | 0.0 | 15.0 |
| BZ#126 | 100 | 100 | WLINR | 0.0 | 15.0 |
| BZ#128 | 51 | 50 | WLINR | 2.0 | 15.0 |
| BZ#138 | 51 | 50 | WLINR | 2.0 | 15.0 |
| BZ#153 | 52 | 50 | WLINR | 4.0 | 15.0 |
| BZ#156 | 47 | 50 | WLINR | 6.0 | 15.0 |
| BZ#157 | 48 | 50 | WLINR | 4.0 | 15.0 |
| BZ#167 | 51 | 50 | WLINR | 2.0 | 15.0 |
| BZ#169 | 50 | 50 | WLINR | 0.0 | 15.0 |
| BZ#170 | 51 | 50 | WLINR | 2.0 | 15.0 |
| BZ#180 | 50 | 50 | WLINR | 0.0 | 15.0 |
| BZ#183 | 51 | 50 | WLINR | 2.0 | 15.0 |
| BZ#184 | 52 | 50 | WLINR | 4.0 | 15.0 |
| BZ#187 | 100 | 100 | WLINR | 0.0 | 15.0 |
| BZ#189 | 50 | 50 | WLINR | 0.0 | 15.0 |
| BZ#195 | 51 | 50 | WLINR | 2.0 | 15.0 |
| BZ#206 | 53 | 50 | WLINR | 6.0 | 15.0 |
| BZ#209 | 54 | 50 | WLINR | 8.0 | 15.0 |
| Tetrachloro-meta-xylene | 50 | 50 | WLINR | 0.0 | 15.0 |
| BZ#198 | 51 | 50 | WLINR | 2.0 | 15.0 |

## FORM 8
## OTHER ANALYTICAL SEQUENCE

Lab Name: STL BURLINGTON    Contract: 22000

Lab Code: STLVT    Case No.: 22000    SAS No.:    SDG No.: 89891

GC Column: RTX-5    ID: 0.25 (mm)    Init. Calib. Date(s): 10/03/02 10/03/02

Instrument ID: 3327_1

THE ANALYTICAL SEQUENCE OF PERFORMANCE EVALUATION MIXTURES, BLANKS, SAMPLES, AND STANDARDS IS GIVEN BELOW:

MEAN SURROGATE RT FROM INITIAL CALIBRATION
S1 : 5.00    S2 : 22.56

| | CLIENT SAMPLE NO. | LAB SAMPLE ID | DATE ANALYZED | TIME ANALYZED | S1 RT | # | S2 RT | # |
|---|---|---|---|---|---|---|---|---|
| 01 | 32CONG-L1 | 32CONG-L1 | 10/03/02 | 1840 | 5.00 | | 22.56 | |
| 02 | 32CONG-L2 | 32CONG-L2 | 10/03/02 | 1925 | 4.99 | | 22.55 | |
| 03 | 32CONG-L3 | 32CONG-L3 | 10/03/02 | 2010 | 5.00 | | 22.56 | |
| 04 | 32CONG-L4 | 32CONG-L4 | 10/03/02 | 2055 | 5.00 | | 22.56 | |
| 05 | 32CONG-L5 | 32CONG-L5 | 10/03/02 | 2140 | 4.99 | | 22.55 | |
| 06 | 20ICV-50 | 20ICV-50 | 10/03/02 | 2310 | 4.99 | | 22.55 | |
| 07 | PBLK08 | PBLK08 | 10/03/02 | 2355 | 5.00 | | 22.56 | |
| 08 | 08LCS | 08LCS | 10/04/02 | 0040 | 5.00 | | 22.55 | |
| 09 | 08LCSD | 08LCSD | 10/04/02 | 0125 | 4.99 | | 22.54 | |
| 10 | F01009LS13 | 502104 | 10/04/02 | 0210 | 5.00 | | 22.56 | |
| 11 | F01009LS12 | 502105 | 10/04/02 | 0255 | 5.00 | | 22.55 | |
| 12 | F01009LS11 | 502106 | 10/04/02 | 0340 | 4.99 | | 22.54 | |
| 13 | F01009LS23 | 502107 | 10/04/02 | 0425 | 5.00 | | 22.55 | |
| 14 | F01009LS22 | 502108 | 10/04/02 | 0510 | 4.99 | | 22.55 | |
| 15 | F01009LS21 | 502109 | 10/04/02 | 0555 | 5.00 | | 22.55 | |
| 16 | F01009LS33 | 502110 | 10/04/02 | 0640 | 4.99 | | 22.55 | |
| 17 | F01009LS32 | 502111 | 10/04/02 | 0725 | 5.00 | | 22.55 | |
| 18 | 32CONG-L3 | 32CONG-L3 | 10/04/02 | 0855 | 4.99 | | 22.53 | |
| 19 | PIBLK_SCU | PIBLK_SCU | 10/04/02 | 0940 | 5.00 | | 22.55 | |
| 20 | F01009LS31 | 502112 | 10/04/02 | 1025 | 5.00 | | 22.55 | |
| 21 | F01009LS43 | 502113 | 10/04/02 | 1110 | 5.00 | | 22.55 | |
| 22 | F01009LS42 | 502114 | 10/04/02 | 1155 | 5.00 | | 22.55 | |
| 23 | F01009LS41 | 502115 | 10/04/02 | 1241 | 5.00 | | 22.55 | |
| 24 | F01009LS53 | 502116 | 10/04/02 | 1326 | 4.99 | | 22.54 | |
| 25 | F01009LS52 | 502117 | 10/04/02 | 1411 | 5.00 | | 22.55 | |
| 26 | F01009LS51 | 502118 | 10/04/02 | 1456 | 5.00 | | 22.55 | |
| 27 | F01009LS63 | 502119 | 10/04/02 | 1541 | 4.99 | | 22.54 | |
| 28 | F01009LS62 | 502120 | 10/04/02 | 1626 | 5.00 | | 22.55 | |
| 29 | F01009LS61 | 502121 | 10/04/02 | 1711 | 5.00 | | 22.55 | |
| 30 | 32CONG-L3 | 32CONG-L3 | 10/04/02 | 1841 | 4.99 | | 22.53 | |
| 31 | | | | | | | | |
| 32 | | | | | | | | |

QC LIMITS

S1 = Tetrachloro-meta-xylen (+/- 0.05 MINUTES)
S2 = BZ#198 (+/- 0.05 MINUTES)

# Column used to flag retention time values with an asterisk.
* Values outside of QC limits.

FORM 8
OTHER ANALYTICAL SEQUENCE

Lab Name: STL BURLINGTON Contract: 22000

Lab Code: STLVT Case No.: 22000 SAS No.: SDG No.: 89891

GC Column: RTX-CLPII ID: 0.25 (mm) Init. Calib. Date(s): 10/03/02 10/03/02

Instrument ID: 3327_2

THE ANALYTICAL SEQUENCE OF PERFORMANCE EVALUATION MIXTURES, BLANKS, SAMPLES, AND STANDARDS IS GIVEN BELOW:

MEAN SURROGATE RT FROM INITIAL CALIBRATION
S1 : 5.39 S2 : 24.68

| | CLIENT SAMPLE NO. | LAB SAMPLE ID | DATE ANALYZED | TIME ANALYZED | S1 RT | # | S2 RT | # |
|---|---|---|---|---|---|---|---|---|
| 01 | 32CONG-L1 | 32CONG-L1 | 10/03/02 | 1840 | 5.39 | | 24.68 | |
| 02 | 32CONG-L2 | 32CONG-L2 | 10/03/02 | 1925 | 5.39 | | 24.67 | |
| 03 | 32CONG-L3 | 32CONG-L3 | 10/03/02 | 2010 | 5.39 | | 24.68 | |
| 04 | 32CONG-L4 | 32CONG-L4 | 10/03/02 | 2055 | 5.39 | | 24.67 | |
| 05 | 32CONG-L5 | 32CONG-L5 | 10/03/02 | 2140 | 5.38 | | 24.67 | |
| 06 | 20ICV-50 | 20ICV-50 | 10/03/02 | 2310 | 5.39 | | 24.67 | |
| 07 | PBLK08 | PBLK08 | 10/03/02 | 2355 | 5.39 | | 24.67 | |
| 08 | 08LCS | 08LCS | 10/04/02 | 0040 | 5.39 | | 24.67 | |
| 09 | 08LCSD | 08LCSD | 10/04/02 | 0125 | 5.38 | | 24.66 | |
| 10 | F01009LS13 | 502104 | 10/04/02 | 0210 | 5.39 | | 24.67 | |
| 11 | F01009LS12 | 502105 | 10/04/02 | 0255 | 5.38 | | 24.66 | |
| 12 | F01009LS11 | 502106 | 10/04/02 | 0340 | 5.38 | | 24.66 | |
| 13 | F01009LS23 | 502107 | 10/04/02 | 0425 | 5.38 | | 24.66 | |
| 14 | F01009LS22 | 502108 | 10/04/02 | 0510 | 5.38 | | 24.65 | |
| 15 | F01009LS21 | 502109 | 10/04/02 | 0555 | 5.38 | | 24.66 | |
| 16 | F01009LS33 | 502110 | 10/04/02 | 0640 | 5.39 | | 24.66 | |
| 17 | F01009LS32 | 502111 | 10/04/02 | 0725 | 5.39 | | 24.66 | |
| 18 | 32CONG-L3 | 32CONG-L3 | 10/04/02 | 0855 | 5.38 | | 24.64 | |
| 19 | PIBLK_SCU | PIBLK_SCU | 10/04/02 | 0940 | 5.39 | | 24.66 | |
| 20 | F01009LS31 | 502112 | 10/04/02 | 1025 | 5.38 | | 24.65 | |
| 21 | F01009LS43 | 502113 | 10/04/02 | 1110 | 5.38 | | 24.66 | |
| 22 | F01009LS42 | 502114 | 10/04/02 | 1155 | 5.38 | | 24.66 | |
| 23 | F01009LS41 | 502115 | 10/04/02 | 1241 | 5.38 | | 24.65 | |
| 24 | F01009LS53 | 502116 | 10/04/02 | 1326 | 5.38 | | 24.65 | |
| 25 | F01009LS52 | 502117 | 10/04/02 | 1411 | 5.38 | | 24.66 | |
| 26 | F01009LS51 | 502118 | 10/04/02 | 1456 | 5.39 | | 24.66 | |
| 27 | F01009LS63 | 502119 | 10/04/02 | 1541 | 5.37 | | 24.64 | |
| 28 | F01009LS62 | 502120 | 10/04/02 | 1626 | 5.38 | | 24.65 | |
| 29 | F01009LS61 | 502121 | 10/04/02 | 1711 | 5.39 | | 24.66 | |
| 30 | 32CONG-L3 | 32CONG-L3 | 10/04/02 | 1841 | 5.38 | | 24.64 | |
| 31 | | | | | | | | |
| 32 | | | | | | | | |

QC LIMITS
S1 = Tetrachloro-meta-xylen (+/- 0.05 MINUTES)
S2 = BZ#198 (+/- 0.05 MINUTES)

# Column used to flag retention time values with an asterisk.
* Values outside of QC limits.

FORM 10
OTHER IDENTIFICATION SUMMARY
FOR SINGLE COMPONENT ANALYTES

CLIENT SAMPLE NO.

08LCS

Lab Name: STL BURLINGTON Contract: 22000

Lab Code: STLVT Case No.: 22000 SAS No.: SDG No.: 89891

Lab Sample ID: 08LCS Date(s) Analyzed: 10/04/02 10/04/02

Instrument ID (1): 3327_1 Instrument ID (2): 3327_2

GC Column(1): RTX-5 ID: 0.25(mm) GC Column(2): RTX-CLPII ID: 0.25(mm)

| ANALYTE | COL | RT | RT WINDOW FROM | RT WINDOW TO | CONCENTRATION | %D |
|---|---|---|---|---|---|---|
| BZ#8 | 1 | 5.75 | 5.71 | 5.81 | 29 | |
| | 2 | 6.59 | 6.54 | 6.64 | 29 | 0.0 |
| BZ#18 | 1 | 6.69 | 6.65 | 6.75 | 29 | |
| | 2 | 7.70 | 7.65 | 7.75 | 29 | 0.0 |
| BZ#28 | 1 | 7.92 | 7.87 | 7.97 | 28 | |
| | 2 | 9.13 | 9.09 | 9.19 | 28 | 0.0 |
| BZ#44 | 1 | 9.66 | 9.62 | 9.72 | 29 | |
| | 2 | 11.31 | 11.26 | 11.36 | 29 | 0.0 |
| BZ#52 | 1 | 8.98 | 8.93 | 9.03 | 29 | |
| | 2 | 10.34 | 10.29 | 10.39 | 29 | 0.0 |
| BZ#66 | 1 | 11.23 | 11.19 | 11.29 | 28 | |
| | 2 | 13.05 | 13.01 | 13.11 | 28 | 0.0 |
| BZ#77 | 1 | 13.74 | 13.70 | 13.80 | 28 | |
| | 2 | 16.07 | 16.03 | 16.13 | 28 | 0.0 |
| BZ#101 | 1 | 12.20 | 12.16 | 12.26 | 29 | |
| | 2 | 13.91 | 13.86 | 13.96 | 29 | 0.0 |

FORM 10
OTHER IDENTIFICATION SUMMARY
FOR SINGLE COMPONENT ANALYTES

CLIENT SAMPLE NO.

08LCS

Lab Name: STL BURLINGTON Contract: 22000

Lab Code: STLVT Case No.: 22000 SAS No.: SDG No.: 89891

Lab Sample ID: 08LCS Date(s) Analyzed: 10/04/02 10/04/02

Instrument ID (1): 3327_1 Instrument ID (2): 3327_2

GC Column(1): RTX-5 ID: 0.25(mm) GC Column(2): RTX-CLPII ID: 0.25(mm)

| ANALYTE | COL | RT | RT WINDOW FROM | RT WINDOW TO | CONCENTRATION | %D |
|---|---|---|---|---|---|---|
| BZ#105 | 1 | 16.15 | 16.11 | 16.21 | 28 | |
| | 2 | 18.71 | 18.67 | 18.77 | 28 | 0.0 |
| BZ#118 | 1 | 14.93 | 14.89 | 14.99 | 28 | |
| | 2 | 17.07 | 17.02 | 17.12 | 28 | 0.0 |
| BZ#126 | 1 | 17.75 | 17.71 | 17.81 | 28 | |
| | 2 | 20.22 | 20.17 | 20.27 | 58 | 107.1 |
| BZ#128 | 1 | 18.64 | 18.60 | 18.70 | 29 | |
| | 2 | 21.46 | 21.41 | 21.51 | 29 | 0.0 |
| BZ#138 | 1 | 17.32 | 17.28 | 17.38 | 29 | |
| | 2 | 19.71 | 19.66 | 19.76 | 29 | 0.0 |
| BZ#153 | 1 | 15.99 | 15.94 | 16.04 | 58 | |
| | 2 | 17.99 | 17.94 | 18.04 | 29 | 100.0 |
| BZ#170 | 1 | 22.26 | 22.22 | 22.32 | 29 | |
| | 2 | 25.00 | 24.95 | 25.05 | 28 | 3.6 |
| BZ#180 | 1 | 20.77 | 20.73 | 20.83 | 29 | |
| | 2 | 23.11 | 23.07 | 23.17 | 28 | 3.6 |

FORM 10
OTHER IDENTIFICATION SUMMARY
FOR SINGLE COMPONENT ANALYTES

CLIENT SAMPLE NO.

08LCS

Lab Name: STL BURLINGTON Contract: 22000

Lab Code: STLVT Case No.: 22000 SAS No.: SDG No.: 89891

Lab Sample ID: 08LCS Date(s) Analyzed: 10/04/02 10/04/02

Instrument ID (1): 3327_1 Instrument ID (2): 3327_2

GC Column(1): RTX-5 ID: 0.25(mm) GC Column(2): RTX-CLPII ID: 0.25(mm)

| ANALYTE | COL | RT | RT WINDOW FROM | RT WINDOW TO | CONCENTRATION | %D |
|---|---|---|---|---|---|---|
| BZ#187 | 1 | 18.16 | 18.12 | 18.22 | 29 | |
| | 2 | 20.22 | 20.17 | 20.27 | 58 | 100.0 |
| BZ#195 | 1 | 24.54 | 24.50 | 24.60 | 29 | |
| | 2 | 27.19 | 27.15 | 27.25 | 29 | 0.0 |
| BZ#206 | 1 | 27.64 | 27.61 | 27.71 | 29 | |
| | 2 | 29.80 | 29.76 | 29.86 | 29 | 0.0 |
| BZ#209 | 1 | 29.17 | 29.13 | 29.23 | 30 | |
| | 2 | 30.75 | 30.70 | 30.80 | 29 | 3.4 |
| | 1 | | | | | |
| | 2 | | | | | |
| | 1 | | | | | |
| | 2 | | | | | |
| | 1 | | | | | |
| | 2 | | | | | |
| | 1 | | | | | |
| | 2 | | | | | |

page 3 of 3

OTHER

FORM 10
OTHER IDENTIFICATION SUMMARY
FOR SINGLE COMPONENT ANALYTES

CLIENT SAMPLE NO.

O8LCSD

Lab Name: STL BURLINGTON Contract: 22000

Lab Code: STLVT Case No.: 22000 SAS No.: SDG No.: 89891

Lab Sample ID: O8LCSD Date(s) Analyzed: 10/04/02 10/04/02

Instrument ID (1): 3327_1 Instrument ID (2): 3327_2

GC Column(1): RTX-5 ID: 0.25(mm) GC Column(2): RTX-CLPII ID: 0.25(mm)

| ANALYTE | COL | RT | RT WINDOW FROM | RT WINDOW TO | CONCENTRATION | %D |
|---|---|---|---|---|---|---|
| BZ#8 | 1 | 5.75 | 5.71 | 5.81 | 32 | |
| | 2 | 6.58 | 6.54 | 6.64 | 32 | 0.0 |
| BZ#18 | 1 | 6.69 | 6.65 | 6.75 | 32 | |
| | 2 | 7.68 | 7.65 | 7.75 | 32 | 0.0 |
| BZ#28 | 1 | 7.91 | 7.87 | 7.97 | 32 | |
| | 2 | 9.12 | 9.09 | 9.19 | 32 | 0.0 |
| BZ#44 | 1 | 9.65 | 9.62 | 9.72 | 32 | |
| | 2 | 11.29 | 11.26 | 11.36 | 32 | 0.0 |
| BZ#52 | 1 | 8.97 | 8.93 | 9.03 | 32 | |
| | 2 | 10.33 | 10.29 | 10.39 | 32 | 0.0 |
| BZ#66 | 1 | 11.23 | 11.19 | 11.29 | 32 | |
| | 2 | 13.04 | 13.01 | 13.11 | 32 | 0.0 |
| BZ#77 | 1 | 13.73 | 13.70 | 13.80 | 32 | |
| | 2 | 16.06 | 16.03 | 16.13 | 31 | 3.2 |
| BZ#101 | 1 | 12.19 | 12.16 | 12.26 | 33 | |
| | 2 | 13.89 | 13.86 | 13.96 | 32 | 3.1 |

FORM 10
OTHER IDENTIFICATION SUMMARY
FOR SINGLE COMPONENT ANALYTES

CLIENT SAMPLE NO.

O8LCSD

Lab Name: STL BURLINGTON Contract: 22000

Lab Code: STLVT Case No.: 22000 SAS No.: SDG No.: 89891

Lab Sample ID: O8LCSD Date(s) Analyzed: 10/04/02 10/04/02

Instrument ID (1): 3327_1 Instrument ID (2): 3327_2

GC Column(1): RTX-5 ID: 0.25(mm) GC Column(2): RTX-CLPII ID: 0.25(mm)

| ANALYTE | COL | RT | RT WINDOW FROM | TO | CONCENTRATION | %D |
|---|---|---|---|---|---|---|
| BZ#105 | 1 | 16.14 | 16.11 | 16.21 | 32 | |
| | 2 | 18.70 | 18.67 | 18.77 | 32 | 0.0 |
| BZ#118 | 1 | 14.92 | 14.89 | 14.99 | 32 | |
| | 2 | 17.06 | 17.02 | 17.12 | 32 | 0.0 |
| BZ#126 | 1 | 17.74 | 17.71 | 17.81 | 32 | |
| | 2 | 20.20 | 20.17 | 20.27 | 64 | 100.0 |
| BZ#128 | 1 | 18.63 | 18.60 | 18.70 | 33 | |
| | 2 | 21.44 | 21.41 | 21.51 | 33 | 0.0 |
| BZ#138 | 1 | 17.31 | 17.28 | 17.38 | 33 | |
| | 2 | 19.69 | 19.66 | 19.76 | 32 | 3.1 |
| BZ#153 | 1 | 15.98 | 15.94 | 16.04 | 65 | |
| | 2 | 17.97 | 17.94 | 18.04 | 32 | 103.1 |
| BZ#170 | 1 | 22.26 | 22.22 | 22.32 | 32 | |
| | 2 | 24.98 | 24.95 | 25.05 | 32 | 0.0 |
| BZ#180 | 1 | 20.76 | 20.73 | 20.83 | 32 | |
| | 2 | 23.09 | 23.07 | 23.17 | 31 | 3.2 |

FORM 10
OTHER IDENTIFICATION SUMMARY
FOR SINGLE COMPONENT ANALYTES

CLIENT SAMPLE NO.

O8LCSD

Lab Name: STL BURLINGTON Contract: 22000

Lab Code: STLVT Case No.: 22000 SAS No.: SDG No.: 89891

Lab Sample ID: O8LCSD Date(s) Analyzed: 10/04/02 10/04/02

Instrument ID (1): 3327_1 Instrument ID (2): 3327_2

GC Column(1): RTX-5 ID: 0.25(mm) GC Column(2): RTX-CLPII ID: 0.25(mm)

| ANALYTE | COL | RT | RT WINDOW FROM | RT WINDOW TO | CONCENTRATION | %D |
|---|---|---|---|---|---|---|
| BZ#187 | 1 | 18.15 | 18.12 | 18.22 | 33 | |
| | 2 | 20.20 | 20.17 | 20.27 | 64 | 93.9 |
| BZ#195 | 1 | 24.53 | 24.50 | 24.60 | 32 | |
| | 2 | 27.18 | 27.15 | 27.25 | 32 | 0.0 |
| BZ#206 | 1 | 27.64 | 27.61 | 27.71 | 32 | |
| | 2 | 29.79 | 29.76 | 29.86 | 32 | 0.0 |
| BZ#209 | 1 | 29.16 | 29.13 | 29.23 | 33 | |
| | 2 | 30.73 | 30.70 | 30.80 | 32 | 3.1 |
| | 1 | | | | | |
| | 2 | | | | | |
| | 1 | | | | | |
| | 2 | | | | | |
| | 1 | | | | | |
| | 2 | | | | | |
| | 1 | | | | | |
| | 2 | | | | | |

```
Report Date : 17-Oct-2002 09:10                                                                  Page 1

                                   STL Burlington

                               INITIAL CALIBRATION DATA

Start Cal Date   : 03-OCT-2002 18:40
End Cal Date     : 03-OCT-2002 21:40
Quant Method     : ESTD
Target Version   : 3.50
Integrator       : Falcon
Method file      : /var/chem/3327_1.i/100302_1/03OCT021607.b/32CONG_3327RTX5_RAW.m
Cal Date         : 17-Oct-2002 09:09 rrm

Calibration File Names:
Level 1: /var/chem/3327_1.i/100302_1/03OCT021607.b/03oct021607-r041.d
Level 2: /var/chem/3327_1.i/100302_1/03OCT021607.b/03oct021607-r051.d
Level 3: /var/chem/3327_1.i/100302_1/03OCT021607.b/03oct021607-r061.d
Level 4: /var/chem/3327_1.i/100302_1/03OCT021607.b/03oct021607-r071.d
Level 5: /var/chem/3327_1.i/100302_1/03OCT021607.b/03oct021607-r081.d

 ___________________________________________________________________________________________________________________
|                                  |     5     |    25     |    50     |    100    |    200    |     |                  Coefficients             |   %RSD    |
|  Compound                        |  Level 1  |  Level 2  |  Level 3  |  Level 4  |  Level 5  |Curve|      b          m1             m2      |  or R^2   |
|==================================|===========|===========|===========|===========|===========|=====|===========================================|===========|
|    1 BZ#8                        |      4361|      19673|      37982|      71253|     133093|WLINR| -2.04469|  0.00147|            |    0.99732|
|    2 BZ#18                       |      5485|      23391|      43896|      79801|     146005|WLINR| -3.23413|  0.00133|            |    0.99477|
|    3 BZ#28                       |      6346|      32383|      67104|     133381|     261113|WLINR|  0.13508|  0.00076|            |    0.99980|
|    6 BZ#52                       |      6267|      27167|      51494|      93848|     172909|WLINR| -2.92610|  0.00112|            |    0.99536|
|    5 BZ#49                       |      6883|      30625|      58916|     107569|     200601|WLINR| -2.48021|  0.00097|            |    0.99618|
|    4 BZ#44                       |      7169|      32862|      64075|     119217|     223407|WLINR| -1.92159|  0.00087|            |    0.99718|
|    7 BZ#66                       |      4874|      26790|      56883|     114505|     228856|WLINR|  0.87139|  0.00087|            |    0.99988|
|   11 BZ#101                      |      6418|      29678|      56841|     104848|     196433|WLINR| -2.13690|  0.00099|            |    0.99659|
|    9 BZ#81                       |      9573|      52532|     108105|     206589|     397093|WLINR| -0.21880|  0.00098|            |    0.99869|
|   10 BZ#87                       |      9573|      52532|     108105|     206589|     397093|WLINR| -0.21880|  0.00098|            |    0.99869|
|    8 BZ#77                       |      1793|      13528|      30027|      60062|     122197|WLINR|  2.19296|  0.00162|            |    0.99983|
|   15 BZ#123                      |      5173|      28877|      59725|     115477|     228158|WLINR|  0.31286|  0.00087|            |    0.99959|
|   14 BZ#118                      |      5223|      27988|      56824|     109542|     216245|WLINR| -0.02579|  0.00091|            |    0.99956|
|   13 BZ#114                      |      5813|      34637|      75046|     155557|     318063|WLINR|  1.67833|  0.00063|            |    0.99946|
|   19 BZ#153                      |     10078|      47431|      90887|     169588|     318510|WLINR| -3.76716|  0.00122|            |    0.99709|
|__________________________________|___________|___________|___________|___________|___________|_____|_________|_________|____________|___________|
```

STL Burlington

## INITIAL CALIBRATION DATA

Start Cal Date : 03-OCT-2002 18:40
End Cal Date : 03-OCT-2002 21:40
Quant Method : ESTD
Target Version : 3.50
Integrator : Falcon
Method file : /var/chem/3327_1.i/100302_1/03OCT021607.b/32CONG_3327RTX5_RAW.m
Cal Date : 17-Oct-2002 09:09 rrm

| | 5 | 25 | 50 | 100 | 200 | | Coefficients | | | %RSD |
|---|---|---|---|---|---|---|---|---|---|---|
| Compound | Level 1 | Level 2 | Level 3 | Level 4 | Level 5 | Curve | b | m1 | m2 | or R^2 |
| 27 BZ#184 | 10078 | 47431 | 90887 | 169588 | 318510 | WLINR | -3.76716 | 0.00122 | | 0.99709 |
| 12 BZ#105 | 4932 | 30284 | 65716 | 134702 | 279070 | WLINR | 1.78495 | 0.00072 | | 0.99941 |
| 18 BZ#138 | 7081 | 35442 | 70198 | 135647 | 259588 | WLINR | -0.75337 | 0.00076 | | 0.99891 |
| 16 BZ#126 | 2383 | 15457 | 33598 | 66395 | 137164 | WLINR | 1.66247 | 0.00146 | | 0.99974 |
| 28 BZ#187 | 7520 | 34130 | 64933 | 120830 | 226089 | WLINR | -2.22391 | 0.00086 | | 0.99693 |
| 26 BZ#183 | 7632 | 35897 | 70353 | 130881 | 254098 | WLINR | -1.42691 | 0.00078 | | 0.99854 |
| 17 BZ#128 | 7163 | 37607 | 77683 | 150261 | 290932 | WLINR | -0.10137 | 0.00068 | | 0.99926 |
| 22 BZ#167 | 5848 | 30119 | 60027✓ | 115129 | 223579 | WLINR | -0.52304 | 0.00088 | | 0.99913 |
| 20 BZ#156 | 5487 | 30981 | 66753✓ | 135185 | 281219 | WLINR | 1.39830 | 0.00072 | | 0.99936 |
| 21 BZ#157 | 5768 | 31568 | 68103 | 134104 | 274322 | WLINR | 0.94374 | 0.00073 | | 0.99974 |
| 25 BZ#180 | 7726 | 37039 | 74182 | 140107 | 274674 | WLINR | -0.90257 | 0.00072 | | 0.99923 |
| 23 BZ#169 | 4338 | 23175 | 46713 | 90585 | 180982 | WLINR | 0.05400 | 0.00110 | | 0.99978 |
| 24 BZ#170 | 7654 | 38708 | 77513 | 149808 | 287305 | WLINR | -0.59573 | 0.00068 | | 0.99900 |
| 29 BZ#189 | 6905 | 34863 | 70565 | 136042 | 272731 | WLINR | -0.18952 | 0.00073 | | 0.99981 |
| 30 BZ#195 | 8894 | 41606 | 83155 | 156012 | 299152 | WLINR | -1.30019 | 0.00066 | | 0.99850 |
| 31 BZ#206 | 9085 | 40401 | 76390 | 142431 | 271038 | WLINR | -2.23142 | 0.00073 | | 0.99784 |
| 32 BZ#209 | 10693 | 45643 | 85234 | 152724 | 280082 | WLINR | -3.43434 | 0.00069 | | 0.99403 |
| $ 33 Tetrachloro-meta-xylene | 14229 | 80682 | 166684 | 321637 | 615745 | WLINR | 0.11218 | 0.00032 | | 0.99871 |
| $ 34 BZ#198 | 8851 | 40100 | 78261 | 149386 | 281488 | WLINR | -1.65436 | 0.00070 | | 0.99831 |

```
                        STL Burlington

                   INITIAL CALIBRATION DATA

Start Cal Date   : 03-OCT-2002 18:40
End Cal Date     : 03-OCT-2002 21:40
Quant Method     : ESTD
Target Version   : 3.50
Integrator       : Falcon
Method file      : /var/chem/3327_1.i/100302_1/03OCT021607.b/32CONG_3327RTX5_RAW.m
Cal Date         : 17-Oct-2002 09:09 rrm


 _______________________________________________________________________
| Curve     | Formula                                     | Units       |
|==========|=============================================|==============|
| Wt Linear| Amt = b + m1*Rsp                             | Amount       |
|__________|_____________________________________________|______________|
```

STL Burlington

COMPOUND LISTING

Method file : /var/chem/3327_1.i/100302_1/03OCT021607.b/32CONG_3327RTX5_
Quant Method : ESTD
Target Version : 3.50
Last Update : 17-Oct-2002 09:09
Number of Cpnds : 34
Data Type : GC DATA

Global Integrator : Falcon

| Chromat Events | Values |
|---|---|
| Initial:Start Threshold | 19.000000 |
| Initial:End Threshold | 9.500000 |
| Initial:Area Threshold | 190.000000 |
| Initial:P-P Resolution | 1.000000 |
| Initial:Bunch Factor | 5.000000 |
| Initial:Negative Peaks | OFF |
| Initial:Tension | 2.000000 |

| Compound | RT | RT Window | RF |
|---|---|---|---|
| $ 33 Tetrachloro-meta-xylene | 5.001 | 4.951-5.051 | 3.165e-04 |
| 1 BZ#8 | 5.761 | 5.711-5.811 | 1.465e-03 |
| 2 BZ#18 | 6.701 | 6.651-6.751 | 1.327e-03 |
| 3 BZ#28 | 7.925 | 7.875-7.975 | 7.582e-04 |
| 6 BZ#52 | 8.984 | 8.934-9.034 | 1.122e-03 |
| 5 BZ#49 | 9.122 | 9.072-9.172 | 9.699e-04 |
| 4 BZ#44 | 9.667 | 9.617-9.717 | 8.721e-04 |
| 7 BZ#66 | 11.243 | 11.193-11.293 | 8.697e-04 |
| 11 BZ#101 | 12.207 | 12.157-12.257 | 9.910e-04 |
| 9 BZ#81 | 13.318 | 13.268-13.368 | 9.835e-04 |
| 10 BZ#87 | 13.318 | 13.268-13.368 | 9.835e-04 |
| 8 BZ#77 | 13.752 | 13.702-13.802 | 1.621e-03 |
| 15 BZ#123 | 14.825 | 14.775-14.875 | 8.652e-04 |
| 14 BZ#118 | 14.938 | 14.888-14.988 | 9.142e-04 |
| 13 BZ#114 | 15.428 | 15.378-15.478 | 6.308e-04 |
| 19 BZ#153 | 15.993 | 15.943-16.043 | 1.224e-03 |
| 27 BZ#184 | 15.993 | 15.943-16.043 | 1.224e-03 |
| 12 BZ#105 | 16.155 | 16.105-16.205 | 7.209e-04 |
| 18 BZ#138 | 17.328 | 17.278-17.378 | 7.555e-04 |
| 16 BZ#126 | 17.762 | 17.712-17.812 | 1.458e-03 |
| 28 BZ#187 | 18.170 | 18.120-18.220 | 8.624e-04 |
| 26 BZ#183 | 18.416 | 18.366-18.466 | 7.760e-04 |
| 17 BZ#128 | 18.647 | 18.597-18.697 | 6.751e-04 |
| 22 BZ#167 | 18.760 | 18.710-18.810 | 8.802e-04 |

STL Burlington

COMPOUND LISTING

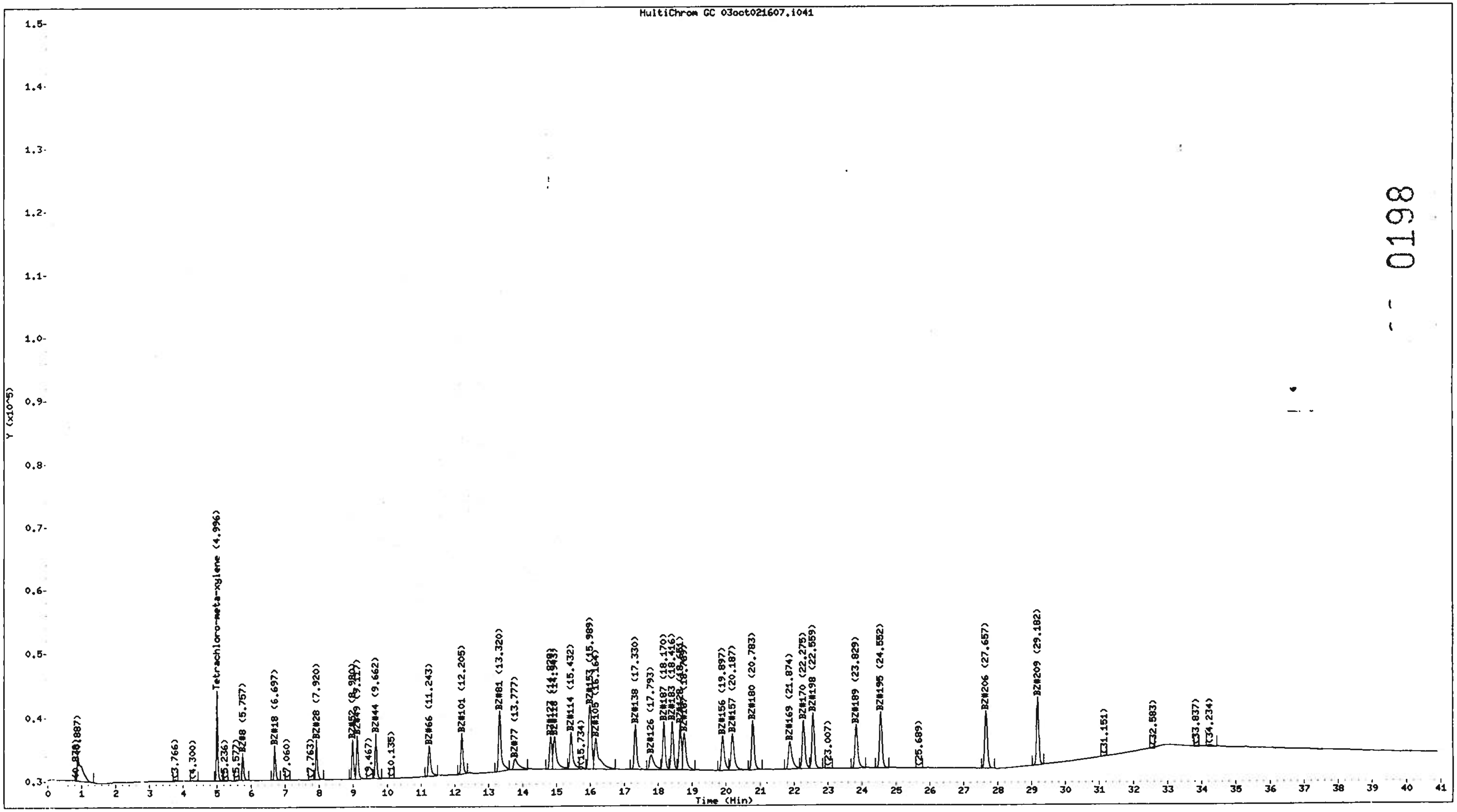
Method file : /var/chem/3327_1.i/100302_1/03OCT021607.b/32CONG_3327RTX5_

| | Compound | RT | RT Window | RF |
|---|---|---|---|---|
| | 20 BZ#156 | 19.886 | 19.836-19.936 | 7.178e-04 |
| | 21 BZ#157 | 20.174 | 20.124-20.224 | 7.303e-04 |
| | 25 BZ#180 | 20.781 | 20.731-20.831 | 7.204e-04 |
| | 23 BZ#169 | 21.854 | 21.804-21.904 | 1.098e-03 |
| | 24 BZ#170 | 22.271 | 22.221-22.321 | 6.827e-04 |
| $ | 34 BZ#198 | 22.559 | 22.509-22.609 | 6.957e-04 |
| | 29 BZ#189 | 23.820 | 23.770-23.870 | 7.310e-04 |
| | 30 BZ#195 | 24.552 | 24.502-24.602 | 6.564e-04 |
| | 31 BZ#206 | 27.655 | 27.605-27.705 | 7.252e-04 |
| | 32 BZ#209 | 29.180 | 29.130-29.230 | 6.915e-04 |

## STL Burlington - Target GC Chromatogram

| | |
|---|---|
| Lab Sample ID: 32CONG-L1 | Client Sample ID: 32CONG-L1 |

```
Matrix      : WATER                    Sample Type     : CALIB_1
Analyst     :                          Injection Date  : 03-OCT-2002 18:40
Instrument  : 3327_1.i                 Dilution Factor : 1.00
Column      : RTX-5                    Data File       : 03oct021607-r041.d
Integrator  : Falcon                   Compound Sublist: all
Method      : /var/chem/3327_1.i/100302_1/03OCT021607.b/32CONG_3327RTX5_RAW.m
Reported    : 17-Oct-2002 09:11 rrm
```



# STL Burlington - Target GC Injection Report

**Lab Sample ID: 32CONG-L1** **Client Sample ID: 32CONG-L1**

Matrix : WATER
Analyst :
Instrument : 3327_1.i
Column : RTX-5
Integrator : Falcon
Method : /var/chem/3327_1.i/100302_1/03OCT021607.b/32CONG_3327RTX5_RAW.m
Reported : 17-Oct-2002 09:11 rrm

Sample Type : CALIB_1
Injection Date : 03-OCT-2002 18:40
Dilution Factor : 1.00
Data File : 03oct021607-r041.d
Compound Sublist: all

## Peaks

| | Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0.838 | | | 334 | 202 | | | |
| | 2 | 0.887 | | | 37382 | 3994 | | | |
| | 3 | 3.766 | | | 850 | 280 | | | |
| | 4 | 4.300 | | | 854 | 117 | | | |
| $ | 5 | 4.996 | 5.001 | -0.004 | 37074 | 14229 | 4.61522 | R | Tetrachloro-meta-xylene |
| | 6 | 5.236 | | | 409 | 122 | | | |
| | 7 | 5.577 | | | 468 | 165 | | | |
| | 8 | 5.757 | 5.761 | -0.004 | 13922 | 4361 | 4.34422 | | BZ#8 |
| | 9 | 6.697 | 6.701 | -0.004 | 17546 | 5485 | 4.04369 | | BZ#18 |
| | 10 | 7.060 | | | 439 | 127 | | | |
| | 11 | 7.763 | | | 365 | 108 | | | |
| | 12 | 7.920 | 7.925 | -0.004 | 22450 | 6346 | 4.94632 | | BZ#28 |
| | 13 | 8.980 | 8.984 | -0.004 | 22262 | 6267 | 4.10619 | | BZ#52 |
| | 14 | 9.117 | 9.122 | -0.004 | 26347 | 6883 | 4.19536 | | BZ#49 |
| | 15 | 9.467 | | | 519 | 112 | | | |
| | 16 | 9.662 | 9.667 | -0.004 | 26568 | 7169 | 4.33073 | | BZ#44 |
| | 17 | 10.135 | | | 340 | 80 | | | |
| | 18 | 11.243 | 11.243 | 0.000 | 24688 | 4874 | 5.11045 | M | BZ#66 |
| | 19 | 12.205 | 12.207 | -0.002 | 27807 | 6418 | 4.22357 | | BZ#101 |
| | 20 | 13.320 | 13.318 | 0.002 | 51615 | 9573 | 9.19589 | M | BZ#81 |
| | 20 | 13.320 | 13.318 | 0.002 | 51615 | 9573 | 9.19589 | M | BZ#87 |
| | 21 | 13.777 | 13.752 | 0.024 | 18490 | 1793 | 5.10007 | M | BZ#77 |
| | 22 | 14.829 | 14.825 | 0.004 | 24177 | 5173 | 4.78841 | M | BZ#123 |
| | 23 | 14.943 | 14.938 | 0.004 | 36806 | 5223 | 4.74888 | M | BZ#118 |
| | 24 | 15.432 | 15.428 | 0.004 | 34053 | 5813 | 5.34511 | M | BZ#114 |
| | 25 | 15.734 | | | 2495 | 339 | | | |
| | 26 | 15.989 | 15.993 | -0.004 | 65435 | 10078 | 8.56463 | M | BZ#153 |
| | 26 | 15.989 | 15.993 | -0.004 | 65435 | 10078 | 8.56463 | M | BZ#184 |
| | 27 | 16.164 | 16.155 | 0.009 | 45565 | 4932 | 5.34067 | M | BZ#105 |
| | 28 | 17.330 | 17.328 | 0.002 | 37735 | 7081 | 4.59641 | | BZ#138 |
| | 29 | 17.793 | 17.762 | 0.031 | 21189 | 2383 | 5.13597 | | BZ#126 |
| | 30 | 18.170 | 18.170 | 0.000 | 36998 | 7520 | 4.26166 | | BZ#187 |
| | 31 | 18.416 | 18.416 | 0.000 | 37537 | 7632 | 4.49580 | M | BZ#183 |
| | 32 | 18.651 | 18.647 | 0.004 | 34475 | 7163 | 4.73424 | M | BZ#128 |
| | 33 | 18.769 | 18.760 | 0.009 | 38278 | 5848 | 4.62424 | M | BZ#167 |
| | 34 | 19.897 | 19.886 | 0.011 | 34190 | 5487 | 5.33710 | | BZ#156 |
| | 35 | 20.187 | 20.174 | 0.013 | 38455 | 5768 | 5.15618 | | BZ#157 |
| | 36 | 20.783 | 20.781 | 0.002 | 42328 | 7726 | 4.66346 | | BZ#180 |
| | 37 | 21.874 | 21.854 | 0.020 | 33668 | 4338 | 4.81774 | | BZ#169 |
| | 38 | 22.275 | 22.271 | 0.004 | 42973 | 7654 | 4.62954 | | BZ#170 |
| $ | 39 | 22.559 | 22.559 | 0.000 | 47334 | 8851 | 4.50346 | R | BZ#198 |
| | 40 | 23.007 | | | 838 | 133 | | | |
| | 41 | 23.829 | 23.820 | 0.009 | 41832 | 6905 | 4.85829 | | BZ#189 |
| | 42 | 24.552 | 24.552 | 0.000 | 47678 | 8894 | 4.53783 | | BZ#195 |
| | 43 | 25.689 | | | 542 | 107 | | | |
| | 44 | 27.657 | 27.655 | 0.002 | 50817 | 9085 | 4.35743 | | BZ#206 |
| | 45 | 29.182 | 29.180 | 0.002 | 49648 | 10693 | 3.95969 | M | BZ#209 |
| | 46 | 31.151 | | | 386 | 97 | | | |
| | 47 | 32.583 | | | 1292 | 246 | | | |
| | 48 | 33.837 | | | 935 | 149 | | | |
| | 49 | 34.234 | | | 2401 | 231 | | | |

```
Flags:  A - Peak quantitates above calibration range
        a - Peak quantitates below reporting limit
        H - User selected alternate compound hit
        M - Peak manually integrated or manually identified
        R - Peak fails recovery
        U - User disabled peak ID: either peak quantitates below reporting limit or
            peak identification not confirmed on second column
```

## Target Compounds

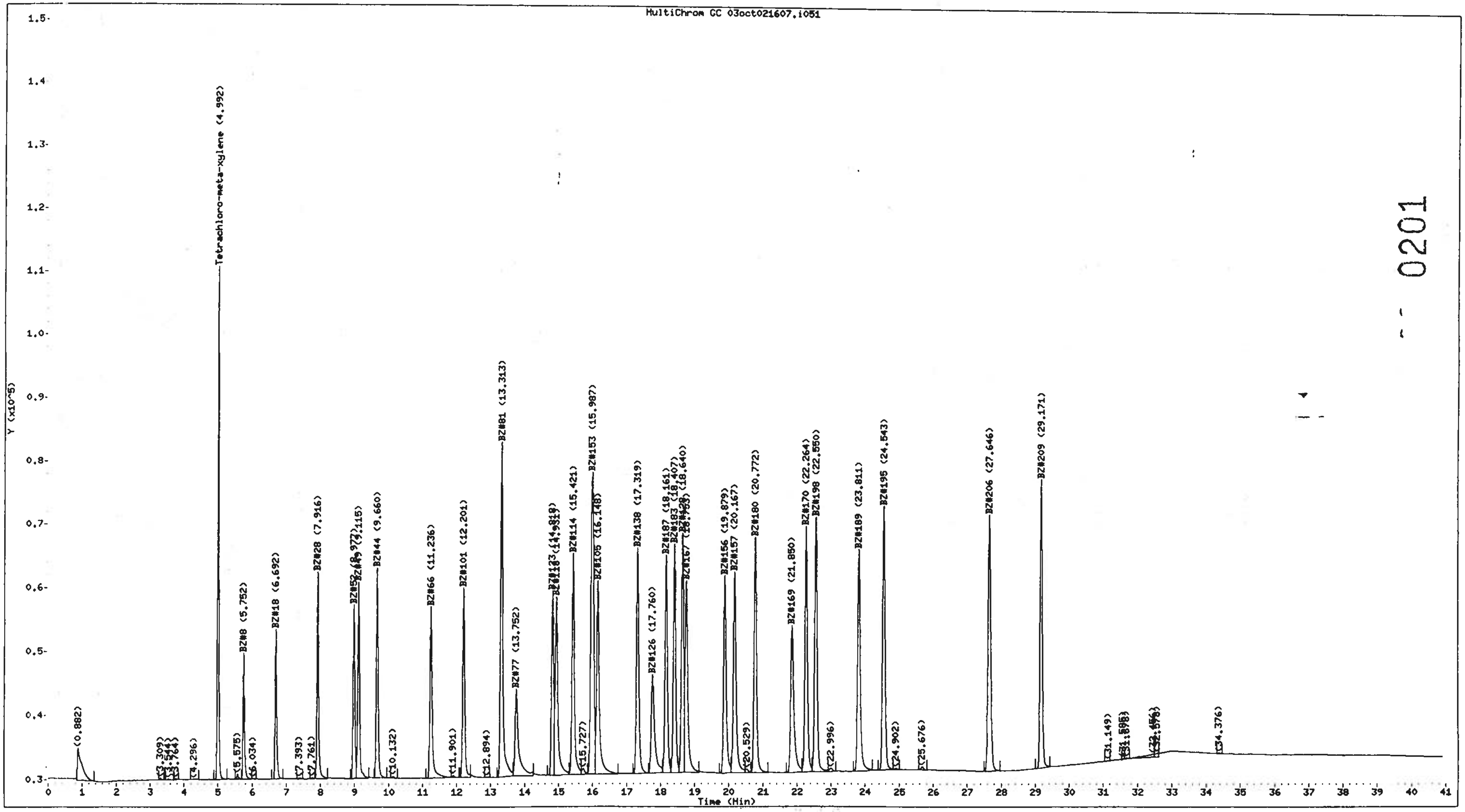
```
  Peak      Expected
   RT          RT                 Target Compound
========    ========    ======================================
   4.996       5.001    Tetrachloro-meta-xylene
   5.757       5.761    BZ#8
   6.697       6.701    BZ#18
   7.920       7.925    BZ#28
   8.980       8.984    BZ#52
   9.117       9.122    BZ#49
   9.662       9.667    BZ#44
  11.243      11.243    BZ#66
  12.205      12.207    BZ#101
  13.320      13.318    BZ#87
  13.320      13.318    BZ#81
  13.777      13.752    BZ#77
  14.827      14.825    BZ#123
  14.943      14.938    BZ#118
  15.432      15.428    BZ#114
  15.989      15.993    BZ#153
  15.989      15.993    BZ#184
  16.164      16.155    BZ#105
  17.330      17.328    BZ#138
  17.793      17.762    BZ#126
  18.170      18.170    BZ#187
  18.414      18.416    BZ#183
  18.651      18.647    BZ#128
  18.769      18.760    BZ#167
  19.897      19.886    BZ#156
  20.187      20.174    BZ#157
  20.783      20.781    BZ#180
  21.874      21.854    BZ#169
  22.275      22.271    BZ#170
  22.559      22.559    BZ#198
  23.829      23.820    BZ#189
  24.552      24.552    BZ#195
  27.657      27.655    BZ#206
  29.182      29.180    BZ#209
```

# STL Burlington - Target GC Chromatogram

Lab Sample ID: 32CONG-L2 Client Sample ID: 32CONG-L2

| | | | |
|---|---|---|---|
| Matrix | : WATER | Sample Type | : CALIB_2 |
| Analyst | : | Injection Date | : 03-OCT-2002 19:25 |
| Instrument | : 3327_1.i | Dilution Factor | : 1.00 |
| Column | : RTX-5 | Data File | : 03oct021607-r051.d |
| Integrator | : Falcon | Compound Sublist | : all |

Method : /var/chem/3327_1.i/100302_1/03OCT021607.b/32CONG_3327RTX5_RAW.m
Reported : 17-Oct-2002 09:11 rrm



# STL Burlington - Target GC Injection Report

Lab Sample ID: 32CONG-L2 Client Sample ID: 32CONG-L2

Matrix : WATER
Analyst :
Instrument : 3327_1.i
Column : RTX-5
Integrator : Falcon
Method : /var/chem/3327_1.i/100302_1/03OCT021607.b/32CONG_3327RTX5_RAW.m
Reported : 17-Oct-2002 09:11 rrm

Sample Type : CALIB_2
Injection Date : 03-OCT-2002 19:25
Dilution Factor : 1.00
Data File : 03oct021607-r051.d
Compound Sublist: all

## Peaks

| | Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0.882 | | | 45161 | 5060 | | | |
| | 2 | 3.309 | | | 1012 | 302 | | | |
| | 3 | 3.544 | | | 489 | 141 | | | |
| | 4 | 3.764 | | | 613 | 205 | | | |
| | 5 | 4.296 | | | 744 | 108 | | | |
| $ | 6 | 4.992 | 5.001 | -0.009 | 202322 | 80682 | 25.6455 | R | Tetrachloro-meta-xylene |
| | 7 | 5.575 | | | 2636 | 821 | | | |
| | 8 | 5.752 | 5.761 | -0.009 | 60511 | 19673 | 26.7765 | | BZ#8 |
| | 9 | 6.034 | | | 607 | 152 | | | |
| | 10 | 6.692 | 6.701 | -0.009 | 74748 | 23391 | 27.8024 | | BZ#18 |
| | 11 | 7.393 | | | 674 | 227 | | | |
| | 12 | 7.761 | | | 812 | 241 | | | |
| | 13 | 7.916 | 7.925 | -0.009 | 108049 | 32383 | 24.6864 | | BZ#28 |
| | 14 | 8.977 | 8.984 | -0.007 | 95930 | 27167 | 27.5584 | | BZ#52 |
| | 15 | 9.115 | 9.122 | -0.007 | 115235 | 30625 | 27.2219 | | BZ#49 |
| | 16 | 9.660 | 9.667 | -0.007 | 120931 | 32862 | 26.7384 | | BZ#44 |
| | 17 | 10.132 | | | 1167 | 307 | | | |
| | 18 | 11.236 | 11.243 | -0.007 | 126146 | 26790 | 24.1714 | M | BZ#66 |
| | 19 | 11.901 | | | 1554 | 315 | | | |
| | 20 | 12.201 | 12.207 | -0.007 | 127908 | 29678 | 27.2751 | M | BZ#101 |
| | 21 | 12.894 | | | 375 | 85 | | | |
| | 22 | 13.313 | 13.318 | -0.004 | 257131 | 52532 | 51.4445 | | BZ#81 |
| | 22 | 13.313 | 13.318 | -0.004 | 257131 | 52532 | 51.4445 | M | BZ#87 |
| | 23 | 13.752 | 13.752 | 0.000 | 101645 | 13528 | 24.1268 | | BZ#77 |
| | 24 | 14.818 | 14.825 | -0.007 | 126905 | 28877 | 25.2965 | | BZ#123 |
| | 25 | 14.931 | 14.938 | -0.007 | 155526 | 27988 | 25.5598 | | BZ#118 |
| | 26 | 15.421 | 15.428 | -0.007 | 168726 | 34637 | 23.5270 | | BZ#114 |
| | 27 | 15.727 | | | 5743 | 887 | | | |
| | 28 | 15.987 | 15.993 | -0.007 | 290917 | 47431 | 54.2710 | | BZ#153 |
| | 28 | 15.987 | 15.993 | -0.007 | 290917 | 47431 | 54.2710 | M | BZ#184 |
| | 29 | 16.148 | 16.155 | -0.007 | 172085 | 30284 | 23.6182 | | BZ#105 |
| | 30 | 17.319 | 17.328 | -0.009 | 172697 | 35442 | 26.0235 | | BZ#138 |
| | 31 | 17.760 | 17.762 | -0.002 | 109183 | 15457 | 24.1928 | | BZ#126 |
| | 32 | 18.161 | 18.170 | -0.009 | 167392 | 34130 | 27.2113 | | BZ#187 |
| | 33 | 18.407 | 18.416 | -0.009 | 172816 | 35897 | 26.4305 | | BZ#183 |
| | 34 | 18.640 | 18.647 | -0.007 | 173824 | 37607 | 25.2864 | | BZ#128 |
| | 35 | 18.753 | 18.760 | -0.007 | 171039 | 30119 | 25.9870 | | BZ#167 |
| | 36 | 19.879 | 19.886 | -0.007 | 167468 | 30981 | 23.6378 | | BZ#156 |
| | 37 | 20.167 | 20.174 | -0.007 | 180468 | 31568 | 23.9982 | | BZ#157 |
| | 38 | 20.529 | | | 3441 | 547 | | | |
| | 39 | 20.772 | 20.781 | -0.009 | 190218 | 37039 | 25.7814 | | BZ#180 |
| | 40 | 21.850 | 21.854 | -0.004 | 153795 | 23175 | 25.5034 | | BZ#169 |
| | 41 | 22.264 | 22.271 | -0.007 | 198101 | 38708 | 25.8297 | | BZ#170 |
| $ | 42 | 22.550 | 22.559 | -0.009 | 207793 | 40100 | 26.2440 | R | BZ#198 |
| | 43 | 22.996 | | | 3498 | 542 | | | |
| | 44 | 23.811 | 23.820 | -0.009 | 193959 | 34863 | 25.2966 | M | BZ#189 |
| | 45 | 24.543 | 24.552 | -0.009 | 215881 | 41606 | 26.0100 | M | BZ#195 |
| | 46 | 24.902 | | | 1369 | 213 | | | |
| | 47 | 25.676 | | | 2507 | 460 | | | |
| | 48 | 27.646 | 27.655 | -0.009 | 222799 | 40401 | 27.0692 | | BZ#206 |
| | 49 | 29.171 | 29.180 | -0.009 | 208245 | 45643 | 28.1270 | M | BZ#209 |
| | 50 | 31.149 | | | 207 | 45 | | | |
| | 51 | 31.585 | | | 418 | 126 | | | |
| | 52 | 31.678 | | | 687 | 157 | | | |
| | 53 | 32.456 | | | 10055 | 478 | | | |

0202

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| 54 | 32.578 | | | 4098 | 597 | | | |
| 55 | 34.376 | | | 1174 | 210 | | | |

Flags: A - Peak quantitates above calibration range
a - Peak quantitates below reporting limit
H - User selected alternate compound hit
M - Peak manually integrated or manually identified
R - Peak fails recovery
U - User disabled peak ID: either peak quantitates below reporting limit or peak identification not confirmed on second column

## Target Compounds

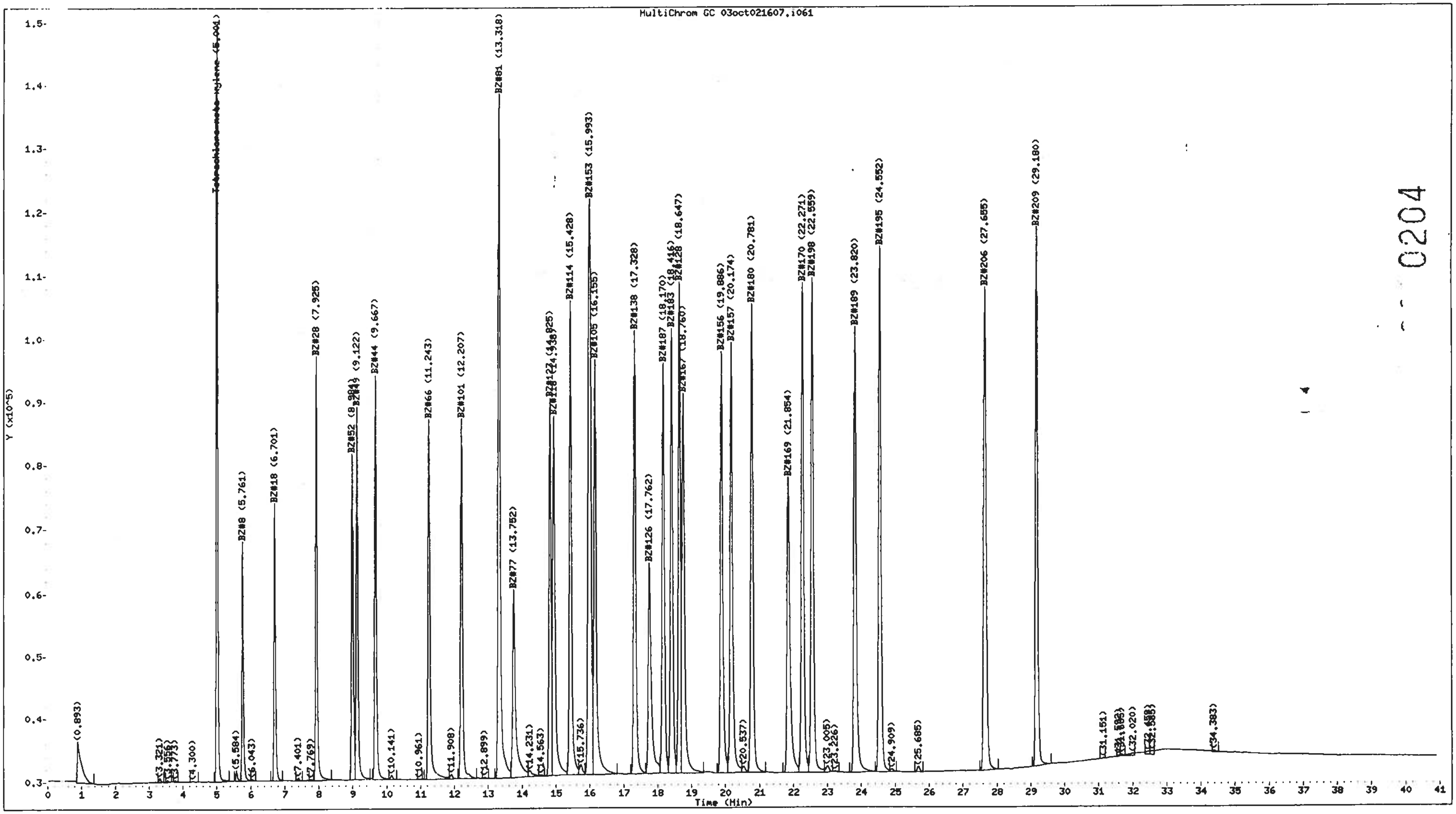
| Peak RT | Expected RT | Target Compound |
|---|---|---|
| 4.992 | 5.001 | Tetrachloro-meta-xylene |
| 5.752 | 5.761 | BZ#8 |
| 6.692 | 6.701 | BZ#18 |
| 7.916 | 7.925 | BZ#28 |
| 8.977 | 8.984 | BZ#52 |
| 9.115 | 9.122 | BZ#49 |
| 9.660 | 9.667 | BZ#44 |
| 11.236 | 11.243 | BZ#66 |
| 12.201 | 12.207 | BZ#101 |
| 13.313 | 13.318 | BZ#87 |
| 13.313 | 13.318 | BZ#81 |
| 13.752 | 13.752 | BZ#77 |
| 14.818 | 14.825 | BZ#123 |
| 14.931 | 14.938 | BZ#118 |
| 15.421 | 15.428 | BZ#114 |
| 15.987 | 15.993 | BZ#153 |
| 15.987 | 15.993 | BZ#184 |
| 16.148 | 16.155 | BZ#105 |
| 17.319 | 17.328 | BZ#138 |
| 17.760 | 17.762 | BZ#126 |
| 18.161 | 18.170 | BZ#187 |
| 18.407 | 18.416 | BZ#183 |
| 18.640 | 18.647 | BZ#128 |
| 18.753 | 18.760 | BZ#167 |
| 19.879 | 19.886 | BZ#156 |
| 20.167 | 20.174 | BZ#157 |
| 20.772 | 20.781 | BZ#180 |
| 21.850 | 21.854 | BZ#169 |
| 22.264 | 22.271 | BZ#170 |
| 22.550 | 22.559 | BZ#198 |
| 23.811 | 23.820 | BZ#189 |
| 24.543 | 24.552 | BZ#195 |
| 27.646 | 27.655 | BZ#206 |
| 29.171 | 29.180 | BZ#209 |

# STL Burlington - Target GC Chromatogram

| Lab Sample ID: 32CONG-L3 | Client Sample ID: 32CONG-L3 |
|---|---|

Matrix : WATER
Analyst :
Instrument : 3327_1.i
Column : RTX-5
Integrator : Falcon
Method : /var/chem/3327_1.i/100302_1/03OCT021607.b/32CONG_3327RTX5_RAW.m
Reported : 17-Oct-2002 09:11 rrm

Sample Type : CALIB_3
Injection Date : 03-OCT-2002 20:10
Dilution Factor : 1.00
Data File : 03oct021607-r061.d
Compound Sublist: all



# STL Burlington - Target GC Injection Report

**Lab Sample ID: 32CONG-L3** **Client Sample ID: 32CONG-L3**

Matrix : WATER
Analyst :
Instrument : 3327_1.i
Column : RTX-5
Integrator : Falcon
Method : /var/chem/3327_1.i/100302_1/03OCT021607.b/32CONG_3327RTX5_RAW.m
Reported : 17-Oct-2002 09:11 rrm

Sample Type : CALIB_3
Injection Date : 03-OCT-2002 20:10
Dilution Factor : 1.00
Data File : 03oct021607-r061.d
Compound Sublist: all

## Peaks

| | Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0.893 | | | 54481 | 6509 | | | |
| | 2 | 3.321 | | | 2032 | 611 | | | |
| | 3 | 3.556 | | | 879 | 282 | | | |
| | 4 | 3.773 | | | 801 | 274 | | | |
| | 5 | 4.300 | | | 708 | 112 | | | |
| $ | 6 | 5.001 | 5.001 | 0.000 | 424411 | 166684 | 52.8625 | R | Tetrachloro-meta-xylene |
| | 7 | 5.584 | | | 5298 | 1652 | | | |
| | 8 | 5.761 | 5.761 | 0.000 | 114029 | 37982 | 53.5994 | | BZ#8 |
| | 9 | 6.043 | | | 1144 | 289 | | | |
| | 10 | 6.701 | 6.701 | 0.000 | 139142 | 43896 | 55.0096 | | BZ#18 |
| | 11 | 7.401 | | | 1385 | 461 | | | |
| | 12 | 7.769 | | | 796 | 236 | | | |
| | 13 | 7.925 | 7.925 | 0.000 | 220719 | 67104 | 51.0102 | | BZ#28 |
| | 14 | 8.984 | 8.984 | 0.000 | 180478 | 51494 | 54.8560 | | BZ#52 |
| | 15 | 9.122 | 9.122 | 0.000 | 219582 | 58916 | 54.6603 | | BZ#49 |
| | 16 | 9.667 | 9.667 | 0.000 | 235900 | 64075 | 53.9603 | | BZ#44 |
| | 17 | 10.141 | | | 3090 | 695 | | | |
| | 18 | 10.961 | | | 455 | 120 | | | |
| | 19 | 11.243 | 11.243 | 0.000 | 251426 | 56883 | 50.3442 | | BZ#66 |
| | 20 | 11.908 | | | 4083 | 726 | | | |
| | 21 | 12.207 | 12.207 | 0.000 | 248459 | 56841 | 54.1946 | | BZ#101 |
| | 22 | 12.899 | | | 886 | 200 | | | |
| | 23 | 13.318 | 13.318 | 0.000 | 506970 | 108105 | 106.098 | M | BZ#81 |
| | 23 | 13.318 | 13.318 | 0.000 | 506970 | 108105 | 106.098 | M | BZ#87 |
| | 24 | 13.752 | 13.752 | 0.000 | 192270 | 30027 | 50.8778 | M | BZ#77 |
| | 25 | 14.231 | | | 8619 | 942 | | | |
| | 26 | 14.563 | | | 1395 | 231 | | | |
| | 27 | 14.825 | 14.825 | 0.000 | 255514 | 59725 | 51.9854 | M | BZ#123 |
| | 28 | 14.938 | 14.938 | 0.000 | 296947 | 56824 | 51.9206 | M | BZ#118 |
| | 29 | 15.428 | 15.428 | 0.000 | 345115 | 75046 | 49.0166 | M | BZ#114 |
| | 30 | 15.736 | | | 9857 | 1588 | | | |
| | 31 | 15.993 | 15.993 | 0.000 | 554603 | 90887 | 107.445 | M | BZ#153 |
| | 31 | 15.993 | 15.993 | 0.000 | 554603 | 90887 | 107.445 | M | BZ#184 |
| | 32 | 16.155 | 16.155 | 0.000 | 342681 | 65716 | 49.1628 | M | BZ#105 |
| | 33 | 17.328 | 17.328 | 0.000 | 336653 | 70198 | 52.2820 | M | BZ#138 |
| | 34 | 17.762 | 17.762 | 0.000 | 213845 | 33598 | 50.6354 | | BZ#126 |
| | 35 | 18.170 | 18.170 | 0.000 | 317650 | 64933 | 53.7771 | | BZ#187 |
| | 36 | 18.416 | 18.416 | 0.000 | 334851 | 70353 | 53.1696 | | BZ#183 |
| | 37 | 18.647 | 18.647 | 0.000 | 350353 | 77683 | 52.3410 | | BZ#128 |
| | 38 | 18.760 | 18.760 | 0.000 | 332778 | 60027 | 52.3114 | | BZ#167 |
| | 39 | 19.886 | 19.886 | 0.000 | 338088 | 66753 | 49.3164 | | BZ#156 |
| | 40 | 20.174 | 20.174 | 0.000 | 357199 | 68103 | 50.6801 | | BZ#157 |
| | 41 | 20.537 | | | 6410 | 1005 | | | |
| | 42 | 20.781 | 20.781 | 0.000 | 369555 | 74182 | 52.5402 | | BZ#180 |
| | 43 | 21.854 | 21.854 | 0.000 | 293660 | 46713 | 51.3515 | | BZ#169 |
| | 44 | 22.271 | 22.271 | 0.000 | 389489 | 77513 | 52.3213 | | BZ#170 |
| $ | 45 | 22.559 | 22.559 | 0.000 | 399373 | 78261 | 52.7934 | R | BZ#198 |
| | 46 | 23.005 | | | 6886 | 1034 | | | |
| | 47 | 23.226 | | | 1271 | 184 | | | |
| | 48 | 23.820 | 23.820 | 0.000 | 380308 | 70565 | 51.3961 | | BZ#189 |
| | 49 | 24.552 | 24.552 | 0.000 | 420847 | 83155 | 53.2828 | | BZ#195 |
| | 50 | 24.909 | | | 2900 | 444 | | | |
| | 51 | 25.685 | | | 4449 | 864 | | | |
| | 52 | 27.655 | 27.655 | 0.000 | 425323 | 76390 | 53.1700 | | BZ#206 |
| | 53 | 29.180 | 29.180 | 0.000 | 387176 | 85234 | 55.5036 | M | BZ#209 |

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| 54 | 31.151 | | | 388 | 87 | | | |
| 55 | 31.592 | | | 786 | 237 | | | |
| 56 | 31.685 | | | 1386 | 293 | | | |
| 57 | 32.020 | | | 3897 | 368 | | | |
| 58 | 32.459 | | | 4126 | 561 | | | |
| 59 | 32.585 | | | 4379 | 638 | | | |
| 60 | 34.383 | | | 1653 | 321 | | | |

Flags:
A - Peak quantitates above calibration range
a - Peak quantitates below reporting limit
H - User selected alternate compound hit
M - Peak manually integrated or manually identified
R - Peak fails recovery
U - User disabled peak ID: either peak quantitates below reporting limit or peak identification not confirmed on second column

## Target Compounds

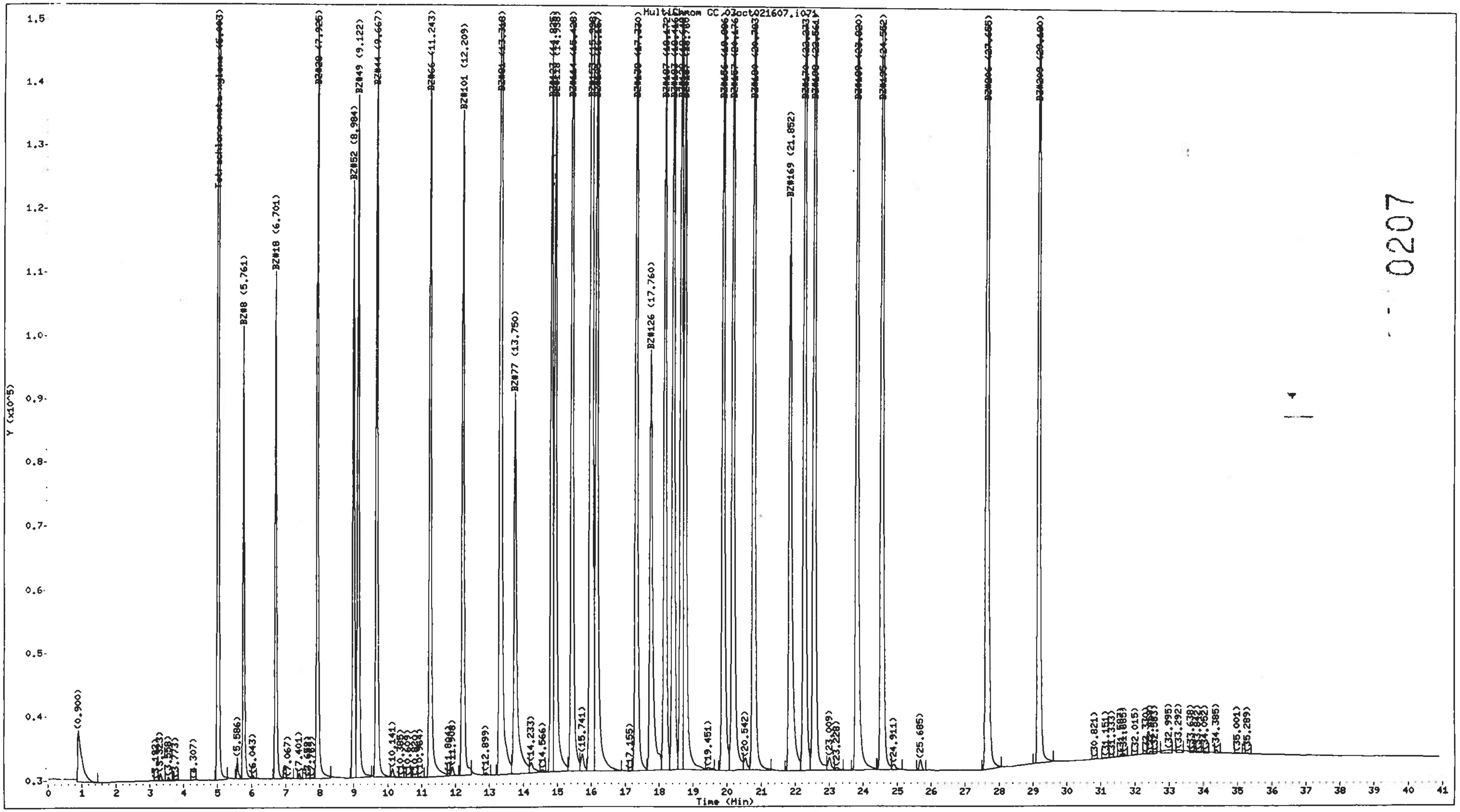
| Peak RT | Expected RT | Target Compound |
|---|---|---|
| 5.001 | 5.001 | Tetrachloro-meta-Xylene |
| 5.761 | 5.761 | BZ#8 |
| 6.701 | 6.701 | BZ#18 |
| 7.925 | 7.925 | BZ#28 |
| 8.984 | 8.984 | BZ#52 |
| 9.122 | 9.122 | BZ#49 |
| 9.667 | 9.667 | BZ#44 |
| 11.243 | 11.243 | BZ#66 |
| 12.207 | 12.207 | BZ#101 |
| 13.318 | 13.318 | BZ#87 |
| 13.318 | 13.318 | BZ#81 |
| 13.752 | 13.752 | BZ#77 |
| 14.825 | 14.825 | BZ#123 |
| 14.938 | 14.938 | BZ#118 |
| 15.428 | 15.428 | BZ#114 |
| 15.993 | 15.993 | BZ#153 |
| 15.993 | 15.993 | BZ#184 |
| 16.155 | 16.155 | BZ#105 |
| 17.328 | 17.328 | BZ#138 |
| 17.762 | 17.762 | BZ#126 |
| 18.170 | 18.170 | BZ#187 |
| 18.416 | 18.416 | BZ#183 |
| 18.647 | 18.647 | BZ#128 |
| 18.760 | 18.760 | BZ#167 |
| 19.886 | 19.886 | BZ#156 |
| 20.174 | 20.174 | BZ#157 |
| 20.781 | 20.781 | BZ#180 |
| 21.854 | 21.854 | BZ#169 |
| 22.271 | 22.271 | BZ#170 |
| 22.559 | 22.559 | BZ#198 |
| 23.820 | 23.820 | BZ#189 |
| 24.552 | 24.552 | BZ#195 |
| 27.655 | 27.655 | BZ#206 |
| 29.180 | 29.180 | BZ#209 |

STL Burlington - Target GC Chromatogram

| | |
|---|---|
| Lab Sample ID: 32CONG-L4 | Client Sample ID: 32CONG-L4 |

Matrix : WATER
Analyst :
Instrument : 3327_1.i
Column : RTX-5
Integrator : Falcon
Method : /var/chem/3327_1.i/100302_1/03OCT021607.b/32CONG_3327RTX5_RAW.m
Reported : 17-Oct-2002 09:11 rrm

Sample Type : CALIB_4
Injection Date : 03-OCT-2002 20:55
Dilution Factor : 1.00
Data File : 03oct021607-r071.d
Compound Sublist: all



# STL Burlington - Target GC Injection Report

| Lab Sample ID: 32CONG-L4 | Client Sample ID: 32CONG-L4 |
|---|---|

Matrix : WATER
Analyst : 
Instrument : 3327_1.i
Column : RTX-5
Integrator : Falcon
Method : /var/chem/3327_1.i/100302_1/03OCT021607.b/32CONG_3327RTX5_RAW.m
Reported : 17-Oct-2002 09:11 rrm

Sample Type : CALIB_4
Injection Date : 03-OCT-2002 20:55
Dilution Factor : 1.00
Data File : 03oct021607-r071.d
Compound Sublist: all

## Peaks

| | Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0.900 | | | 67589 | 7976 | | | |
| | 2 | 3.192 | | | 227 | 65 | | | |
| | 3 | 3.323 | | | 3993 | 1194 | | | |
| | 4 | 3.558 | | | 1758 | 553 | | | |
| | 5 | 3.773 | | | 767 | 269 | | | |
| | 6 | 4.307 | | | 293 | 73 | | | |
| $ | 7 | 5.003 | 5.001 | 0.002 | 848262 | 321637 | 101.900 | R | Tetrachloro-meta-xylene |
| | 8 | 5.586 | | | 10284 | 3227 | | | |
| | 9 | 5.761 | 5.761 | 0.000 | 210442 | 71253 | 102.342 | | BZ#8 |
| | 10 | 6.043 | | | 2120 | 536 | | | |
| | 11 | 6.701 | 6.701 | 0.000 | 252278 | 79801 | 102.650 | | BZ#18 |
| | 12 | 7.067 | | | 992 | 143 | | | |
| | 13 | 7.401 | | | 2673 | 886 | | | |
| | 14 | 7.659 | | | 392 | 137 | | | |
| | 15 | 7.769 | | | 579 | 175 | | | |
| | 16 | 7.925 | 7.925 | 0.000 | 433100 | 133381 | 101.258 | | BZ#28 |
| | 17 | 8.984 | 8.984 | 0.000 | 330098 | 93848 | 102.382 | | BZ#52 |
| | 18 | 9.122 | 9.122 | 0.000 | 401944 | 107569 | 101.847 | | BZ#49 |
| | 19 | 9.667 | 9.667 | 0.000 | 440192 | 119217 | 102.051 | | BZ#44 |
| | 20 | 10.141 | | | 5727 | 1346 | | | |
| | 21 | 10.385 | | | 333 | 98 | | | |
| | 22 | 10.609 | | | 282 | 77 | | | |
| | 23 | 10.820 | | | 391 | 102 | | | |
| | 24 | 10.964 | | | 1022 | 257 | | | |
| | 25 | 11.243 | 11.243 | 0.000 | 477317 | 114505 | 100.460 | M | BZ#66 |
| | 26 | 11.804 | | | 1744 | 370 | | | |
| | 27 | 11.908 | | | 5873 | 1286 | | | |
| | 28 | 12.209 | 12.207 | 0.002 | 446512 | 104848 | 101.771 | | BZ#101 |
| | 29 | 12.899 | | | 1826 | 408 | | | |
| | 30 | 13.318 | 13.318 | 0.000 | 951531 | 206589 | 202.954 | M | BZ#81 |
| | 30 | 13.318 | 13.318 | 0.000 | 951531 | 206589 | 202.954 | M | BZ#87 |
| | 31 | 13.750 | 13.752 | -0.002 | 347923 | 60062 | 99.5757 | M | BZ#77 |
| | 32 | 14.233 | | | 13397 | 1550 | | | |
| | 33 | 14.566 | | | 2376 | 431 | | | |
| | 34 | 14.825 | 14.825 | 0.000 | 494558 | 115477 | 100.220 | M | BZ#123 |
| | 35 | 14.938 | 14.938 | 0.000 | 547802 | 109542 | 100.113 | M | BZ#118 |
| | 36 | 15.428 | 15.428 | 0.000 | 688190 | 155557 | 99.8021 | M | BZ#114 |
| | 37 | 15.741 | | | 16068 | 2691 | | | |
| | 38 | 15.998 | 15.993 | 0.004 | 1018555 | 169588 | 203.746 | M | BZ#153 |
| | 38 | 15.998 | 15.993 | 0.004 | 1018555 | 169588 | 203.746 | M | BZ#184 |
| | 39 | 16.157 | 16.155 | 0.002 | 673461 | 134702 | 98.8982 | M | BZ#105 |
| | 40 | 17.155 | | | 614 | 134 | | | |
| | 41 | 17.330 | 17.328 | 0.002 | 636842 | 135647 | 101.730 | M | BZ#138 |
| | 42 | 17.760 | 17.762 | -0.002 | 399109 | 66395 | 98.4409 | M | BZ#126 |
| | 43 | 18.172 | 18.170 | 0.002 | 584866 | 120830 | 101.985 | M | BZ#187 |
| | 44 | 18.416 | 18.416 | 0.000 | 631644 | 130881 | 100.142 | M | BZ#183 |
| | 45 | 18.649 | 18.647 | 0.002 | 686546 | 150261 | 101.337 | M | BZ#128 |
| | 46 | 18.760 | 18.760 | 0.000 | 622875 | 115129 | 100.811 | M | BZ#167 |
| | 47 | 19.451 | | | 3658 | 357 | | | |
| | 48 | 19.886 | 19.886 | 0.000 | 669390 | 135185 | 98.4397 | | BZ#156 |
| | 49 | 20.176 | 20.174 | 0.002 | 694453 | 134104 | 98.8814 | | BZ#157 |
| | 50 | 20.542 | | | 11909 | 1872 | | | |
| | 51 | 20.783 | 20.781 | 0.002 | 704657 | 140107 | 100.034 | | BZ#180 |
| | 52 | 21.852 | 21.854 | -0.002 | 546885 | 90585 | 99.5292 | | BZ#169 |
| | 53 | 22.273 | 22.271 | 0.002 | 751388 | 149808 | 101.676 | | BZ#170 |

# STL Burlington - Target GC Injection Report

```
                                                            Extract
   Peak    Peak     Expected   Delta                         Conc.
   No.      RT         RT        RT       Area     Height    (ppb)    Flags            Peak Identification
  =====  ========  ========  ========  ========  ========  ==========  =====  ====================================
$    54    22.561    22.559     0.002    758899    149386     102.276  R      BZ#198
     55    23.009                         13115      1971
     56    23.228                          2780       368
     57    23.820    23.820     0.000    733534    136042     99.2622         BZ#189
     58    24.552    24.552     0.000    804526    156012     101.106         BZ#195
     59    24.911                          5997       838
     60    25.685                          8224      1653
     61    27.655    27.655     0.000    801003    142431     101.066         BZ#206
     62    29.180    29.180     0.000    716160    152724     102.172  M      BZ#209
     63    30.821                           438       115
     64    31.151                           797       148
     65    31.333                           365       111
     66    31.587                          1253       406
     67    31.685                          1415       415
     68    32.015                           603       177
     69    32.330                           452       109
     70    32.459                          2260       429
     71    32.583                          2413       355
     72    32.995                          8414       536
     73    33.292                          4865       456
     74    33.638                          2109       333
     75    33.842                          1954       271
     76    34.052                          1473       238
     77    34.385                          2450       555
     78    35.001                           752       132
     79    35.289                           354        80

Flags:  A - Peak quantitates above calibration range
        a - Peak quantitates below reporting limit
        H - User selected alternate compound hit
        M - Peak manually integrated or manually identified
        R - Peak fails recovery
        U - User disabled peak ID: either peak quantitates below reporting limit or
            peak identification not confirmed on second column
```

## Target Compounds

```
  Peak     Expected
   RT         RT                  Target Compound
========   ========   ====================================
   5.003      5.001   Tetrachloro-meta-xylene
   5.761      5.761   BZ#8
   6.701      6.701   BZ#18
   7.925      7.925   BZ#28
   8.984      8.984   BZ#52
   9.122      9.122   BZ#49
   9.667      9.667   BZ#44
  11.243     11.243   BZ#66
  12.209     12.207   BZ#101
  13.318     13.318   BZ#87
  13.318     13.318   BZ#81
  13.750     13.752   BZ#77
  14.825     14.825   BZ#123
  14.938     14.938   BZ#118
  15.428     15.428   BZ#114
  15.998     15.993   BZ#153
  15.998     15.993   BZ#184
  16.157     16.155   BZ#105
  17.330     17.328   BZ#138
  17.760     17.762   BZ#126
  18.172     18.170   BZ#187
  18.416     18.416   BZ#183
  18.649     18.647   BZ#128
  18.760     18.760   BZ#167
  19.886     19.886   BZ#156
  20.176     20.174   BZ#157
  20.783     20.781   BZ#180
  21.852     21.854   BZ#169
  22.273     22.271   BZ#170
```

0209

# STL Burlington - Target GC Injection Report

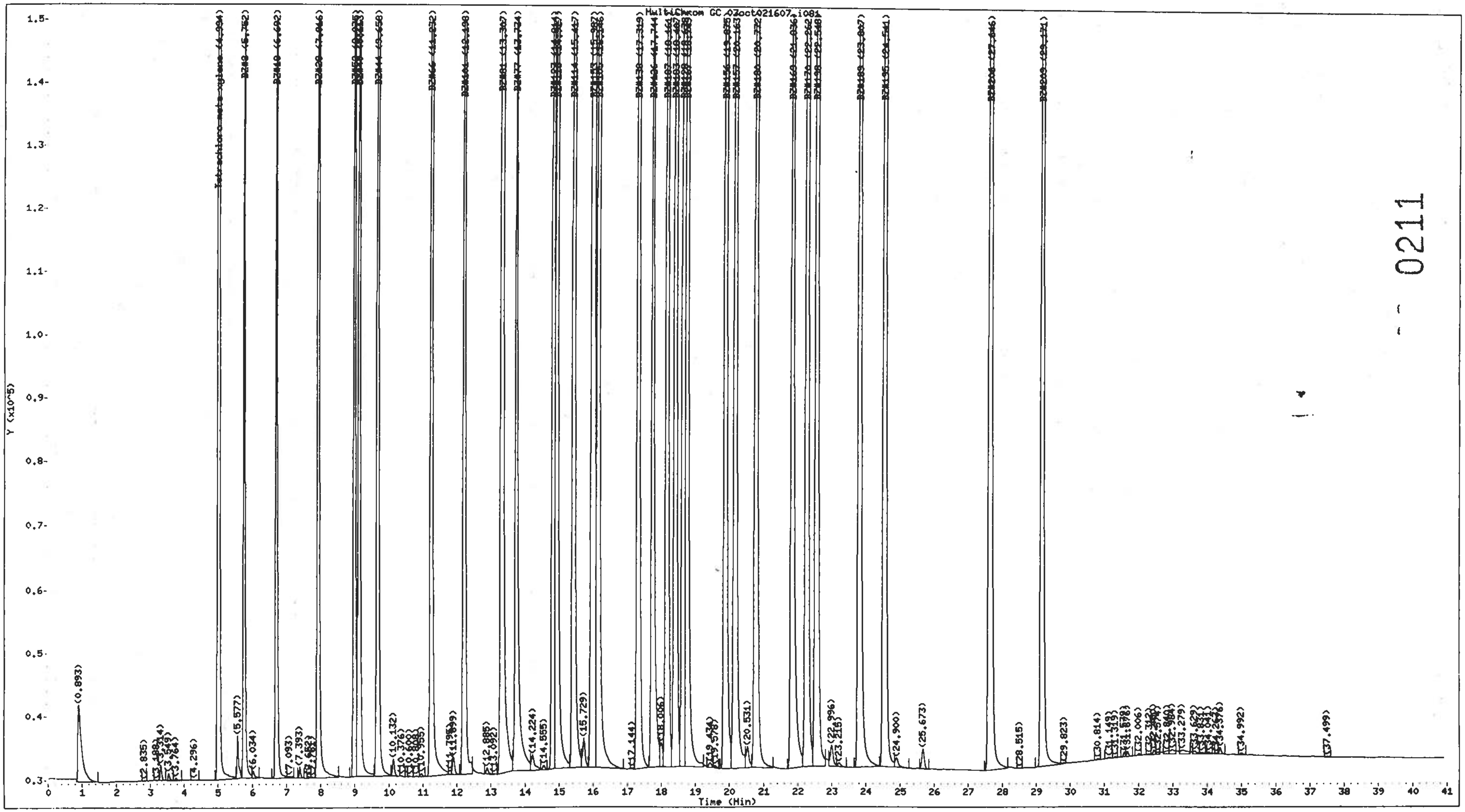
```
 Peak      Expected
  RT          RT                  Target Compound
========   ========   ======================================
  22.561     22.559   BZ#198
  23.820     23.820   BZ#189
  24.552     24.552   BZ#195
  27.655     27.655   BZ#206
  29.180     29.180   BZ#209
```

# STL Burlington - Target GC Chromatogram

| Lab Sample ID: 32CONG-L5 | Client Sample ID: 32CONG-L5 |
|---|---|

Matrix : WATER
Analyst :
Instrument : 3327_1.i
Column : RTX-5
Integrator : Falcon
Method : /var/chem/3327_1.i/100302_1/03OCT021607.b/32CONG_3327RTX5_RAW.m
Reported : 17-Oct-2002 09:11 rrm

Sample Type : CALIB_5
Injection Date : 03-OCT-2002 21:40
Dilution Factor : 1.00
Data File : 03oct021607-r081.d
Compound Sublist: all



```
                    STL Burlington - Target GC Injection Report

 Lab Sample ID: 32CONG-L5              Client Sample ID: 32CONG-L5

 Matrix           : WATER              Sample Type      : CALIB_5
 Analyst          :                    Injection Date   : 03-OCT-2002 21:40
 Instrument       : 3327_1.i           Dilution Factor  : 1.00
 Column           : RTX-5              Data File        : 03oct021607-r081.d
 Integrator       : Falcon             Compound Sublist: all
 Method           : /var/chem/3327_1.i/100302_1/03OCT021607.b/32CONG_3327RTX5_RAW.m
 Reported         : 17-Oct-2002 09:11 rrm

   _______________________________ Peaks _______________________________

                                                        Extract
  Peak    Peak    Expected   Delta                       Conc.
   No.     RT        RT        RT      Area     Height   (ppb)    Flags         Peak Identification
  =====  ========  ========  ========  ========  ========  ==========  =====  ====================================
      1    0.893                          96110     12054
      2    2.835                            195        52
      3    3.188                            437       129
      4    3.314                           7913      2383
      5    3.549                           3624      1111
      6    3.764                           1490       394
      7    4.296                            676       100
 $    8    4.994     5.001    -0.007    1674721    615745     194.976  MR     Tetrachloro-meta-xylene
      9    5.577                          21503      6613
     10    5.752     5.761    -0.009     395190    133093     192.938  M      BZ#8
     11    6.034                           4857      1075
     12    6.692     6.701    -0.009     465566    146005     190.494         BZ#18
     13    7.093                           2188       257
     14    7.393                           5229      1736
     15    7.652                            859       290
     16    7.761                            475       146
     17    7.916     7.925    -0.009     860993    261113     198.099         BZ#28
     18    8.975     8.984    -0.009     608347    172909     191.097         BZ#52
     19    9.113     9.122    -0.009     751011    200601     192.075         BZ#49
     20    9.658     9.667    -0.009     829777    223407     192.919         BZ#44
     21   10.132                          10803      2663
     22   10.376                            683       201
     23   10.600                            611       164
     24   10.808                            735       198
     25   10.955                           2105       542
     26   11.232    11.243    -0.011     932875    228856     199.914  M      BZ#66
     27   11.795                           3151       664
     28   11.899                          12071      2676
     29   12.198    12.207    -0.009     837124    196433     192.535  M      BZ#101
     30   12.885                           3906       912
     31   13.092                            361        96
     32   13.307    13.318    -0.011    1811812    397093     390.307         BZ#81
     32   13.307    13.318    -0.011    1811812    397093     390.307  M      BZ#87
     33   13.734    13.752    -0.018     641222    122197     200.320  AM     BZ#77
     34   14.224                          17216      2402
     35   14.555                           3312       713
     36   14.814    14.825    -0.011     958440    228158     197.709  M      BZ#123
     37   14.927    14.938    -0.011    1050163    216245     197.657  M      BZ#118
     38   15.417    15.428    -0.011    1392288    318063     202.309  AM     BZ#114
     39   15.729                          24000      4649
     40   15.987    15.993    -0.007    1913772    318510     385.972  M      BZ#153
     40   15.987    15.993    -0.007    1913772    318510     385.972  M      BZ#184
     41   16.146    16.155    -0.009    1330209    279070     202.980  A      BZ#105
     42   17.144                            672       201
     43   17.319    17.328    -0.009    1223066    259588     195.368  M      BZ#138
     44   17.744    17.762    -0.018     739670    137164     201.595  AM     BZ#126
     45   18.006                          19621      3865
     46   18.161    18.170    -0.009    1101956    226089     192.765  M      BZ#187
     47   18.407    18.416    -0.009    1211099    254098     195.762  M      BZ#183
     48   18.638    18.647    -0.009    1339181    290932     196.301         BZ#128
     49   18.749    18.760    -0.011    1168127    223579     196.266         BZ#167
     50   19.434                           4683       756
     51   19.578                           1791       394
     52   19.875    19.886    -0.011    1357359    281219     203.[illegible]69  A      BZ#156
     53   20.163    20.174    -0.011    1369760    274322     201.[illegible]84  A      BZ#157
```

# STL Burlington - Target GC Injection Report

```
                                                           Extract
 Peak      Peak     Expected    Delta                       Conc.
  No.       RT         RT         RT       Area     Height   (ppb)     Flags            Peak Identification
=====   ========   ========   ========   ========  ========  ==========  =====   ==================================
    54    20.531                             20359      3349
    55    20.772     20.781     -0.009     1360655    274674     196.980  M       BZ#180
    56    21.836     21.854     -0.018     1039118    180982     198.798  M       BZ#169
    57    22.262     22.271     -0.009     1454206    287305     195.543  M       BZ#170
$   58    22.548     22.559     -0.011     1449033    281488     194.182  MR      BZ#198
    59    22.996                             20735      3408
    60    23.215                              3852       574
    61    23.807     23.820     -0.013     1431078    272731     199.187  M       BZ#189
    62    24.541     24.552     -0.011     1543499    299152     195.063  M       BZ#195
    63    24.900                             10692      1510
    64    25.673                             15993      3172
    65    27.646     27.655     -0.009     1521519    271038     194.337          BZ#206
    66    28.515                               319        76
    67    29.171     29.180     -0.009     1332724    280082     190.238  M       BZ#209
    68    29.823                              1337       178
    69    30.814                               786       221
    70    31.149                              1291       191
    71    31.319                               935       262
    72    31.579                              2572       798
    73    31.676                              3249       850
    74    32.006                              1280       351
    75    32.312                               663       149
    76    32.450                              3000       696
    77    32.574                              2111       342
    78    32.840                              4306       487
    79    32.984                              6041       667
    80    33.279                              8047       598
    81    33.629                              2982       408
    82    33.831                              1645       221
    83    34.041                              1465       295
    84    34.263                               603       152
    85    34.376                              3900      1000
    86    34.992                              1559       288
    87    37.499                               517       102

Flags:  A - Peak quantitates above calibration range
        a - Peak quantitates below reporting limit
        H - User selected alternate compound hit
        M - Peak manually integrated or manually identified
        R - Peak fails recovery
        U - User disabled peak ID: either peak quantitates below reporting limit or
            peak identification not confirmed on second column
```

## Target Compounds

```
   Peak      Expected
    RT          RT                   Target Compound
 ========    ========    ======================================
    4.994       5.001    Tetrachloro-meta-xylene
    5.752       5.761    BZ#8
    6.692       6.701    BZ#18
    7.916       7.925    BZ#28
    8.975       8.984    BZ#52
    9.113       9.122    BZ#49
    9.658       9.667    BZ#44
   11.232      11.243    BZ#66
   12.198      12.207    BZ#101
   13.307      13.318    BZ#87
   13.307      13.318    BZ#81
   13.734      13.752    BZ#77
   14.814      14.825    BZ#123
   14.927      14.938    BZ#118
   15.417      15.428    BZ#114
   15.987      15.993    BZ#153
   15.987      15.993    BZ#184
   16.146      16.155    BZ#105
   17.319      17.328    BZ#138
   17.744      17.762    BZ#126
   18.161      18.170    BZ#187
```

STL Burlington - Target GC Injection Report

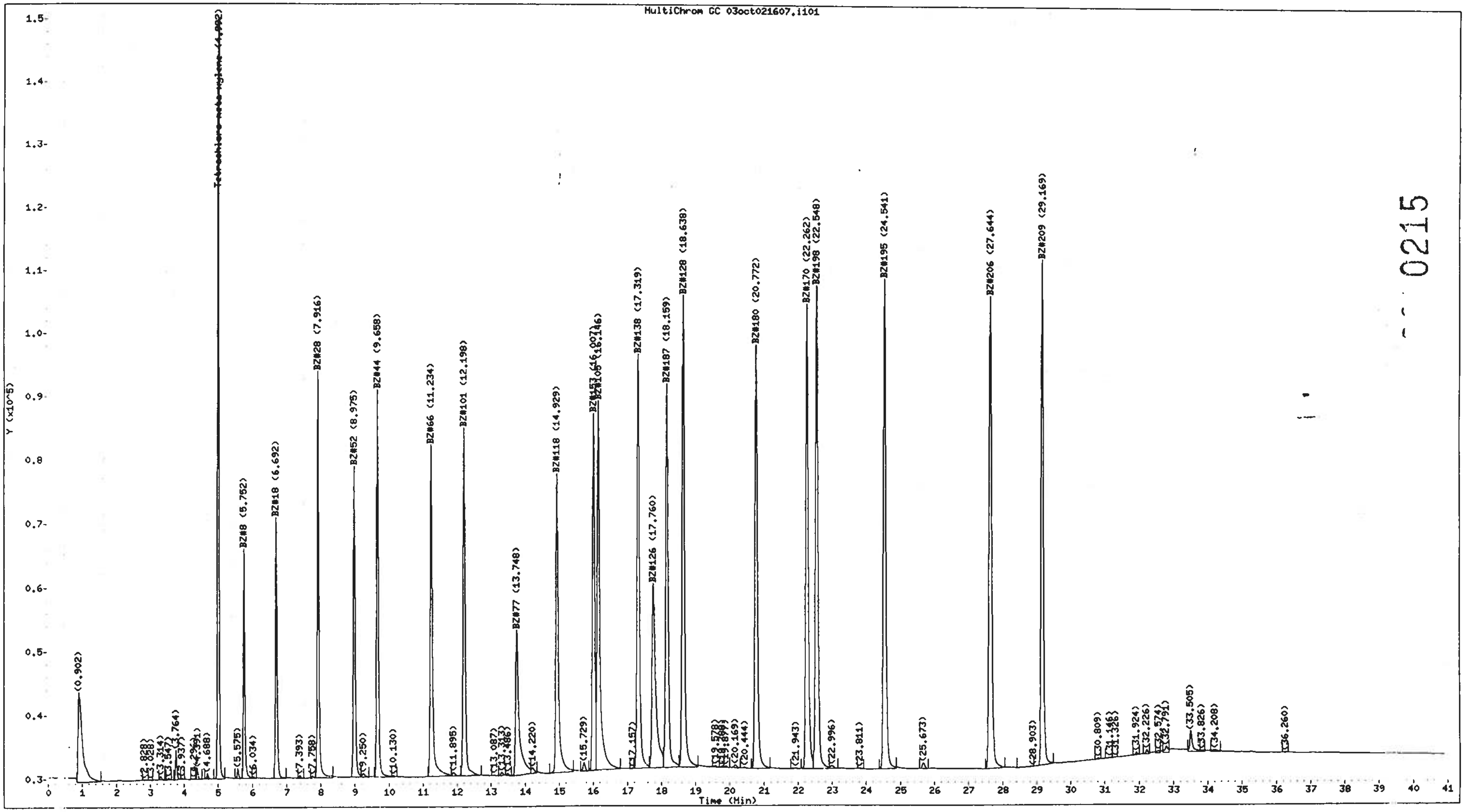
```
  Peak      Expected
   RT          RT                    Target Compound
========    ========    ======================================
  18.407      18.416    BZ#183
  18.638      18.647    BZ#128
  18.749      18.760    BZ#167
  19.875      19.886    BZ#156
  20.163      20.174    BZ#157
  20.772      20.781    BZ#180
  21.836      21.854    BZ#169
  22.262      22.271    BZ#170
  22.548      22.559    BZ#198
  23.807      23.820    BZ#189
  24.541      24.552    BZ#195
  27.646      27.655    BZ#206
  29.171      29.180    BZ#209
```

STL Burlington - Target GC Chromatogram

| | | | |
|---|---|---|---|
| Lab Sample ID: | 20ICV-50 | Client Sample ID: | 20ICV-50 |

Matrix : WATER
Analyst :
Instrument : 3327_1.i
Column : RTX-5
Integrator : Falcon
Method : /var/chem/3327_1.i/100302_1/03OCT021607.b/32CONG_3327RTX5_RAW.m
Reported : 17-Oct-2002 09:11 rrm

Sample Type : CCALIB_6
Injection Date : 03-OCT-2002 23:10
Dilution Factor : 1.00
Data File : 03oct021607-r101.d
Compound Sublist: 20ICV



# STL Burlington - Target GC Injection Report

| Lab Sample ID: 20ICV-50 | Client Sample ID: 20ICV-50 |
|---|---|

Matrix : WATER
Analyst :
Instrument : 3327_1.i
Column : RTX-5
Integrator : Falcon
Method : /var/chem/3327_1.i/100302_1/03OCT021607.b/32CONG_3327RTX5_RAW.m
Reported : 17-Oct-2002 09:11 rrm

Sample Type : CCALIB_6
Injection Date : 03-OCT-2002 23:10
Dilution Factor : 1.00
Data File : 03oct021607-r101.d
Compound Sublist: 20ICV

## Peaks

| | Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0.902 | | | 128097 | 14077 | | | |
| | 2 | 2.828 | | | 595 | 94 | | | |
| | 3 | 3.028 | | | 207 | 44 | | | |
| | 4 | 3.314 | | | 1947 | 565 | | | |
| | 5 | 3.547 | | | 765 | 256 | | | |
| | 6 | 3.764 | | | 12991 | 4557 | | | |
| | 7 | 3.937 | | | 739 | 231 | | | |
| | 8 | 4.296 | | | 629 | 118 | | | |
| | 9 | 4.391 | | | 4437 | 1631 | | | |
| | 10 | 4.688 | | | 2711 | 861 | | | |
| $ | 11 | 4.992 | 5.001 | -0.009 | 392997 | 155078 | 49.1896 | R | Tetrachloro-meta-xylene |
| | 12 | 5.575 | | | 4898 | 1582 | | | |
| | 13 | 5.752 | 5.761 | -0.009 | 109024 | 36019 | 50.7236 | | BZ#8 |
| | 14 | 6.034 | | | 1242 | 287 | | | |
| | 15 | 6.692 | 6.701 | -0.009 | 130237 | 40866 | 50.9892 | | BZ#18 |
| | 16 | 7.393 | | | 1257 | 419 | | | |
| | 17 | 7.758 | | | 1046 | 306 | | | |
| | 18 | 7.916 | 7.925 | -0.009 | 212998 | 63854 | 48.5462 | | BZ#28 |
| | 19 | 8.975 | 8.984 | -0.009 | 178742 | 48789 | 51.8207 | | BZ#52 |
| | 20 | 9.250 | | | 3328 | 535 | | | |
| | 21 | 9.658 | 9.667 | -0.009 | 226035 | 60817 | 51.1189 | | BZ#44 |
| | 22 | 10.130 | | | 1082 | 211 | | | |
| | 23 | 11.234 | 11.243 | -0.009 | 243430 | 52036 | 46.1286 | | BZ#66 |
| | 24 | 11.895 | | | 3512 | 578 | | | |
| | 25 | 12.198 | 12.207 | -0.009 | 242507 | 54594 | 51.9678 | | BZ#101 |
| | 26 | 13.087 | | | 512 | 125 | | | |
| | 27 | 13.313 | | | 2147 | 511 | | | |
| | 28 | 13.486 | | | 1433 | 314 | | | |
| | 29 | 13.748 | 13.752 | -0.004 | 165043 | 22896 | 39.3158 | | BZ#77 |
| | 30 | 14.220 | | | 5630 | 827 | | | |
| | 31 | 14.929 | 14.938 | -0.009 | 252553 | 47024 | 42.9618 | | BZ#118 |
| | 32 | 15.729 | | | 5687 | 1283 | | | |
| | 33 | 16.007 | 15.993 | 0.013 | 258960 | 56198 | 64.9986 | | BZ#153 |
| | 34 | 16.146 | 16.155 | -0.009 | 334813 | 58153 | 43.7103 | M | BZ#105 |
| | 35 | 17.157 | | | 298 | 64 | | | |
| | 36 | 17.319 | 17.328 | -0.009 | 322440 | 65260 | 48.5513 | M | BZ#138 |
| | 37 | 17.760 | 17.762 | -0.002 | 226244 | 29042 | 43.9945 | M | BZ#126 |
| | 38 | 18.159 | 18.170 | -0.011 | 311913 | 60443 | 49.9047 | M | BZ#187 |
| | 39 | 18.638 | 18.647 | -0.009 | 374085 | 74491 | 50.1861 | M | BZ#128 |
| | 40 | 19.578 | | | 1704 | 291 | | | |
| | 41 | 19.788 | | | 1140 | 246 | | | |
| | 42 | 19.877 | | | 1376 | 260 | | | |
| | 43 | 20.169 | | | 3013 | 458 | | | |
| | 44 | 20.444 | | | 930 | 173 | | | |
| | 45 | 20.772 | 20.781 | -0.009 | 349615 | 66891 | 47.2876 | M | BZ#180 |
| | 46 | 21.943 | | | 1311 | 146 | | | |
| | 47 | 22.262 | 22.271 | -0.009 | 376653 | 73450 | 49.5476 | | BZ#170 |
| $ | 48 | 22.548 | 22.559 | -0.011 | 393195 | 76395 | 51.4952 | R | BZ#198 |
| | 49 | 22.996 | | | 3256 | 449 | | | |
| | 50 | 23.811 | | | 558 | 112 | | | |
| | 51 | 24.541 | 24.552 | -0.011 | 401984 | 77564 | 49.6128 | | BZ#195 |
| | 52 | 25.673 | | | 4837 | 917 | | | |
| | 53 | 27.644 | 27.655 | -0.011 | 418214 | 74869 | 52.0669 | | BZ#206 |
| | 54 | 28.903 | | | 888 | 10 | | | |
| | 55 | 29.169 | 29.180 | -0.011 | 371696 | 80182 | 51.0102 | M | BZ#209 |

# STL Burlington - Target GC Injection Report

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| 56 | 30.809 | | | 702 | 206 | | | |
| 57 | 31.146 | | | 651 | 130 | | | |
| 58 | 31.326 | | | 194 | 52 | | | |
| 59 | 31.924 | | | 1633 | 436 | | | |
| 60 | 32.226 | | | 2973 | 713 | | | |
| 61 | 32.574 | | | 2368 | 358 | | | |
| 62 | 32.791 | | | 6637 | 1066 | | | |
| 63 | 33.505 | | | 18506 | 3315 | | | |
| 64 | 33.826 | | | 2032 | 274 | | | |
| 65 | 34.208 | | | 3262 | 296 | | | |
| 66 | 36.260 | | | 486 | 102 | | | |

Flags: A - Peak quantitates above calibration range
a - Peak quantitates below reporting limit
H - User selected alternate compound hit
M - Peak manually integrated or manually identified
R - Peak fails recovery
U - User disabled peak ID: either peak quantitates below reporting limit or peak identification not confirmed on second column

## Target Compounds

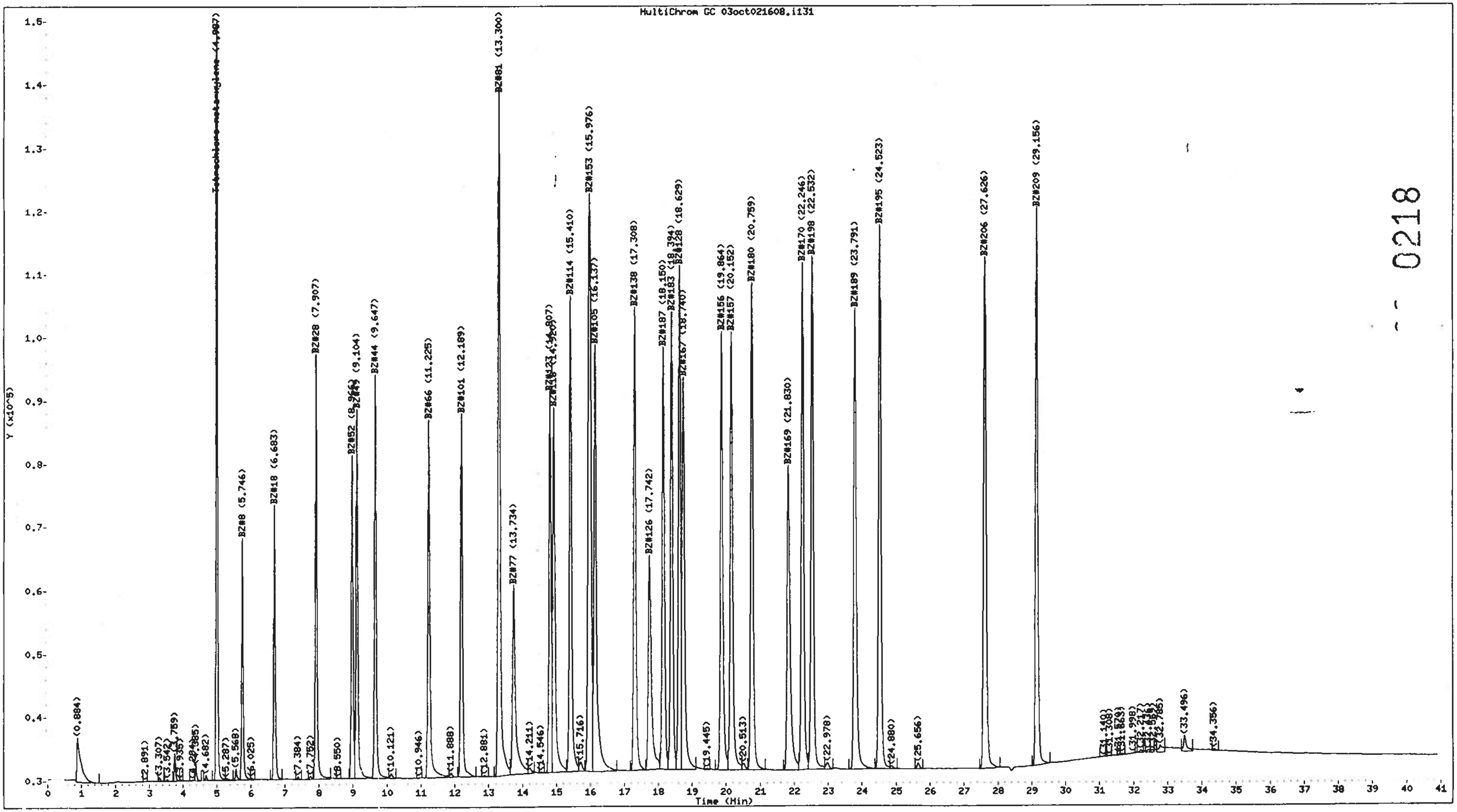
| Peak RT | Expected RT | Target Compound |
|---|---|---|
| 4.992 | 5.001 | Tetrachloro-meta-xylene |
| 5.752 | 5.761 | BZ#8 |
| 6.692 | 6.701 | BZ#18 |
| 7.916 | 7.925 | BZ#28 |
| 8.975 | 8.984 | BZ#52 |
| 9.658 | 9.667 | BZ#44 |
| 11.234 | 11.243 | BZ#66 |
| 12.198 | 12.207 | BZ#101 |
| 13.748 | 13.752 | BZ#77 |
| 14.929 | 14.938 | BZ#118 |
| 16.007 | 15.993 | BZ#153 |
| 16.146 | 16.155 | BZ#105 |
| 17.319 | 17.328 | BZ#138 |
| 17.760 | 17.762 | BZ#126 |
| 18.159 | 18.170 | BZ#187 |
| 18.638 | 18.647 | BZ#128 |
| 20.772 | 20.781 | BZ#180 |
| 22.262 | 22.271 | BZ#170 |
| 22.548 | 22.559 | BZ#198 |
| 24.541 | 24.552 | BZ#195 |
| 27.644 | 27.655 | BZ#206 |
| 29.169 | 29.180 | BZ#209 |

STL Burlington - Target GC Chromatogram

Lab Sample ID: 32CONG-L3 Client Sample ID: 32CONG-L3

Matrix : WATER
Analyst :
Instrument : 3327_1.i
Column : RTX-5
Integrator : Falcon
Method : /var/chem/3327_1.i/100302_1/03OCT021608.b/32CONG_3327RTX5_RAW.m
Reported : 17-Oct-2002 09:44 rrm

Sample Type : CCALIB_3
Injection Date : 04-OCT-2002 08:55
Dilution Factor : 1.00
Data File : 03oct021608-r131.d
Compound Sublist: all



## STL Burlington - Target GC Injection Report

Lab Sample ID: 32CONG-L3 Client Sample ID: 32CONG-L3

Matrix : WATER
Analyst :
Instrument : 3327_1.i
Column : RTX-5
Integrator : Falcon
Method : /var/chem/3327_1.i/100302_1/03OCT021608.b/32CONG_3327RTX5_RAW.m
Reported : 17-Oct-2002 09:44 rrm

Sample Type : CCALIB_3
Injection Date : 04-OCT-2002 08:55
Dilution Factor : 1.00
Data File : 03oct021608-r131.d
Compound Sublist: all

### Peaks

| | Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0.884 | | | 57204 | 6938 | | | |
| | 2 | 2.891 | | | 257 | 83 | | | |
| | 3 | 3.307 | | | 2099 | 598 | | | |
| | 4 | 3.542 | | | 927 | 279 | | | |
| | 5 | 3.759 | | | 12358 | 4342 | | | |
| | 6 | 3.935 | | | 664 | 201 | | | |
| | 7 | 4.294 | | | 538 | 111 | | | |
| | 8 | 4.385 | | | 6480 | 2445 | | | |
| | 9 | 4.682 | | | 2954 | 889 | | | |
| $ | 10 | 4.987 | 5.001 | -0.014 | 420628 | 165206 | 52.3948 | R | Tetrachloro-meta-xylene |
| | 11 | 5.287 | | | 2419 | 316 | | | |
| | 12 | 5.568 | | | 6014 | 1725 | | | |
| | 13 | 5.746 | 5.761 | -0.016 | 114852 | 38147 | 53.8411 | | BZ#8 |
| | 14 | 6.025 | | | 1429 | 322 | | | |
| | 15 | 6.683 | 6.701 | -0.018 | 138770 | 43361 | 54.2998 | | BZ#18 |
| | 16 | 7.384 | | | 1321 | 447 | | | |
| | 17 | 7.752 | | | 1716 | 499 | | | |
| | 18 | 7.907 | 7.925 | -0.018 | 221723 | 67052 | 50.9708 | | BZ#28 |
| | 19 | 8.550 | | | 633 | 127 | | | |
| | 20 | 8.966 | 8.984 | -0.018 | 180721 | 51107 | 54.4218 | | BZ#52 |
| | 21 | 9.104 | 9.122 | -0.018 | 224170 | 58309 | 54.0716 | | BZ#49 |
| | 22 | 9.647 | 9.667 | -0.020 | 239445 | 63737 | 53.6655 | | BZ#44 |
| | 23 | 10.121 | | | 3817 | 776 | | | |
| | 24 | 10.946 | | | 382 | 108 | | | |
| | 25 | 11.225 | 11.243 | -0.018 | 255793 | 56544 | 50.0494 | | BZ#66 |
| | 26 | 11.888 | | | 3813 | 716 | | | |
| | 27 | 12.189 | 12.207 | -0.018 | 250369 | 57325 | 54.6743 | | BZ#101 |
| | 28 | 12.881 | | | 886 | 197 | | | |
| | 29 | 13.300 | 13.318 | -0.018 | 515513 | 108920 | 106.900 | | BZ#81 |
| | 29 | 13.300 | 13.318 | -0.018 | 515513 | 108920 | 106.900 | M | BZ#87 |
| | 30 | 13.734 | 13.752 | -0.018 | 193250 | 29834 | 50.5649 | | BZ#77 |
| | 31 | 14.211 | | | 5959 | 873 | | | |
| | 32 | 14.546 | | | 607 | 152 | | | |
| | 33 | 14.807 | 14.825 | -0.018 | 259328 | 60129 | 52.3349 | | BZ#123 |
| | 34 | 14.920 | 14.938 | -0.018 | 302390 | 57570 | 52.6026 | M | BZ#118 |
| | 35 | 15.410 | 15.428 | -0.018 | 352512 | 75121 | 49.0639 | M | BZ#114 |
| | 36 | 15.716 | | | 9100 | 1504 | | | |
| | 37 | 15.976 | 15.993 | -0.018 | 566602 | 91374 | 108.041 | M | BZ#153 |
| | 37 | 15.976 | 15.993 | -0.018 | 566602 | 91374 | 108.041 | M | BZ#184 |
| | 38 | 16.137 | 16.155 | -0.018 | 371297 | 67323 | 50.3214 | M | BZ#105 |
| | 39 | 17.308 | 17.328 | -0.020 | 344192 | 73130 | 54.4972 | | BZ#138 |
| | 40 | 17.742 | 17.762 | -0.020 | 217263 | 33798 | 50.9270 | M | BZ#126 |
| | 41 | 18.150 | 18.170 | -0.020 | 325630 | 66606 | 55.2200 | M | BZ#187 |
| | 42 | 18.394 | 18.416 | -0.022 | 344467 | 72173 | 54.5820 | M | BZ#183 |
| | 43 | 18.629 | 18.647 | -0.018 | 364640 | 79548 | 53.6000 | M | BZ#128 |
| | 44 | 18.740 | 18.760 | -0.020 | 342583 | 61926 | 53.9829 | M | BZ#167 |
| | 45 | 19.445 | | | 1450 | 186 | | | |
| | 46 | 19.864 | 19.886 | -0.022 | 351458 | 69214 | 51.0830 | | BZ#156 |
| | 47 | 20.152 | 20.174 | -0.022 | 370342 | 69136 | 51.4345 | | BZ#157 |
| | 48 | 20.513 | | | 6025 | 990 | | | |
| | 49 | 20.759 | 20.781 | -0.022 | 381929 | 76886 | 54.4883 | | BZ#180 |
| | 50 | 21.830 | 21.854 | -0.024 | 306389 | 48183 | 52.9658 | | BZ#169 |
| | 51 | 22.246 | 22.271 | -0.024 | 405816 | 80165 | 54.1318 | | BZ#170 |
| $ | 52 | 22.532 | 22.559 | -0.027 | 418592 | 81084 | 54.7574 | R | BZ#198 |
| | 53 | 22.978 | | | 6915 | 1044 | | | |

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| 54 | 23.791 | 23.820 | -0.029 | 399197 | 72777 | 53.0131 | | BZ#189 |
| 55 | 24.523 | 24.552 | -0.029 | 440231 | 86019 | 55.1627 | | BZ#195 |
| 56 | 24.880 | | | 2974 | 448 | | | |
| 57 | 25.656 | | | 4525 | 877 | | | |
| 58 | 27.626 | 27.655 | -0.029 | 451590 | 80774 | 56.3495 | | BZ#206 |
| 59 | 29.156 | 29.180 | -0.024 | 413244 | 88356 | 57.6624 | M | BZ#209 |
| 60 | 31.140 | | | 268 | 50 | | | |
| 61 | 31.308 | | | 231 | 67 | | | |
| 62 | 31.570 | | | 866 | 247 | | | |
| 63 | 31.663 | | | 1234 | 271 | | | |
| 64 | 31.998 | | | 1134 | 134 | | | |
| 65 | 32.217 | | | 2336 | 485 | | | |
| 66 | 32.436 | | | 2511 | 398 | | | |
| 67 | 32.569 | | | 2589 | 422 | | | |
| 68 | 32.785 | | | 10258 | 1132 | | | |
| 69 | 33.496 | | | 16599 | 2506 | | | |
| 70 | 34.356 | | | 2062 | 366 | | | |

Flags: A - Peak quantitates above calibration range
a - Peak quantitates below reporting limit
H - User selected alternate compound hit
M - Peak manually integrated or manually identified
R - Peak fails recovery
U - User disabled peak ID: either peak quantitates below reporting limit or peak identification not confirmed on second column

## Target Compounds

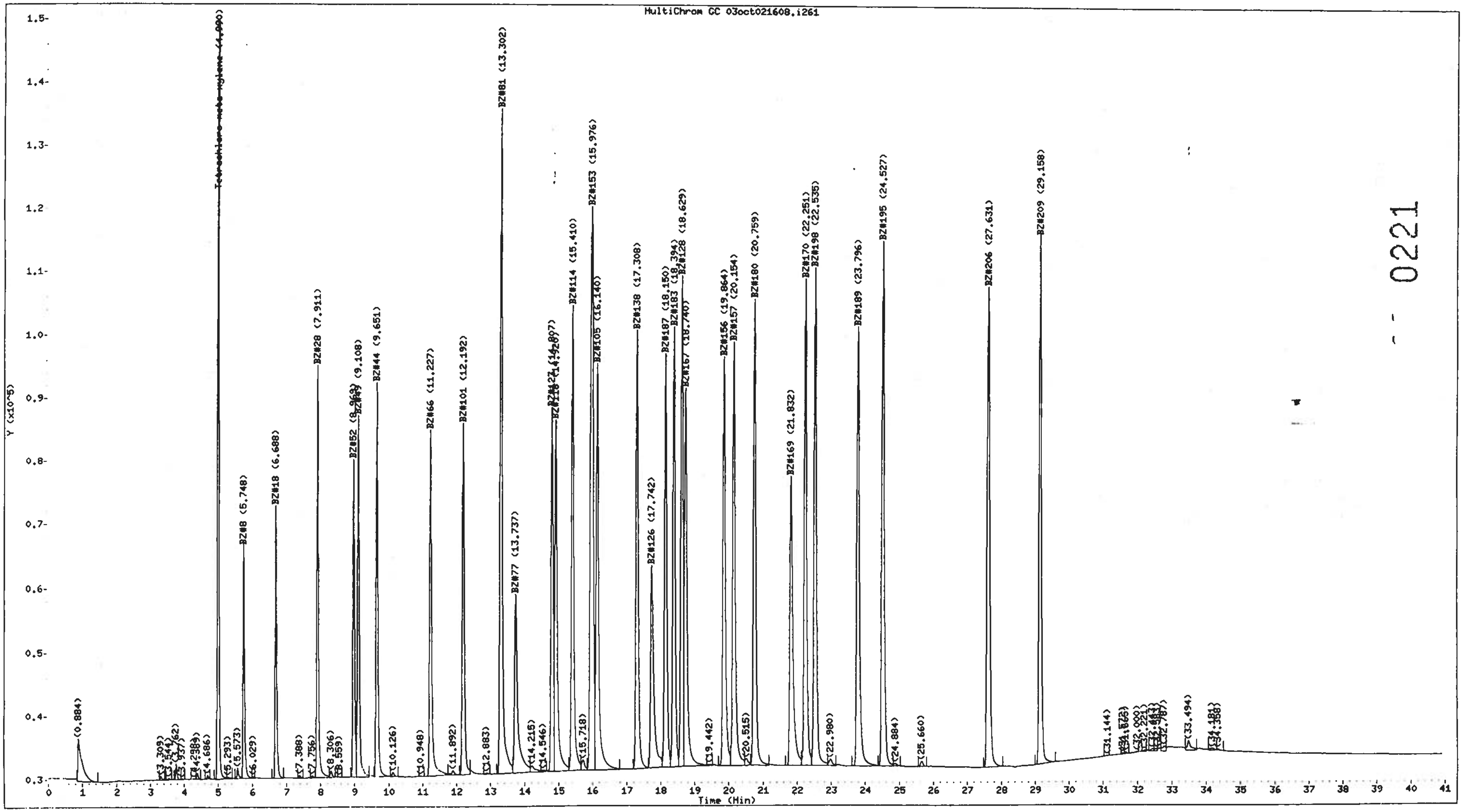
| Peak RT | Expected RT | Target Compound |
|---|---|---|
| 4.987 | 5.001 | Tetrachloro-meta-xylene |
| 5.746 | 5.761 | BZ#8 |
| 6.683 | 6.701 | BZ#18 |
| 7.907 | 7.925 | BZ#28 |
| 8.966 | 8.984 | BZ#52 |
| 9.104 | 9.122 | BZ#49 |
| 9.647 | 9.667 | BZ#44 |
| 11.225 | 11.243 | BZ#66 |
| 12.189 | 12.207 | BZ#101 |
| 13.300 | 13.318 | BZ#87 |
| 13.300 | 13.318 | BZ#81 |
| 13.734 | 13.752 | BZ#77 |
| 14.807 | 14.825 | BZ#123 |
| 14.920 | 14.938 | BZ#118 |
| 15.410 | 15.428 | BZ#114 |
| 15.976 | 15.993 | BZ#153 |
| 15.976 | 15.993 | BZ#184 |
| 16.137 | 16.155 | BZ#105 |
| 17.308 | 17.328 | BZ#138 |
| 17.742 | 17.762 | BZ#126 |
| 18.150 | 18.170 | BZ#187 |
| 18.394 | 18.416 | BZ#183 |
| 18.629 | 18.647 | BZ#128 |
| 18.740 | 18.760 | BZ#167 |
| 19.864 | 19.886 | BZ#156 |
| 20.152 | 20.174 | BZ#157 |
| 20.759 | 20.781 | BZ#180 |
| 21.830 | 21.854 | BZ#169 |
| 22.246 | 22.271 | BZ#170 |
| 22.532 | 22.559 | BZ#198 |
| 23.791 | 23.820 | BZ#189 |
| 24.523 | 24.552 | BZ#195 |
| 27.626 | 27.655 | BZ#206 |
| 29.156 | 29.180 | BZ#209 |

# STL Burlington - Target GC Chromatogram

| Lab Sample ID: 32CONG-L3 | Client Sample ID: 32CONG-L3 |
|---|---|

Matrix : WATER
Analyst :
Instrument : 3327_1.i
Column : RTX-5
Integrator : Falcon
Method : /var/chem/3327_1.i/100302_1/03OCT021608.b/32CONG_3327RTX5_RAW.m
Reported : 17-Oct-2002 09:46 rrm

Sample Type : CCALIB_3
Injection Date : 04-OCT-2002 18:41
Dilution Factor : 1.00
Data File : 03oct021608-r261.d
Compound Sublist: all



# STL Burlington - Target GC Injection Report

Lab Sample ID: 32CONG-L3 Client Sample ID: 32CONG-L3

Matrix : WATER
Analyst :
Instrument : 3327_1.i
Column : RTX-5
Integrator : Falcon
Method : /var/chem/3327_1.i/100302_1/03OCT021608.b/32CONG_3327RTX5_RAW.m
Reported : 17-Oct-2002 09:46 rrm

Sample Type : CCALIB_3
Injection Date : 04-OCT-2002 18:41
Dilution Factor : 1.00
Data File : 03oct021608-r261.d
Compound Sublist: all

## Peaks

| | Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0.884 | | | 55222 | 6687 | | | |
| | 2 | 3.309 | | | 1969 | 594 | | | |
| | 3 | 3.544 | | | 837 | 272 | | | |
| | 4 | 3.762 | | | 7250 | 2495 | | | |
| | 5 | 3.937 | | | 429 | 137 | | | |
| | 6 | 4.298 | | | 456 | 94 | | | |
| | 7 | 4.389 | | | 2652 | 1011 | | | |
| | 8 | 4.686 | | | 1736 | 631 | | | |
| $ | 9 | 4.990 | 5.001 | -0.011 | 410053 | 161760 | 51.3042 | R | Tetrachloro-meta-xylene |
| | 10 | 5.293 | | | 1666 | 264 | | | |
| | 11 | 5.573 | | | 5684 | 1670 | | | |
| | 12 | 5.748 | 5.761 | -0.013 | 111187 | 37181 | 52.4259 | M | BZ#8 |
| | 13 | 6.029 | | | 1045 | 291 | | M | |
| | 14 | 6.688 | 6.701 | -0.013 | 135282 | 42734 | 53.4678 | | BZ#18 |
| | 15 | 7.388 | | | 1273 | 428 | | | |
| | 16 | 7.756 | | | 1297 | 376 | | | |
| | 17 | 7.911 | 7.925 | -0.013 | 213544 | 64979 | 49.3991 | | BZ#28 |
| | 18 | 8.306 | | | 4230 | 993 | | | |
| | 19 | 8.559 | | | 388 | 86 | | | |
| | 20 | 8.969 | 8.984 | -0.016 | 175351 | 50007 | 53.1874 | | BZ#52 |
| | 21 | 9.108 | 9.122 | -0.013 | 213799 | 56939 | 52.7429 | | BZ#49 |
| | 22 | 9.651 | 9.667 | -0.016 | 229774 | 62059 | 52.2021 | | BZ#44 |
| | 23 | 10.126 | | | 3080 | 678 | | | |
| | 24 | 10.948 | | | 475 | 119 | | | |
| | 25 | 11.227 | 11.243 | -0.016 | 242929 | 54571 | 48.3334 | | BZ#66 |
| | 26 | 11.892 | | | 4929 | 684 | | | |
| | 27 | 12.192 | 12.207 | -0.016 | 237472 | 55424 | 52.7903 | | BZ#101 |
| | 28 | 12.883 | | | 913 | 188 | | | |
| | 29 | 13.302 | 13.318 | -0.016 | 497943 | 105012 | 103.056 | | BZ#81 |
| | 29 | 13.302 | 13.318 | -0.016 | 497943 | 105012 | 103.056 | M | BZ#87 |
| | 30 | 13.737 | 13.752 | -0.016 | 189899 | 28307 | 48.0891 | | BZ#77 |
| | 31 | 14.215 | | | 9813 | 1006 | | | |
| | 32 | 14.546 | | | 1922 | 281 | | | |
| | 33 | 14.807 | 14.825 | -0.018 | 252260 | 57504 | 50.0638 | | BZ#123 |
| | 34 | 14.920 | 14.938 | -0.018 | 293881 | 55490 | 50.7011 | | BZ#118 |
| | 35 | 15.410 | 15.428 | -0.018 | 341524 | 73463 | 48.0180 | | BZ#114 |
| | 36 | 15.718 | | | 10255 | 1600 | | | |
| | 37 | 15.976 | 15.993 | -0.018 | 548726 | 89125 | 105.289 | | BZ#153 |
| | 37 | 15.976 | 15.993 | -0.018 | 548726 | 89125 | 105.289 | M | BZ#184 |
| | 38 | 16.140 | 16.155 | -0.016 | 338894 | 64247 | 48.1038 | | BZ#105 |
| | 39 | 17.308 | 17.328 | -0.020 | 333735 | 69380 | 51.6640 | | BZ#138 |
| | 40 | 17.742 | 17.762 | -0.020 | 209606 | 32040 | 48.3645 | | BZ#126 |
| | 41 | 18.150 | 18.170 | -0.020 | 316229 | 65457 | 54.2290 | | BZ#187 |
| | 42 | 18.394 | 18.416 | -0.022 | 333013 | 69583 | 52.5721 | | BZ#183 |
| | 43 | 18.629 | 18.647 | -0.018 | 350446 | 77599 | 52.2843 | | BZ#128 |
| | 44 | 18.740 | 18.760 | -0.020 | 332742 | 59844 | 52.1503 | | BZ#167 |
| | 45 | 19.442 | | | 1689 | 208 | | | |
| | 46 | 19.864 | 19.886 | -0.022 | 336521 | 64743 | 47.8735 | | BZ#156 |
| | 47 | 20.154 | 20.174 | -0.020 | 356521 | 67140 | 49.9768 | | BZ#157 |
| | 48 | 20.515 | | | 7103 | 1079 | | | |
| | 49 | 20.759 | 20.781 | -0.022 | 369861 | 73863 | 52.3104 | | BZ#180 |
| | 50 | 21.832 | 21.854 | -0.022 | 291272 | 45736 | 50.2786 | | BZ#169 |
| | 51 | 22.251 | 22.271 | -0.020 | 387818 | 77128 | 52.0585 | | BZ#170 |
| $ | 52 | 22.535 | 22.559 | -0.024 | 402202 | 78875 | 53.2206 | R | BZ#198 |
| | 53 | 22.980 | | | 7105 | 1035 | | | |

# STL Burlington - Target GC Injection Report

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| 54 | 23.796 | 23.820 | -0.024 | 380589 | 69640 | 50.7199 | | BZ#189 |
| 55 | 24.527 | 24.552 | -0.024 | 420226 | 83254 | 53.3478 | | BZ#195 |
| 56 | 24.884 | | | 2661 | 418 | | | |
| 57 | 25.660 | | | 4108 | 818 | | | |
| 58 | 27.631 | 27.655 | -0.024 | 429476 | 76281 | 53.0910 | | BZ#206 |
| 59 | 29.158 | 29.180 | -0.022 | 393431 | 84352 | 54.8937 | M | BZ#209 |
| 60 | 31.144 | | | 243 | 46 | | | |
| 61 | 31.572 | | | 902 | 250 | | | |
| 62 | 31.665 | | | 1242 | 280 | | | |
| 63 | 32.000 | | | 856 | 120 | | | |
| 64 | 32.221 | | | 1231 | 237 | | | |
| 65 | 32.443 | | | 2394 | 384 | | | |
| 66 | 32.583 | | | 2436 | 413 | | | |
| 67 | 32.787 | | | 6018 | 807 | | | |
| 68 | 33.494 | | | 12142 | 1591 | | | |
| 69 | 34.181 | | | 3251 | 331 | | | |
| 70 | 34.358 | | | 1188 | 281 | | | |

Flags:
A - Peak quantitates above calibration range
a - Peak quantitates below reporting limit
H - User selected alternate compound hit
M - Peak manually integrated or manually identified
R - Peak fails recovery
U - User disabled peak ID: either peak quantitates below reporting limit or peak identification not confirmed on second column

## Target Compounds

| Peak RT | Expected RT | Target Compound |
|---|---|---|
| 4.990 | 5.001 | Tetrachloro-meta-xylene |
| 5.748 | 5.761 | BZ#8 |
| 6.688 | 6.701 | BZ#18 |
| 7.911 | 7.925 | BZ#28 |
| 8.969 | 8.984 | BZ#52 |
| 9.108 | 9.122 | BZ#49 |
| 9.651 | 9.667 | BZ#44 |
| 11.227 | 11.243 | BZ#66 |
| 12.192 | 12.207 | BZ#101 |
| 13.302 | 13.318 | BZ#87 |
| 13.302 | 13.318 | BZ#81 |
| 13.737 | 13.752 | BZ#77 |
| 14.807 | 14.825 | BZ#123 |
| 14.920 | 14.938 | BZ#118 |
| 15.410 | 15.428 | BZ#114 |
| 15.976 | 15.993 | BZ#153 |
| 15.976 | 15.993 | BZ#184 |
| 16.140 | 16.155 | BZ#105 |
| 17.308 | 17.328 | BZ#138 |
| 17.742 | 17.762 | BZ#126 |
| 18.150 | 18.170 | BZ#187 |
| 18.394 | 18.416 | BZ#183 |
| 18.629 | 18.647 | BZ#128 |
| 18.740 | 18.760 | BZ#167 |
| 19.864 | 19.886 | BZ#156 |
| 20.154 | 20.174 | BZ#157 |
| 20.759 | 20.781 | BZ#180 |
| 21.832 | 21.854 | BZ#169 |
| 22.251 | 22.271 | BZ#170 |
| 22.535 | 22.559 | BZ#198 |
| 23.796 | 23.820 | BZ#189 |
| 24.527 | 24.552 | BZ#195 |
| 27.631 | 27.655 | BZ#206 |
| 29.158 | 29.180 | BZ#209 |

## STL Burlington

## INITIAL CALIBRATION DATA

Start Cal Date : 03-OCT-2002 18:40
End Cal Date : 03-OCT-2002 21:40
Quant Method : ESTD
Target Version : 3.50
Integrator : Falcon
Method file : /var/chem/3327_2.i/100302_1/03OCT021607.b/32CONG_3327RTXCLPII_RAW.m
Cal Date : 04-Oct-2002 12:18 rrm

Calibration File Names:
Level 1: /var/chem/3327_2.i/100302_1/03OCT021607.b/03oct021607-r041.d
Level 2: /var/chem/3327_2.i/100302_1/03OCT021607.b/03oct021607-r051.d
Level 3: /var/chem/3327_2.i/100302_1/03OCT021607.b/03oct021607-r061.d
Level 4: /var/chem/3327_2.i/100302_1/03OCT021607.b/03oct021607-r071.d
Level 5: /var/chem/3327_2.i/100302_1/03OCT021607.b/03oct021607-r081.d

| Compound | 5<br>Level 1 | 25<br>Level 2 | 50<br>Level 3 | 100<br>Level 4 | 200<br>Level 5 | Curve | Coefficients<br>b | <br>m1 | <br>m2 | %RSD<br>or R^2 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 BZ#8 | 4944 | 23838 | 46481 | 87494 | 165840 | WLINR | -1.42146 | 0.00118 | | 0.99788 |
| 2 BZ#18 | 6495 | 29235 | 55172 | 100369 | 186298 | WLINR | -2.68457 | 0.00104 | | 0.99538 |
| 3 BZ#28 | 7012 | 39745 | 85333 | 173210 | 343465 | WLINR | 1.07124 | 0.00058 | | 0.99980 |
| 6 BZ#52 | 7604 | 35213 | 67668 | 124213 | 230838 | WLINR | -2.22282 | 0.00084 | | 0.99594 |
| 5 BZ#49 | 8227 | 39204 | 76215 | 141280 | 267450 | WLINR | -1.68428 | 0.00073 | | 0.99730 |
| 4 BZ#44 | 8320 | 41791 | 83572 | 158622 | 301387 | WLINR | -0.89301 | 0.00065 | | 0.99824 |
| 7 BZ#66 | 6006 | 36028 | 78980 | 162454 | 330616 | WLINR | 1.67912 | 0.00061 | | 0.99954 |
| 11 BZ#101 | 8231 | 40794 | 80265 | 150679 | 284650 | WLINR | -1.25606 | 0.00068 | | 0.99758 |
| 9 BZ#81 | 10022 | 59978 | 130413 | 263128 | 521982 | WLINR | 2.58862 | 0.00076 | | 0.99978 |
| 10 BZ#87 | 10022 | 59978 | 130413 | 263128 | 521982 | WLINR | 2.58862 | 0.00076 | | 0.99978 |
| 8 BZ#77 | 2700 | 19896 | 44585 | 91982 | 190275 | WLINR | 2.50881 | 0.00105 | | 0.99941 |
| 15 BZ#123 | 6627 | 40501 | 86587 | 174308 | 345413 | WLINR | 1.23200 | 0.00057 | | 0.99985 |
| 14 BZ#118 | 6784 | 39268 | 83739 | 167479 | 333214 | WLINR | 1.00263 | 0.00059 | | 0.99987 |
| 13 BZ#114 | 7270 | 47772 | 109103 | 234109 | 482348 | WLINR | 2.56520 | 0.00042 | | 0.99838 |
| 19 BZ#153 | 8902 | 45139 | 89534 | 170112 | 321342 | WLINR | -0.95231 | 0.00061 | | 0.99794 |

STL Burlington

INITIAL CALIBRATION DATA

Start Cal Date : 03-OCT-2002 18:40
End Cal Date : 03-OCT-2002 21:40
Quant Method : ESTD
Target Version : 3.50
Integrator : Falcon
Method file : /var/chem/3327_2.i/100302_1/03OCT021607.b/32CONG_3327RTXCLPII_RAW.m
Cal Date : 04-Oct-2002 12:18 rrm

| Compound | 5<br>Level 1 | 25<br>Level 2 | 50<br>Level 3 | 100<br>Level 4 | 200<br>Level 5 | Curve | Coefficients<br>b | m1 | m2 | %RSD<br>or R^2 |
|---|---|---|---|---|---|---|---|---|---|---|
| 27 BZ#184 | 10485 | 50157 | 98719 | 186931 | 352924 | WLINR | -1.35204 | 0.00055 | | 0.99800 |
| 12 BZ#105 | 6174 | 40415 | 94992 | 204453 | 424839 | WLINR | 2.77662 | 0.00047 | | 0.99772 |
| 18 BZ#138 | 9165 | 50057 | 104398 | 205712 | 394979 | WLINR | 0.24037 | 0.00050 | | 0.99925 |
| 16 BZ#126 | 10187 | 50351 | 100576 | 189311 | 361934 | WLINR | -2.02878 | 0.00108 | | 0.99829 |
| 28 BZ#187 | 10187 | 50351 | 100576 | 189311 | 361934 | WLINR | -2.02878 | 0.00108 | | 0.99829 |
| 26 BZ#183 | 10465 | 53003 | 106856 | 205341 | 396614 | WLINR | -0.53326 | 0.00050 | | 0.99911 |
| 17 BZ#128 | 9081 | 53427 | 113838 | 230090 | 447305 | WLINR | 0.97859 | 0.00044 | | 0.99963 |
| 22 BZ#167 | 7466 | 43165 | 91112 | 178798 | 352446 | WLINR | 0.70283 | 0.00056 | | 0.99970 |
| 20 BZ#156 | 7360 | 45457 | 102613 | 218167 | 456967 | WLINR | 2.37167 | 0.00044 | | 0.99811 |
| 21 BZ#157 | 7779 | 46641 | 103494 | 214633 | 442528 | WLINR | 1.89980 | 0.00045 | | 0.99912 |
| 25 BZ#180 | 10251 | 55007 | 114928 | 228735 | 449485 | WLINR | 0.44386 | 0.00044 | | 0.99981 |
| 23 BZ#169 | 6247 | 35861 | 75279 | 151041 | 308920 | WLINR | 1.09227 | 0.00065 | | 0.99986 |
| 24 BZ#170 | 9879 | 56258 | 119740 | 236160 | 466793 | WLINR | 0.76598 | 0.00042 | | 0.99976 |
| 29 BZ#189 | 9204 | 52430 | 113321 | 229338 | 467690 | WLINR | 1.30453 | 0.00043 | | 0.99969 |
| 30 BZ#195 | 11148 | 59628 | 126710 | 248523 | 486905 | WLINR | 0.39995 | 0.00041 | | 0.99962 |
| 31 BZ#206 | 15282 | 75265 | 151655 | 286941 | 552215 | WLINR | -0.85299 | 0.00036 | | 0.99872 |
| 32 BZ#209 | 17056 | 75639 | 146594 | 273462 | 507641 | WLINR | -2.22659 | 0.00038 | | 0.99692 |
| $ 33 Tetrachloro-meta-xylene | 15468 | 94788 | 198952 | 387043 | 745379 | WLINR | 0.63387 | 0.00026 | | 0.99896 |
| $ 34 BZ#198 | 11598 | 60886 | 123303 | 241368 | 466213 | WLINR | -0.16003 | 0.00042 | | 0.99937 |

```
                              STL Burlington

                          INITIAL CALIBRATION DATA

Start Cal Date    : 03-OCT-2002 18:40
End Cal Date      : 03-OCT-2002 21:40
Quant Method      : ESTD
Target Version    : 3.50
Integrator        : Falcon
Method file       : /var/chem/3327_2.i/100302_1/03OCT021607.b/32CONG_3327RTXCLPII_RAW.m
Cal Date          : 04-Oct-2002 12:18 rrm


 ____________________________________________________________________
| Curve     | Formula                                 | Units        |
|==========|=========================================|==============|
| Wt Linear| Amt = b + m1*Rsp                        |  Amount      |
|__________|_________________________________________|______________|
```

```
                           STL Burlington

                          COMPOUND LISTING

Method file     : /var/chem/3327_2.i/100302_1/03OCT021607.b/32CONG_3327RTXCL
Quant Method    : ESTD                          Target Version   : 3.50
Last Update     : 04-Oct-2002 12:18             Number of Cpnds : 34
Data Type       : GC DATA

Global Integrator : Falcon
Chromat Events              Values
--------------              ------
Initial:Start Threshold     19.000000
Initial:End Threshold       9.500000
Initial:Area Threshold      190.000000
Initial:P-P Resolution      1.000000
Initial:Bunch Factor        5.000000
Initial:Negative Peaks      OFF
Initial:Tension             2.000000
```

| Compound | RT | RT Window | RF |
|---|---|---|---|
| $ 33 Tetrachloro-meta-xylene | 5.391 | 5.341-5.441 | 2.614e-04 |
| 1 BZ#8 | 6.592 | 6.542-6.642 | 1.178e-03 |
| 2 BZ#18 | 7.698 | 7.648-7.748 | 1.042e-03 |
| 3 BZ#28 | 9.137 | 9.087-9.187 | 5.775e-04 |
| 6 BZ#52 | 10.341 | 10.291-10.391 | 8.401e-04 |
| 5 BZ#49 | 10.480 | 10.430-10.530 | 7.296e-04 |
| 4 BZ#44 | 11.312 | 11.262-11.362 | 6.476e-04 |
| 7 BZ#66 | 13.056 | 13.006-13.106 | 6.051e-04 |
| 11 BZ#101 | 13.914 | 13.864-13.964 | 6.841e-04 |
| 9 BZ#81 | 15.421 | 15.371-15.471 | 7.580e-04 |
| 10 BZ#87 | 15.421 | 15.371-15.471 | 7.580e-04 |
| 8 BZ#77 | 16.080 | 16.030-16.130 | 1.052e-03 |
| 15 BZ#123 | 16.946 | 16.896-16.996 | 5.721e-04 |
| 14 BZ#118 | 17.075 | 17.025-17.125 | 5.948e-04 |
| 13 BZ#114 | 17.656 | 17.606-17.706 | 4.170e-04 |
| 19 BZ#153 | 17.995 | 17.945-18.045 | 6.059e-04 |
| 27 BZ#184 | 17.802 | 17.752-17.852 | 5.531e-04 |
| 12 BZ#105 | 18.720 | 18.670-18.770 | 4.749e-04 |
| 18 BZ#138 | 19.713 | 19.663-19.763 | 4.956e-04 |
| 16 BZ#126 | 20.225 | 20.175-20.275 | 1.081e-03 |
| 28 BZ#187 | 20.225 | 20.175-20.275 | 1.081e-03 |
| 26 BZ#183 | 20.489 | 20.439-20.539 | 4.955e-04 |
| 17 BZ#128 | 21.462 | 21.412-21.512 | 4.394e-04 |
| 22 BZ#167 | 21.061 | 21.011-21.111 | 5.594e-04 |

## STL Burlington

## COMPOUND LISTING

Method file : /var/chem/3327_2.i/100302_1/03OCT021607.b/32CONG_3327RTXCL

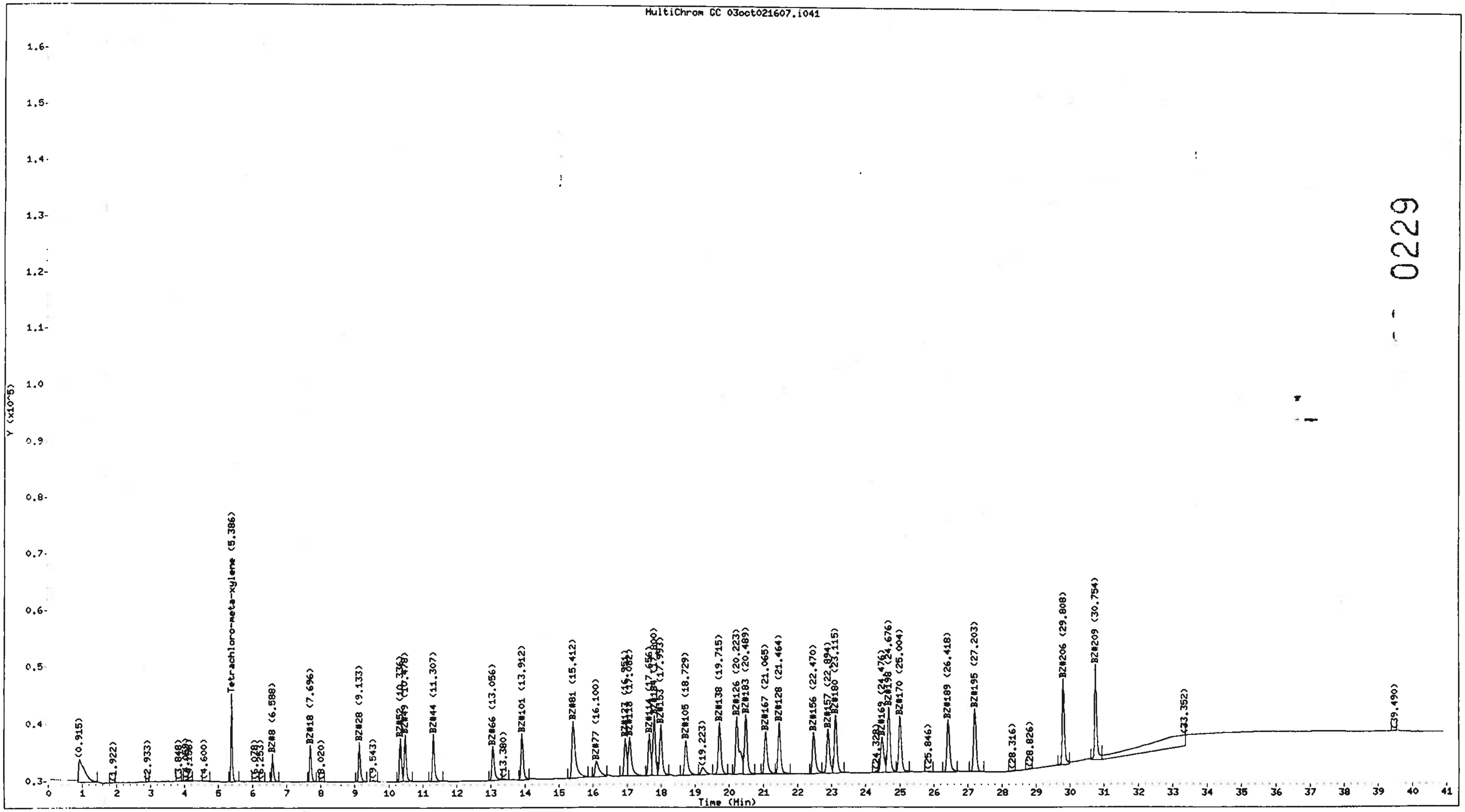
| | Compound | RT | RT Window | RF |
|---|---|---|---|---|
| | 20 BZ#156 | 22.464 | 22.414-22.514 | 4.432e-04 |
| | 21 BZ#157 | 22.885 | 22.835-22.935 | 4.546e-04 |
| | 25 BZ#180 | 23.115 | 23.065-23.165 | 4.401e-04 |
| | 23 BZ#169 | 24.461 | 24.411-24.511 | 6.487e-04 |
| | 24 BZ#170 | 25.004 | 24.954-25.054 | 4.232e-04 |
| $ | 34 BZ#198 | 24.678 | 24.628-24.728 | 4.215e-04 |
| | 29 BZ#189 | 26.412 | 26.362-26.462 | 4.283e-04 |
| | 30 BZ#195 | 27.203 | 27.153-27.253 | 4.052e-04 |
| | 31 BZ#206 | 29.805 | 29.755-29.855 | 3.554e-04 |
| | 32 BZ#209 | 30.754 | 30.704-30.804 | 3.833e-04 |

# STL Burlington - Target GC Chromatogram

| | |
|---|---|
| Lab Sample ID: 32CONG-L1 | Client Sample ID: 32CONG-L1 |

| | | | |
|---|---|---|---|
| Matrix | : WATER | Sample Type | : CALIB_1 |
| Analyst | : | Injection Date | : 03-OCT-2002 18:40 |
| Instrument | : 3327_2.i | Dilution Factor | : 1.00 |
| Column | : RTX-CLPII | Data File | : 03oct021607-r041.d |
| Integrator | : Falcon | Compound Sublist | : all |

Method : /var/chem/3327_2.i/100302_1/03OCT021607.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 14:57 rrm



0229

# STL Burlington - Target GC Injection Report

Lab Sample ID: 32CONG-L1    Client Sample ID: 32CONG-L1

Matrix : WATER
Analyst :
Instrument : 3327_2.i
Column : RTX-CLPII
Integrator : Falcon
Method : /var/chem/3327_2.i/100302_1/03OCT021607.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 09:12 rrm

Sample Type : CALIB_1
Injection Date : 03-OCT-2002 18:40
Dilution Factor : 1.00
Data File : 03oct021607-r041.d
Compound Sublist: all

## Peaks

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.915 | | | 46788 | 3999 | | | |
| 2 | 1.922 | | | 247 | 27 | | | |
| 3 | 2.933 | | | 217 | 50 | | | |
| 4 | 3.848 | | | 421 | 89 | | | |
| 5 | 4.059 | | | 1318 | 378 | | | |
| 6 | 4.156 | | | 1247 | 198 | | | |
| 7 | 4.600 | | | 1540 | 232 | | | |
| $ 8 | 5.386 | 5.391 | -0.004 | 42733 | 15468 | 4.67708 | R | Tetrachloro-meta-xylene |
| 9 | 6.078 | | | 753 | 184 | | | |
| 10 | 6.253 | | | 449 | 158 | | | |
| 11 | 6.588 | 6.592 | -0.004 | 16990 | 4944 | 4.40287 | | BZ#8 |
| 12 | 7.696 | 7.698 | -0.002 | 23495 | 6495 | 4.08315 | | BZ#18 |
| 13 | 8.020 | | | 539 | 131 | | | |
| 14 | 9.133 | 9.137 | -0.004 | 26694 | 7012 | 5.12048 | | BZ#28 |
| 15 | 9.543 | | | 1285 | 268 | | | |
| 16 | 10.336 | 10.341 | -0.004 | 29835 | 7604 | 4.16558 | | BZ#52 |
| 17 | 10.478 | 10.480 | -0.002 | 34485 | 8227 | 4.31814 | | BZ#49 |
| 18 | 11.307 | 11.312 | -0.004 | 36620 | 8320 | 4.49488 | | BZ#44 |
| 19 | 13.056 | 13.056 | 0.000 | 31580 | 6006 | 5.31356 | | BZ#66 |
| 20 | 13.380 | | | 1766 | 238 | | | |
| 21 | 13.912 | 13.914 | -0.002 | 39453 | 8231 | 4.37512 | | BZ#101 |
| 22 | 15.412 | 15.421 | -0.009 | 72993 | 10022 | 10.1856 | | BZ#81 |
| 22 | 15.412 | 15.421 | -0.009 | 72993 | 10022 | 10.1856 | M | BZ#87 |
| 23 | 16.100 | 16.080 | 0.020 | 23366 | 2700 | 5.34803 | | BZ#77 |
| 24 | 16.951 | 16.946 | 0.004 | 32720 | 6627 | 5.02340 | | BZ#123 |
| 25 | 17.082 | 17.075 | 0.007 | 44070 | 6784 | 5.03749 | | BZ#118 |
| 26 | 17.656 | 17.656 | 0.000 | 35790 | 7270 | 5.59648 | | BZ#114 |
| 27 | 17.800 | 17.802 | -0.002 | 53541 | 10485 | 4.44757 | | BZ#184 |
| 28 | 17.993 | 17.995 | -0.002 | 47653 | 8902 | 4.44137 | | BZ#153 |
| 29 | 18.729 | 18.720 | 0.009 | 38805 | 6174 | 5.70888 | | BZ#105 |
| 30 | 19.223 | | | 11496 | 1262 | | | |
| 31 | 19.715 | 19.713 | 0.002 | 50481 | 9165 | 4.78261 | | BZ#138 |
| 32 | 20.223 | 20.225 | -0.002 | 74501 | 10187 | 8.98457 | M | BZ#126 |
| 32 | 20.223 | 20.225 | -0.002 | 74501 | 10187 | 8.98457 | M | BZ#187 |
| 33 | 20.489 | 20.489 | 0.000 | 58664 | 10465 | 4.65217 | | BZ#183 |
| 34 | 21.065 | 21.061 | 0.004 | 45495 | 7466 | 4.87950 | | BZ#167 |
| 35 | 21.464 | 21.462 | 0.002 | 49331 | 9081 | 4.96850 | | BZ#128 |
| 36 | 22.470 | 22.464 | 0.007 | 44616 | 7360 | 5.63394 | | BZ#156 |
| 37 | 22.894 | 22.885 | 0.009 | 45901 | 7779 | 5.43583 | | BZ#157 |
| 38 | 23.115 | 23.115 | 0.000 | 57617 | 10251 | 4.95528 | | BZ#180 |
| 39 | 24.328 | | | 1654 | 316 | | | |
| 40 | 24.476 | 24.461 | 0.016 | 39708 | 6247 | 5.14484 | | BZ#169 |
| $ 41 | 24.676 | 24.678 | -0.002 | 64634 | 11598 | 4.72892 | R | BZ#198 |
| 42 | 25.004 | 25.004 | 0.000 | 55326 | 9879 | 4.94696 | | BZ#170 |
| 43 | 25.846 | | | 1129 | 162 | | | |
| 44 | 26.418 | 26.412 | 0.007 | 54078 | 9204 | 5.24668 | | BZ#189 |
| 45 | 27.203 | 27.203 | 0.000 | 60323 | 11148 | 4.91692 | | BZ#195 |
| 46 | 28.316 | | | 579 | 120 | | | |
| 47 | 28.826 | | | 517 | 91 | | | |
| 48 | 29.808 | 29.805 | 0.002 | 67680 | 15282 | 4.57753 | | BZ#206 |
| 49 | 30.754 | 30.754 | 0.000 | 74546 | 17056 | 4.31125 | | BZ#209 |
| 50 | 33.352 | | | 193323 | 1868 | | | |
| 51 | 39.490 | | | 527 | 89 | | | |

0230

# STL Burlington - Target GC Injection Report

Flags:
- A - Peak quantitates above calibration range
- a - Peak quantitates below reporting limit
- H - User selected alternate compound hit
- M - Peak manually integrated or manually identified
- R - Peak fails recovery
- U - User disabled peak ID: either peak quantitates below reporting limit or peak identification not confirmed on second column

## Target Compounds

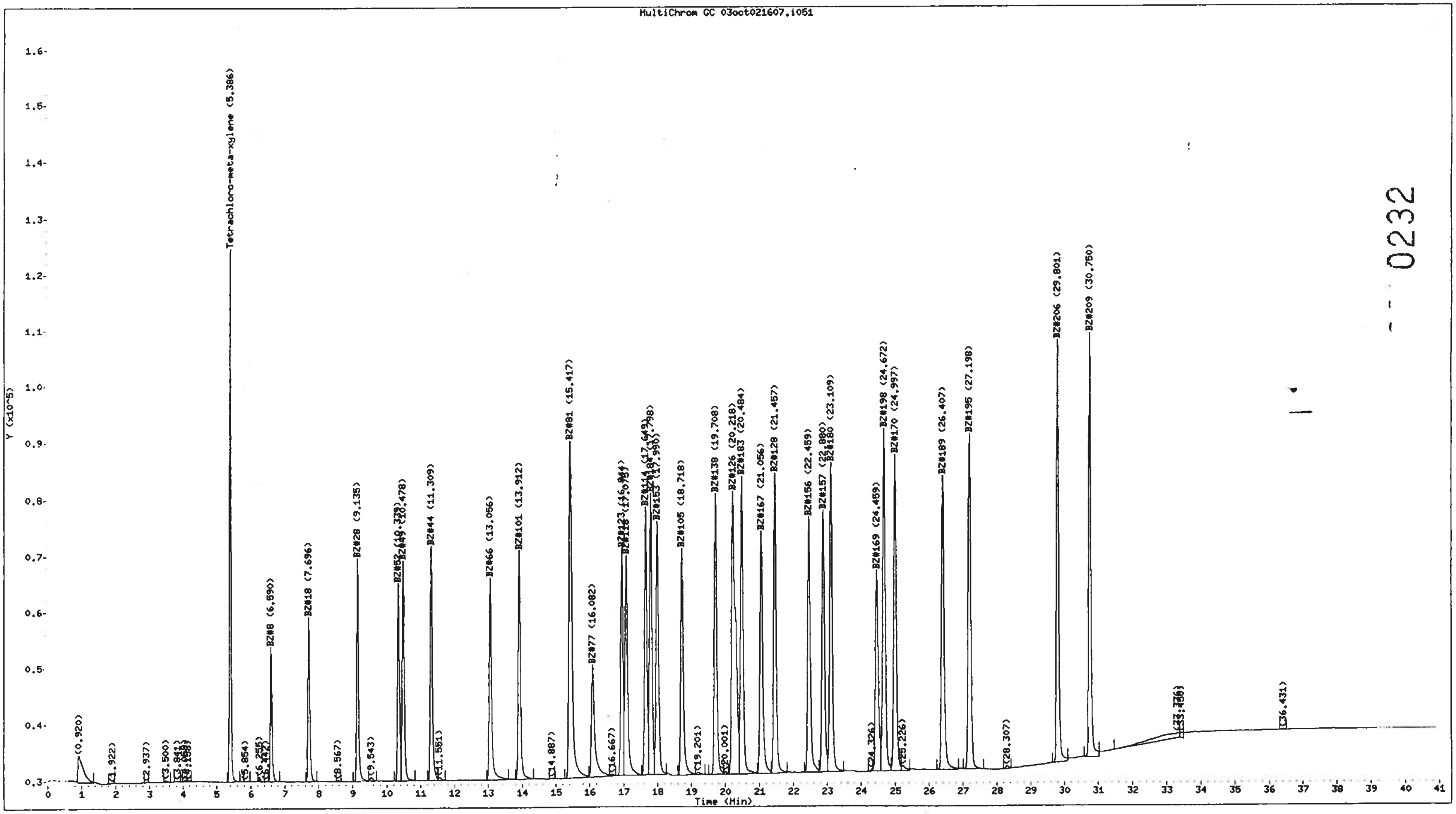
| Peak RT | Expected RT | Target Compound |
|---|---|---|
| 5.386 | 5.391 | Tetrachloro-meta-xylene |
| 6.588 | 6.592 | BZ#8 |
| 7.696 | 7.698 | BZ#18 |
| 9.133 | 9.137 | BZ#28 |
| 10.336 | 10.341 | BZ#52 |
| 10.478 | 10.480 | BZ#49 |
| 11.307 | 11.312 | BZ#44 |
| 13.056 | 13.056 | BZ#66 |
| 13.912 | 13.914 | BZ#101 |
| 15.412 | 15.421 | BZ#87 |
| 15.412 | 15.421 | BZ#81 |
| 16.100 | 16.080 | BZ#77 |
| 16.951 | 16.946 | BZ#123 |
| 17.082 | 17.075 | BZ#118 |
| 17.656 | 17.656 | BZ#114 |
| 17.800 | 17.802 | BZ#184 |
| 17.993 | 17.995 | BZ#153 |
| 18.729 | 18.720 | BZ#105 |
| 19.715 | 19.713 | BZ#138 |
| 20.223 | 20.225 | BZ#126 |
| 20.223 | 20.225 | BZ#187 |
| 20.489 | 20.489 | BZ#183 |
| 21.065 | 21.061 | BZ#167 |
| 21.464 | 21.462 | BZ#128 |
| 22.470 | 22.464 | BZ#156 |
| 22.894 | 22.885 | BZ#157 |
| 23.115 | 23.115 | BZ#180 |
| 24.476 | 24.461 | BZ#169 |
| 24.676 | 24.678 | BZ#198 |
| 25.004 | 25.004 | BZ#170 |
| 26.418 | 26.412 | BZ#189 |
| 27.203 | 27.203 | BZ#195 |
| 29.808 | 29.805 | BZ#206 |
| 30.754 | 30.754 | BZ#209 |

STL Burlington - Target GC Chromatogram

| Lab Sample ID: 32CONG-L2 | Client Sample ID: 32CONG-L2 |
|---|---|

Matrix : WATER
Analyst :
Instrument : 3327_2.i
Column : RTX-CLPII
Integrator : Falcon
Method : /var/chem/3327_2.i/100302_1/03OCT021607.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 14:58 rrm

Sample Type : CALIB_2
Injection Date : 03-OCT-2002 19:25
Dilution Factor : 1.00
Data File : 03oct021607-r051.d
Compound Sublist: all



## STL Burlington - Target GC Injection Report

**Lab Sample ID: 32CONG-L2** **Client Sample ID: 32CONG-L2**

Matrix : WATER
Analyst :
Instrument : 3327_2.i
Column : RTX-CLPII
Integrator : Falcon
Method : /var/chem/3327_2.i/100302_1/03OCT021607.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 09:12 rrm

Sample Type : CALIB_2
Injection Date : 03-OCT-2002 19:25
Dilution Factor : 1.00
Data File : 03oct021607-r051.d
Compound Sublist: all

### Peaks

| | Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0.920 | | | 51354 | 4777 | | | |
| | 2 | 1.922 | | | 251 | 29 | | | |
| | 3 | 2.937 | | | 208 | 43 | | | |
| | 4 | 3.500 | | | 1030 | 314 | | | |
| | 5 | 3.841 | | | 852 | 209 | | | |
| | 6 | 4.059 | | | 955 | 272 | | | |
| | 7 | 4.158 | | | 1208 | 187 | | | |
| $ | 8 | 5.386 | 5.391 | -0.004 | 266121 | 94788 | 25.4107 | R | Tetrachloro-meta-xylene |
| | 9 | 5.854 | | | 1021 | 116 | | | |
| | 10 | 6.255 | | | 2331 | 810 | | | |
| | 11 | 6.442 | | | 415 | 138 | | | |
| | 12 | 6.590 | 6.592 | -0.002 | 82773 | 23838 | 26.6612 | | BZ#8 |
| | 13 | 7.696 | 7.698 | -0.002 | 110378 | 29235 | 27.7780 | | BZ#18 |
| | 14 | 8.567 | | | 659 | 210 | | | |
| | 15 | 9.135 | 9.137 | -0.002 | 147393 | 39745 | 24.0229 | | BZ#28 |
| | 16 | 9.543 | | | 4035 | 694 | | | |
| | 17 | 10.339 | 10.341 | -0.002 | 142864 | 35213 | 27.3609 | | BZ#52 |
| | 18 | 10.478 | 10.480 | -0.002 | 168038 | 39204 | 26.9189 | | BZ#49 |
| | 19 | 11.309 | 11.312 | -0.002 | 179718 | 41791 | 26.1701 | | BZ#44 |
| | 20 | 11.551 | | | 3474 | 572 | | | |
| | 21 | 13.056 | 13.056 | 0.000 | 177380 | 36028 | 23.4810 | | BZ#66 |
| | 22 | 13.912 | 13.914 | -0.002 | 198395 | 40794 | 26.6529 | | BZ#101 |
| | 23 | 14.887 | | | 424 | 102 | | | |
| | 24 | 15.417 | 15.421 | -0.004 | 395808 | 59978 | 48.0538 | | BZ#81 |
| | 24 | 15.417 | 15.421 | -0.004 | 395808 | 59978 | 48.0538 | M | BZ#87 |
| | 25 | 16.082 | 16.080 | 0.002 | 139047 | 19896 | 23.4307 | | BZ#77 |
| | 26 | 16.667 | | | 1982 | 296 | | | |
| | 27 | 16.944 | 16.946 | -0.002 | 190245 | 40501 | 24.4032 | | BZ#123 |
| | 28 | 17.075 | 17.075 | 0.000 | 220516 | 39268 | 24.3577 | | BZ#118 |
| | 29 | 17.649 | 17.656 | -0.007 | 219646 | 47772 | 22.4841 | | BZ#114 |
| | 30 | 17.798 | 17.802 | -0.004 | 260158 | 50157 | 26.3915 | | BZ#184 |
| | 31 | 17.990 | 17.995 | -0.004 | 236245 | 45139 | 26.3972 | | BZ#153 |
| | 32 | 18.718 | 18.720 | -0.002 | 215638 | 40415 | 21.9712 | | BZ#105 |
| | 33 | 19.201 | | | 3252 | 420 | | | |
| | 34 | 19.708 | 19.713 | -0.004 | 258687 | 50057 | 25.0490 | | BZ#138 |
| | 35 | 20.001 | | | 2656 | 460 | | | |
| | 36 | 20.218 | 20.225 | -0.007 | 400618 | 50351 | 52.4066 | | BZ#126 |
| | 36 | 20.218 | 20.225 | -0.007 | 400618 | 50351 | 52.4066 | M | BZ#187 |
| | 37 | 20.484 | 20.489 | -0.004 | 291562 | 53003 | 25.7299 | | BZ#183 |
| | 38 | 21.056 | 21.061 | -0.004 | 244136 | 43165 | 24.8504 | | BZ#167 |
| | 39 | 21.457 | 21.462 | -0.004 | 273098 | 53427 | 24.4527 | | BZ#128 |
| | 40 | 22.459 | 22.464 | -0.004 | 247303 | 45457 | 22.5202 | | BZ#156 |
| | 41 | 22.880 | 22.885 | -0.004 | 249694 | 46641 | 23.1010 | | BZ#157 |
| | 42 | 23.109 | 23.115 | -0.007 | 296362 | 55007 | 24.6522 | | BZ#180 |
| | 43 | 24.326 | | | 1647 | 409 | | | |
| | 44 | 24.459 | 24.461 | -0.002 | 214007 | 35861 | 24.3561 | | BZ#169 |
| $ | 45 | 24.672 | 24.678 | -0.007 | 325876 | 60886 | 25.5055 | R | BZ#198 |
| | 46 | 24.997 | 25.004 | -0.007 | 294426 | 56258 | 24.5754 | | BZ#170 |
| | 47 | 25.226 | | | 7144 | 862 | | | |
| | 48 | 26.407 | 26.412 | -0.004 | 290862 | 52430 | 23.7607 | | BZ#189 |
| | 49 | 27.198 | 27.203 | -0.004 | 327736 | 59628 | 24.5602 | | BZ#195 |
| | 50 | 28.307 | | | 2768 | 534 | | | |
| | 51 | 29.801 | 29.805 | -0.004 | 340941 | 75265 | 25.8927 | | BZ#206 |
| | 52 | 30.750 | 30.754 | -0.004 | 333445 | 75639 | 26.7671 | | BZ#209 |
| | 53 | 33.336 | | | 55286 | 899 | | | |

```
                                                       Extract
Peak     Peak   Expected   Delta                        Conc.
 No.      RT       RT        RT      Area    Height     (ppb)     Flags          Peak Identification
=====  ========  ========  ========  ========  ========  ==========  =====  ====================================
   54    33.450                          6324       993
   55    36.431                           682       137


Flags:  A - Peak quantitates above calibration range
        a - Peak quantitates below reporting limit
        H - User selected alternate compound hit
        M - Peak manually integrated or manually identified
        R - Peak fails recovery
        U - User disabled peak ID: either peak quantitates below reporting limit or
            peak identification not confirmed on second column
```

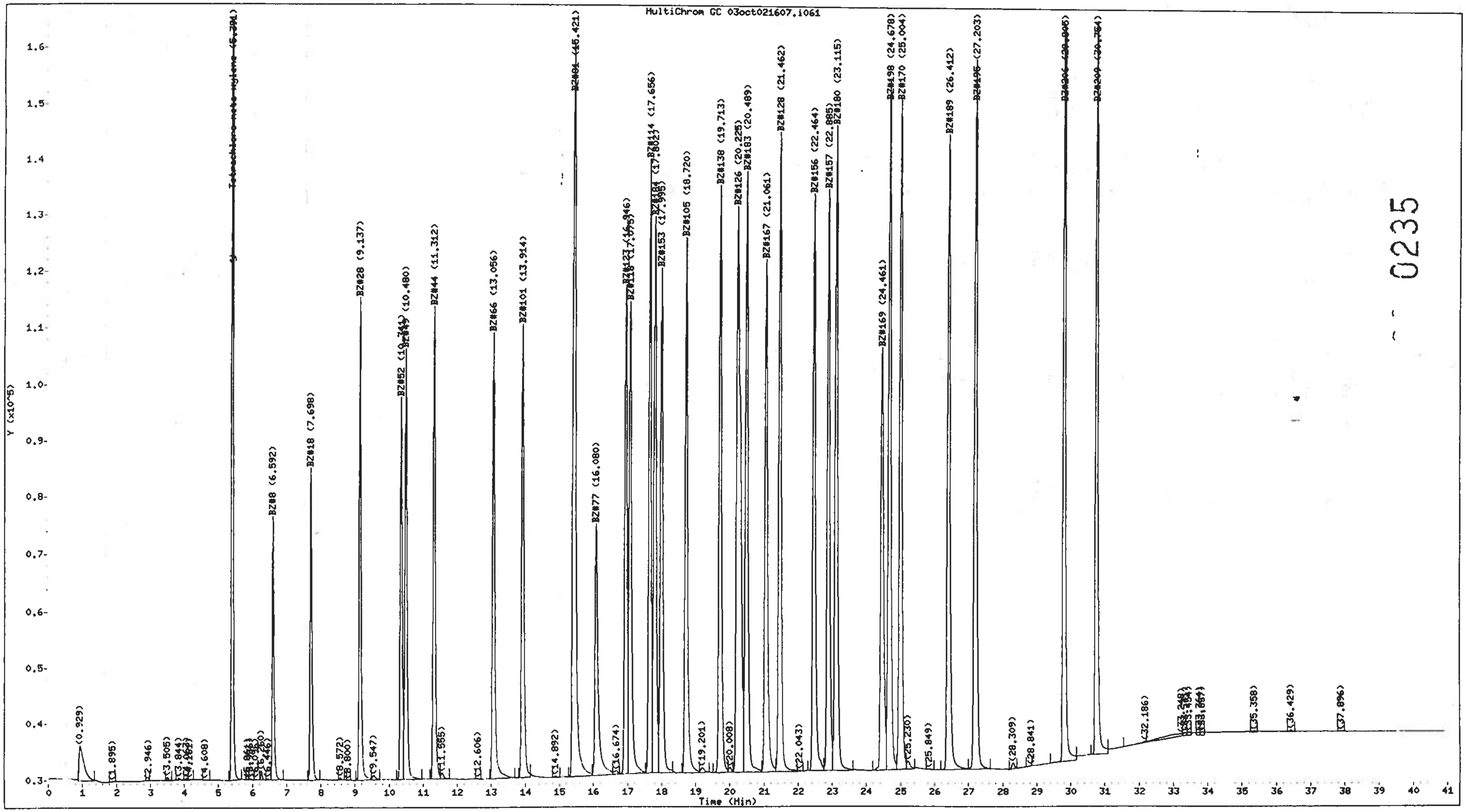
## Target Compounds

```
  Peak     Expected
   RT         RT                  Target Compound
========  ========  ====================================
   5.386     5.391  Tetrachloro-meta-xylene
   6.590     6.592  BZ#8
   7.696     7.698  BZ#18
   9.135     9.137  BZ#28
  10.339    10.341  BZ#52
  10.478    10.480  BZ#49
  11.309    11.312  BZ#44
  13.056    13.056  BZ#66
  13.912    13.914  BZ#101
  15.417    15.421  BZ#87
  15.417    15.421  BZ#81
  16.082    16.080  BZ#77
  16.944    16.946  BZ#123
  17.075    17.075  BZ#118
  17.649    17.656  BZ#114
  17.798    17.802  BZ#184
  17.990    17.995  BZ#153
  18.718    18.720  BZ#105
  19.708    19.713  BZ#138
  20.218    20.225  BZ#126
  20.218    20.225  BZ#187
  20.484    20.489  BZ#183
  21.056    21.061  BZ#167
  21.457    21.462  BZ#128
  22.459    22.464  BZ#156
  22.880    22.885  BZ#157
  23.109    23.115  BZ#180
  24.459    24.461  BZ#169
  24.672    24.678  BZ#198
  24.997    25.004  BZ#170
  26.407    26.412  BZ#189
  27.198    27.203  BZ#195
  29.801    29.805  BZ#206
  30.750    30.754  BZ#209
```

STL Burlington - Target GC Chromatogram

| | |
|---|---|
| Lab Sample ID: 32CONG-L3 | Client Sample ID: 32CONG-L3 |

```
Matrix           : WATER             Sample Type      : CALIB_3
Analyst          :                   Injection Date   : 03-OCT-2002 20:10
Instrument       : 3327_2.i          Dilution Factor  : 1.00
Column           : RTX-CLPII         Data File        : 03oct021607-r061.d
Integrator       : Falcon            Compound Sublist: all
Method           : /var/chem/3327_2.i/100302_1/03OCT021607.b/32CONG_3327RTXCLPII_RAW.m
Reported         : 17-Oct-2002 14:58 rrm
```



0235

# STL Burlington - Target GC Injection Report

Lab Sample ID: 32CONG-L3 Client Sample ID: 32CONG-L3

Matrix : WATER
Analyst :
Instrument : 3327_2.i
Column : RTX-CLPII
Integrator : Falcon
Method : /var/chem/3327_2.i/100302_1/03OCT021607.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 09:12 rrm

Sample Type : CALIB_3
Injection Date : 03-OCT-2002 20:10
Dilution Factor : 1.00
Data File : 03oct021607-r061.d
Compound Sublist: all

## Peaks

| | Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0.929 | | | 62233 | 6172 | | | |
| | 2 | 1.895 | | | 391 | 63 | | | |
| | 3 | 2.946 | | | 247 | 49 | | | |
| | 4 | 3.505 | | | 2120 | 631 | | | |
| | 5 | 3.844 | | | 1489 | 361 | | | |
| | 6 | 4.063 | | | 1165 | 357 | | | |
| | 7 | 4.161 | | | 1306 | 195 | | | |
| | 8 | 4.608 | | | 632 | 103 | | | |
| $ | 9 | 5.391 | 5.391 | 0.000 | 591027 | 198952 | 52.6383 | R | Tetrachloro-meta-xylene |
| | 10 | 5.861 | | | 355 | 108 | | | |
| | 11 | 5.936 | | | 1061 | 242 | | | |
| | 12 | 6.096 | | | 414 | 116 | | | |
| | 13 | 6.260 | | | 4759 | 1639 | | | |
| | 14 | 6.446 | | | 871 | 281 | | | |
| | 15 | 6.592 | 6.592 | 0.000 | 163728 | 46481 | 53.3360 | | BZ#8 |
| | 16 | 7.698 | 7.698 | 0.000 | 213153 | 55172 | 54.8041 | | BZ#18 |
| | 17 | 8.572 | | | 1371 | 427 | | | |
| | 18 | 8.800 | | | 204 | 66 | | | |
| | 19 | 9.137 | 9.137 | 0.000 | 319694 | 85333 | 50.3487 | | BZ#28 |
| | 20 | 9.547 | | | 5313 | 789 | | | |
| | 21 | 10.341 | 10.341 | 0.000 | 280648 | 67668 | 54.6276 | | BZ#52 |
| | 22 | 10.480 | 10.480 | 0.000 | 337341 | 76215 | 53.9222 | | BZ#49 |
| | 23 | 11.312 | 11.312 | 0.000 | 360769 | 83572 | 53.2268 | | BZ#44 |
| | 24 | 11.555 | | | 6588 | 1068 | | | |
| | 25 | 12.606 | | | 509 | 128 | | | |
| | 26 | 13.056 | 13.056 | 0.000 | 378251 | 78980 | 49.4728 | | BZ#66 |
| | 27 | 13.914 | 13.914 | 0.000 | 392515 | 80265 | 53.6567 | | BZ#101 |
| | 28 | 14.892 | | | 1140 | 235 | | | |
| | 29 | 15.421 | 15.421 | 0.000 | 830251 | 130413 | 101.446 | | BZ#81 |
| | 29 | 15.421 | 15.421 | 0.000 | 830251 | 130413 | 101.446 | M | BZ#87 |
| | 30 | 16.080 | 16.080 | 0.000 | 282441 | 44585 | 49.3927 | | BZ#77 |
| | 31 | 16.674 | | | 4856 | 650 | | | |
| | 32 | 16.946 | 16.946 | 0.000 | 409965 | 86587 | 50.7696 | | BZ#123 |
| | 33 | 17.075 | 17.075 | 0.000 | 460541 | 83739 | 50.8073 | | BZ#118 |
| | 34 | 17.656 | 17.656 | 0.000 | 506718 | 109103 | 48.0566 | | BZ#114 |
| | 35 | 17.802 | 17.802 | 0.000 | 517961 | 98719 | 53.2528 | | BZ#184 |
| | 36 | 17.995 | 17.995 | 0.000 | 478907 | 89534 | 53.2960 | | BZ#153 |
| | 37 | 18.720 | 18.720 | 0.000 | 478592 | 94992 | 47.8919 | | BZ#105 |
| | 38 | 19.201 | | | 6726 | 884 | | | |
| | 39 | 19.713 | 19.713 | 0.000 | 541370 | 104398 | 51.9808 | | BZ#138 |
| | 40 | 20.008 | | | 5257 | 910 | | | |
| | 41 | 20.225 | 20.225 | 0.000 | 825823 | 100576 | 106.706 | | BZ#126 |
| | 41 | 20.225 | 20.225 | 0.000 | 825823 | 100576 | 106.706 | M | BZ#187 |
| | 42 | 20.489 | 20.489 | 0.000 | 589368 | 106856 | 52.4142 | | BZ#183 |
| | 43 | 21.061 | 21.061 | 0.000 | 505434 | 91112 | 51.6732 | | BZ#167 |
| | 44 | 21.462 | 21.462 | 0.000 | 594303 | 113838 | 50.9954 | | BZ#128 |
| | 45 | 22.043 | | | 1073 | 179 | | | |
| | 46 | 22.464 | 22.464 | 0.000 | 546584 | 102613 | 47.8542 | | BZ#156 |
| | 47 | 22.885 | 22.885 | 0.000 | 545938 | 103494 | 48.9441 | | BZ#157 |
| | 48 | 23.115 | 23.115 | 0.000 | 622085 | 114928 | 51.0232 | | BZ#180 |
| | 49 | 24.461 | 24.461 | 0.000 | 448753 | 75279 | 49.9274 | | BZ#169 |
| $ | 50 | 24.678 | 24.678 | 0.000 | 674129 | 123303 | 51.8164 | R | BZ#198 |
| | 51 | 25.004 | 25.004 | 0.000 | 632278 | 119740 | 51.4423 | | BZ#170 |
| | 52 | 25.230 | | | 10684 | 1489 | | | |
| | 53 | 25.849 | | | 997 | 149 | | | |

# STL Burlington - Target GC Injection Report

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| 54 | 26.412 | 26.412 | 0.000 | 623733 | 113321 | 49.8408 | | BZ#189 |
| 55 | 27.203 | 27.203 | 0.000 | 699164 | 126710 | 51.7406 | | BZ#195 |
| 56 | 28.309 | | | 5601 | 1090 | | | |
| 57 | 28.841 | | | 225 | 28 | | | |
| 58 | 29.805 | 29.805 | 0.000 | 705048 | 151655 | 53.0382 | | BZ#206 |
| 59 | 30.754 | 30.754 | 0.000 | 652163 | 146594 | 53.9653 | | BZ#209 |
| 60 | 32.186 | | | 2626 | 226 | | | |
| 61 | 33.248 | | | 22631 | 360 | | | |
| 62 | 33.341 | | | 3355 | 609 | | | |
| 63 | 33.454 | | | 3854 | 670 | | | |
| 64 | 33.764 | | | 3247 | 516 | | | |
| 65 | 33.837 | | | 4103 | 613 | | | |
| 66 | 35.358 | | | 2663 | 287 | | | |
| 67 | 36.429 | | | 1737 | 309 | | | |
| 68 | 37.896 | | | 783 | 127 | | | |

Flags: A - Peak quantitates above calibration range
a - Peak quantitates below reporting limit
H - User selected alternate compound hit
M - Peak manually integrated or manually identified
R - Peak fails recovery
U - User disabled peak ID: either peak quantitates below reporting limit or peak identification not confirmed on second column

## Target Compounds

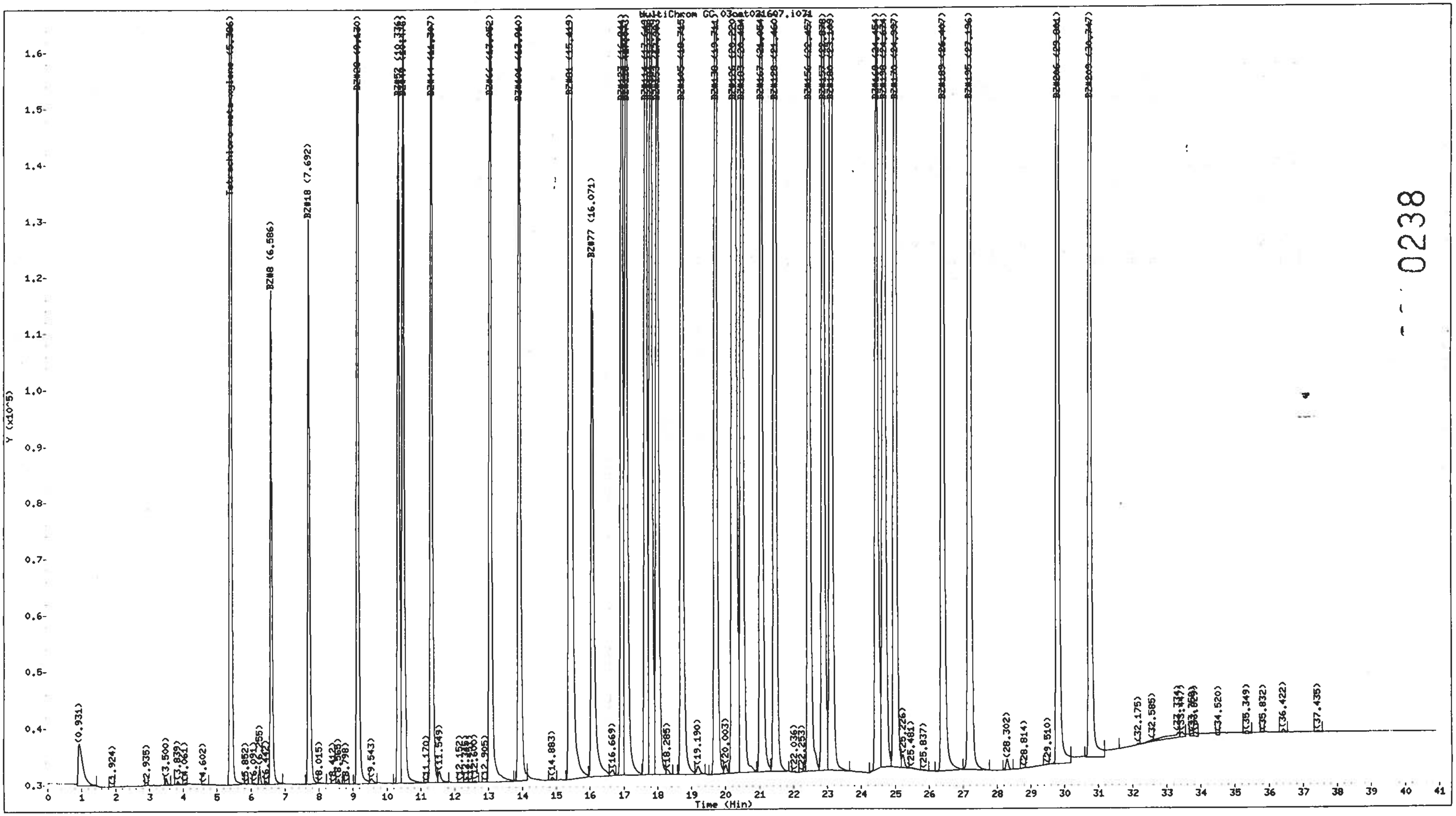
| Peak RT | Expected RT | Target Compound |
|---|---|---|
| 5.391 | 5.391 | Tetrachloro-meta-xylene |
| 6.592 | 6.592 | BZ#8 |
| 7.698 | 7.698 | BZ#18 |
| 9.137 | 9.137 | BZ#28 |
| 10.341 | 10.341 | BZ#52 |
| 10.480 | 10.480 | BZ#49 |
| 11.312 | 11.312 | BZ#44 |
| 13.056 | 13.056 | BZ#66 |
| 13.914 | 13.914 | BZ#101 |
| 15.421 | 15.421 | BZ#87 |
| 15.421 | 15.421 | BZ#81 |
| 16.080 | 16.080 | BZ#77 |
| 16.946 | 16.946 | BZ#123 |
| 17.075 | 17.075 | BZ#118 |
| 17.656 | 17.656 | BZ#114 |
| 17.802 | 17.802 | BZ#184 |
| 17.995 | 17.995 | BZ#153 |
| 18.720 | 18.720 | BZ#105 |
| 19.713 | 19.713 | BZ#138 |
| 20.225 | 20.225 | BZ#126 |
| 20.225 | 20.225 | BZ#187 |
| 20.489 | 20.489 | BZ#183 |
| 21.061 | 21.061 | BZ#167 |
| 21.462 | 21.462 | BZ#128 |
| 22.464 | 22.464 | BZ#156 |
| 22.885 | 22.885 | BZ#157 |
| 23.115 | 23.115 | BZ#180 |
| 24.461 | 24.461 | BZ#169 |
| 24.678 | 24.678 | BZ#198 |
| 25.004 | 25.004 | BZ#170 |
| 26.412 | 26.412 | BZ#189 |
| 27.203 | 27.203 | BZ#195 |
| 29.805 | 29.805 | BZ#206 |
| 30.754 | 30.754 | BZ#209 |

# STL Burlington - Target GC Chromatogram

| Lab Sample ID: 32CONG-L4 | Client Sample ID: 32CONG-L4 |
|---|---|

Matrix : WATER
Analyst :
Instrument : 3327_2.i
Column : RTX-CLPII
Integrator : Falcon
Method : /var/chem/3327_2.i/100302_1/03OCT021607.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 14:58 rrm

Sample Type : CALIB_4
Injection Date : 03-OCT-2002 20:55
Dilution Factor : 1.00
Data File : 03oct021607-r071.d
Compound Sublist: all



0238

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              STL Burlington - Target GC Injection Report

   Lab Sample ID: 32CONG-L4              Client Sample ID: 32CONG-L4

   Matrix          : WATER                Sample Type      : CALIB_4
   Analyst         :        Rw            Injection Date   : 03-OCT-2002 20:55
   Instrument      : 3327_2.i             Dilution Factor  : 1.00
   Column          : RTX-CLPII            Data File        : 03oct021607-r071.d
   Integrator      : Falcon               Compound Sublist: all
   Method          : /var/chem/3327_2.i/100302_1/03OCT021607.b/32CONG_3327RTXCLPII_RAW.m
   Reported        : 17-Oct-2002 09:13 rrm

 ______________________________________ Peaks ______________________________________

                                                          Extract
 Peak     Peak   Expected   Delta                         Conc.
 No.      RT       RT        RT       Area      Height    (ppb)     Flags          Peak Identification
 =====  ======== ======== ======== ======== ======== ========== ===== ====================================
     1    0.931                       73856     7432
     2    1.924                         195       23
     3    2.935                         196       47
     4    3.500                        4169     1246
     5    3.839                        2652      674
     6    4.061                        1429      383
     7    4.602                         995      177
 $   8    5.386    5.391   -0.004   1230086   387043    101.804   R     Tetrachloro-meta-xylene
     9    5.852                         886      174
    10    6.091                         966      249
    11    6.255                        9261     3262
    12    6.442                        1684      552
    13    6.586    6.592   -0.007    315137    87494    101.652         BZ#8
    14    7.692    7.698   -0.007    398309   100369    101.899         BZ#18
    15    8.015                        2142      249
    16    8.412                         260       77
    17    8.565                        2685      831
    18    8.798                         448      133
    19    9.130    9.137   -0.007    665926   173210    101.095         BZ#28
    20    9.543                        5988      804
    21   10.336   10.341   -0.004    528898   124213    102.133         BZ#52
    22   10.476   10.480   -0.004    646690   141280    101.394         BZ#49
    23   11.170                         748      135
    24   11.307   11.312   -0.004    701437   158622    101.828         BZ#44
    25   11.549                       12917     2037
    26   12.152                         369       91
    27   12.345                         391      101
    28   12.451                         454      110
    29   12.600                        1148      277
    30   12.905                         408       92
    31   13.052   13.056   -0.004    780696   162454    99.9859         BZ#66
    32   13.910   13.914   -0.004    756505   150679    101.830         BZ#101
    33   14.883                        2448      503
    34   15.419   15.421   -0.002   1645525   263128    202.048         BZ#81
    34   15.419   15.421   -0.002   1645525   263128    202.048   M     BZ#87
    35   16.071   16.080   -0.009    543221    91982    99.2336         BZ#77
    36   16.669                        6837     1040
    37   16.944   16.946   -0.002    837316   174308    100.956         BZ#123
    38   17.073   17.075   -0.002    916480   167479    100.612         BZ#118
    39   17.649   17.656   -0.007   1104668   234109    100.179         BZ#114
    40   17.798   17.802   -0.004    999442   186931    102.046         BZ#184
    41   17.993   17.995   -0.002    921512   170112    102.118         BZ#153
    42   18.285                        5688      925
    43   18.715   18.720   -0.004   1026999   204453    99.8791         BZ#105
    44   19.190                        9947     1464
    45   19.711   19.713   -0.002   1081863   205712    102.193         BZ#138
    46   20.003                        8084     1527
    47   20.220   20.225   -0.004   1615713   189311    202.639         BZ#126
    47   20.220   20.225   -0.004   1615713   189311    202.639   M     BZ#187
    48   20.484   20.489   -0.004   1146767   205341    101.214         BZ#183
    49   21.054   21.061   -0.007    991190   178798    100.727         BZ#167
    50   21.460   21.462   -0.002   1211187   230090    102.073         BZ#128
    51   22.036                         887      195
    52   22.253                         272       53
    53   22.457   22.464   -0.007   1163235   218167    99.0726         BZ#156
```

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                    STL Burlington - Target GC Injection Report

                                                       Extract
Peak    Peak    Expected   Delta                         Conc.
 No.     RT        RT        RT       Area    Height     (ppb)    Flags          Peak Identification
=====  ========  ========  ========  ========  ========  ==========  =====  ====================================
   54    22.878    22.885    -0.007   1139947    214633     99.4635         BZ#157
   55    23.109    23.115    -0.007   1243944    228735     101.109         BZ#180
   56    24.454    24.461    -0.007    888024    151041     99.0760         BZ#169
$  57    24.674    24.678    -0.004   1342083    241368     101.585  R      BZ#198
   58    24.997    25.004    -0.007   1290897    236160     100.713         BZ#170
   59    25.226                         13349      2306
   60    25.481                          2195       211
   61    25.837                          1107       183
   62    26.407    26.412    -0.004   1285551    229338     99.5318         BZ#189
   63    27.196    27.203    -0.007   1414572    248523     101.097         BZ#195
   64    28.302                         10071      1973
   65    28.814                           308        68
   66    29.510                           387        63
   67    29.801    29.805    -0.004   1389845    286941     101.113         BZ#206
   68    30.747    30.754    -0.007   1260755    273462     102.596         BZ#209
   69    32.175                          1800       218
   70    32.585                          3369       301
   71    33.334                         19914       913
   72    33.447                          6011       925
   73    33.758                          3067       542
   74    33.829                          4733       704
   75    34.520                          2734       412
   76    35.349                          3679       395
   77    35.832                          1032       199
   78    36.422                          3194       592
   79    37.435                          1611       210

Flags:  A - Peak quantitates above calibration range
        a - Peak quantitates below reporting limit
        H - User selected alternate compound hit
        M - Peak manually integrated or manually identified
        R - Peak fails recovery
        U - User disabled peak ID: either peak quantitates below reporting limit or
            peak identification not confirmed on second column

___________________________________ Target Compounds ___________________________________

                         Peak      Expected
                          RT          RT              Target Compound
                       ========   ========   ====================================
                          5.386      5.391   Tetrachloro-meta-xylene
                          6.586      6.592   BZ#8
                          7.692      7.698   BZ#18
                          9.130      9.137   BZ#28
                         10.336     10.341   BZ#52
                         10.476     10.480   BZ#49
                         11.307     11.312   BZ#44
                         13.052     13.056   BZ#66
                         13.910     13.914   BZ#101
                         15.419     15.421   BZ#87
                         15.419     15.421   BZ#81
                         16.071     16.080   BZ#77
                         16.944     16.946   BZ#123
                         17.073     17.075   BZ#118
                         17.649     17.656   BZ#114
                         17.798     17.802   BZ#184
                         17.993     17.995   BZ#153
                         18.715     18.720   BZ#105
                         19.711     19.713   BZ#138
                         20.220     20.225   BZ#126
                         20.220     20.225   BZ#187
                         20.484     20.489   BZ#183
                         21.054     21.061   BZ#167
                         21.460     21.462   BZ#128
                         22.457     22.464   BZ#156
                         22.878     22.885   BZ#157
                         23.109     23.115   BZ#180
                         24.454     24.461   BZ#169
                         24.674     24.678   BZ#198
```

0240

## STL Burlington - Target GC Injection Report

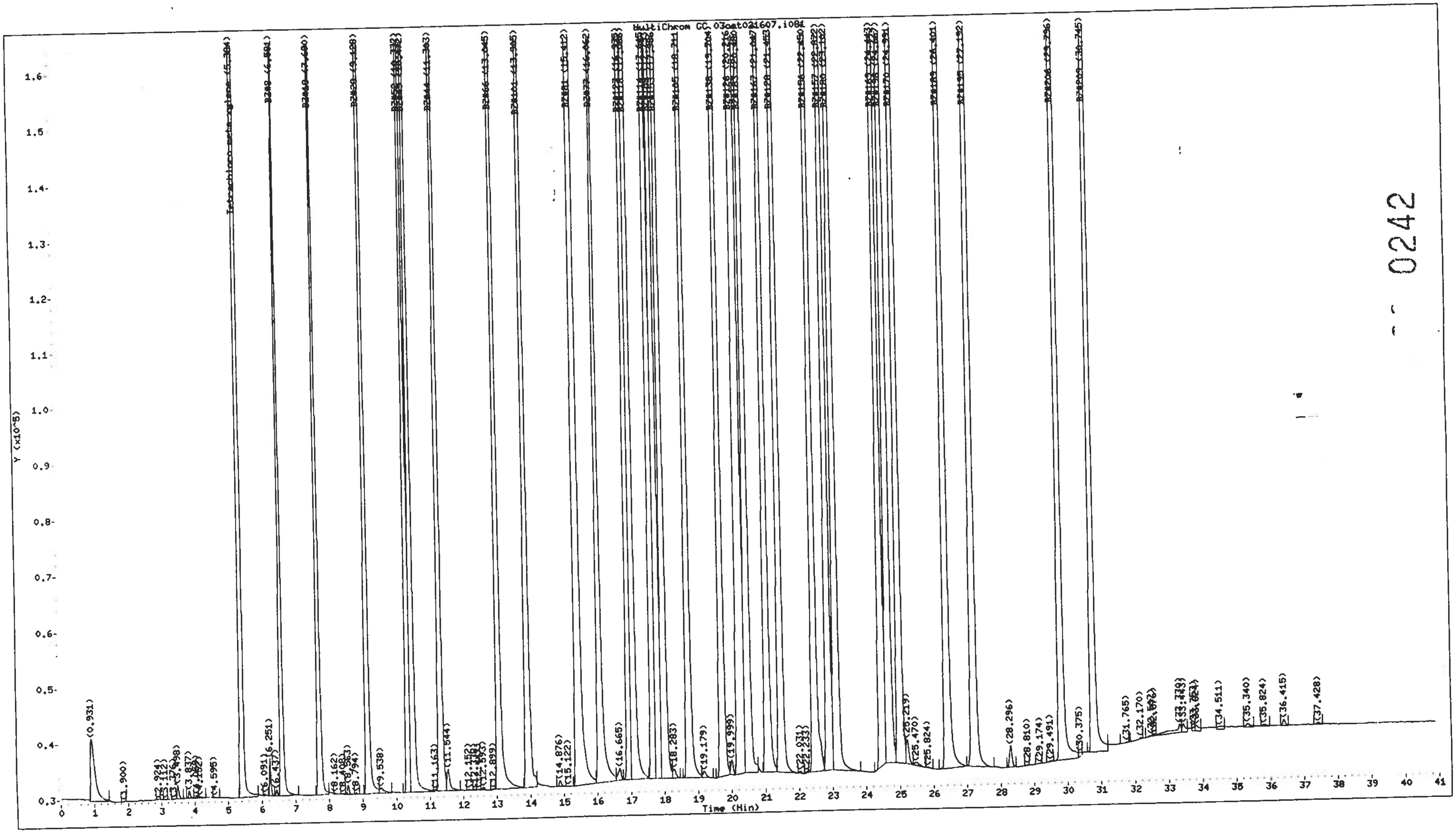
| Peak RT | Expected RT | Target Compound |
|---|---|---|
| 24.997 | 25.004 | BZ#170 |
| 26.407 | 26.412 | BZ#189 |
| 27.196 | 27.203 | BZ#195 |
| 29.801 | 29.805 | BZ#206 |
| 30.747 | 30.754 | BZ#209 |

STL Burlington - Target GC Chromatogram

Lab Sample ID: 32CONG-L5 Client Sample ID: 32CONG-L5

| | | | |
|---|---|---|---|
| Matrix | : WATER | Sample Type | : CALIB_5 |
| Analyst | : | Injection Date | : 03-OCT-2002 21:40 |
| Instrument | : 3327_2.i | Dilution Factor | : 1.00 |
| Column | : RTX-CLPII | Data File | : 03oct021607-r081.d |
| Integrator | : Falcon | Compound Sublist | : all |

Method : /var/chem/3327_2.i/100302_1/03OCT021607.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 14:58 rrm



## STL Burlington - Target GC Injection Report

**Lab Sample ID: 32CONG-L5** **Client Sample ID: 32CONG-L5**

| | | | |
|---|---|---|---|
| Matrix | : WATER | Sample Type | : CALIB_5 |
| Analyst | : | Injection Date | : 03-OCT-2002 21:40 |
| Instrument | : 3327_2.i | Dilution Factor | : 1.00 |
| Column | : RTX-CLPII | Data File | : 03oct021607-r081.d |
| Integrator | : Falcon | Compound Sublist | : all |
| Method | : /var/chem/3327_2.i/100302_1/03OCT021607.b/32CONG_3327RTXCLPII_RAW.m | | |
| Reported | : 17-Oct-2002 09:13 rrm | | |

### Peaks

| | Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0.931 | | | 104206 | 11201 | | | |
| | 2 | 1.900 | | | 196 | 33 | | | |
| | 3 | 2.924 | | | 199 | 54 | | | |
| | 4 | 3.112 | | | 258 | 75 | | | |
| | 5 | 3.376 | | | 220 | 53 | | | |
| | 6 | 3.498 | | | 8622 | 2539 | | | |
| | 7 | 3.837 | | | 4706 | 1292 | | | |
| | 8 | 4.059 | | | 1997 | 519 | | | |
| | 9 | 4.152 | | | 2218 | 253 | | | |
| | 10 | 4.595 | | | 888 | 138 | | | |
| $ | 11 | 5.384 | 5.391 | -0.007 | 2515624 | 745379 | 195.470 | R | Tetrachloro-meta-xylene |
| | 12 | 6.091 | | | 1294 | 337 | | | |
| | 13 | 6.251 | | | 18932 | 6729 | | | |
| | 14 | 6.437 | | | 3390 | 1114 | | | |
| | 15 | 6.581 | 6.592 | -0.011 | 614603 | 165840 | 193.948 | | BZ#8 |
| | 16 | 7.690 | 7.698 | -0.009 | 750730 | 186298 | 191.436 | | BZ#18 |
| | 17 | 8.162 | | | 1001 | 204 | | | |
| | 18 | 8.408 | | | 505 | 154 | | | |
| | 19 | 8.563 | | | 5407 | 1666 | | | |
| | 20 | 8.794 | | | 974 | 283 | | | |
| | 21 | 9.128 | 9.137 | -0.009 | 1378570 | 343465 | 199.413 | | BZ#28 |
| | 22 | 9.538 | | | 8897 | 936 | | | |
| | 23 | 10.332 | 10.341 | -0.009 | 997756 | 230838 | 191.713 | | BZ#52 |
| | 24 | 10.472 | 10.480 | -0.009 | 1256383 | 267450 | 193.447 | | BZ#49 |
| | 25 | 11.163 | | | 1432 | 283 | | | |
| | 26 | 11.303 | 11.312 | -0.009 | 1369755 | 301387 | 194.280 | | BZ#44 |
| | 27 | 11.544 | | | 23865 | 3905 | | | |
| | 28 | 12.152 | | | 705 | 171 | | | |
| | 29 | 12.338 | | | 553 | 168 | | | |
| | 30 | 12.447 | | | 606 | 179 | | | |
| | 31 | 12.593 | | | 2331 | 567 | | | |
| | 32 | 12.899 | | | 589 | 147 | | | |
| | 33 | 13.045 | 13.056 | -0.011 | 1590569 | 330616 | 201.747 | A | BZ#66 |
| | 34 | 13.905 | 13.914 | -0.009 | 1466726 | 284650 | 193.485 | | BZ#101 |
| | 35 | 14.876 | | | 5188 | 1098 | | | |
| | 36 | 15.122 | | | 546 | 110 | | | |
| | 37 | 15.412 | 15.421 | -0.009 | 3244936 | 521982 | 398.267 | | BZ#81 |
| | 37 | 15.412 | 15.421 | -0.009 | 3244936 | 521982 | 398.267 | M | BZ#87 |
| | 38 | 16.062 | 16.080 | -0.018 | 1077416 | 190275 | 202.595 | A | BZ#77 |
| | 39 | 16.665 | | | 14475 | 2177 | | | |
| | 40 | 16.935 | 16.946 | -0.011 | 1685349 | 345413 | 198.848 | | BZ#123 |
| | 41 | 17.066 | 17.075 | -0.009 | 1842189 | 333214 | 199.185 | | BZ#118 |
| | 42 | 17.645 | 17.656 | -0.011 | 2360812 | 482348 | 203.684 | A | BZ#114 |
| | 43 | 17.793 | 17.802 | -0.009 | 1932489 | 352924 | 193.862 | | BZ#184 |
| | 44 | 17.986 | 17.995 | -0.009 | 1777800 | 321342 | 193.748 | | BZ#153 |
| | 45 | 18.283 | | | 10331 | 1621 | | | |
| | 46 | 18.711 | 18.720 | -0.009 | 2189449 | 424839 | 204.549 | A | BZ#105 |
| | 47 | 19.179 | | | 8317 | 1149 | | | |
| | 48 | 19.704 | 19.713 | -0.009 | 2152226 | 394979 | 195.995 | | BZ#138 |
| | 49 | 19.999 | | | 12775 | 2645 | | | |
| | 50 | 20.216 | 20.225 | -0.009 | 3155673 | 361934 | 389.264 | | BZ#126 |
| | 50 | 20.216 | 20.225 | -0.009 | 3155673 | 361934 | 389.264 | M | BZ#187 |
| | 51 | 20.480 | 20.489 | -0.009 | 2227579 | 396614 | 195.990 | | BZ#183 |
| | 52 | 21.047 | 21.061 | -0.013 | 1972582 | 352446 | 197.870 | | BZ#167 |
| | 53 | 21.453 | 21.462 | -0.009 | 2455043 | 447305 | 197.510 | | BZ#128 |

# STL Burlington - Target GC Injection Report

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| 54 | 22.031 | | | 1915 | 414 | | | |
| 55 | 22.233 | | | 1046 | 254 | | | |
| 56 | 22.450 | 22.464 | -0.013 | 2479381 | 456967 | 204.919 | A | BZ#156 |
| 57 | 22.872 | 22.885 | -0.013 | 2374945 | 442528 | 203.056 | A | BZ#157 |
| 58 | 23.102 | 23.115 | -0.013 | 2497502 | 449485 | 198.260 | | BZ#180 |
| 59 | 24.443 | 24.461 | -0.018 | 1808787 | 308920 | 201.496 | A | BZ#169 |
| $ 60 | 24.667 | 24.678 | -0.011 | 2676261 | 466213 | 196.364 | R | BZ#198 |
| 61 | 24.991 | 25.004 | -0.013 | 2618461 | 466793 | 198.322 | | BZ#170 |
| 62 | 25.219 | | | 24548 | 4362 | | | |
| 63 | 25.470 | | | 5472 | 554 | | | |
| 64 | 25.824 | | | 860 | 148 | | | |
| 65 | 26.401 | 26.412 | -0.011 | 2661819 | 467690 | 201.620 | A | BZ#189 |
| 66 | 27.192 | 27.203 | -0.011 | 2847941 | 486905 | 197.685 | | BZ#195 |
| 67 | 28.296 | | | 19884 | 3931 | | | |
| 68 | 28.810 | | | 313 | 69 | | | |
| 69 | 29.174 | | | 368 | 70 | | | |
| 70 | 29.491 | | | 1022 | 194 | | | |
| 71 | 29.796 | 29.805 | -0.009 | 2734894 | 552215 | 195.379 | | BZ#206 |
| 72 | 30.375 | | | 5145 | 793 | | | |
| 73 | 30.745 | 30.754 | -0.009 | 2395709 | 507641 | 192.360 | | BZ#209 |
| 74 | 31.765 | | | 478 | 115 | | | |
| 75 | 32.170 | | | 1580 | 333 | | | |
| 76 | 32.507 | | | 1493 | 202 | | | |
| 77 | 32.576 | | | 1785 | 416 | | | |
| 78 | 33.330 | | | 22671 | 1523 | | | |
| 79 | 33.443 | | | 9065 | 1506 | | | |
| 80 | 33.753 | | | 3359 | 746 | | | |
| 81 | 33.824 | | | 7632 | 1019 | | | |
| 82 | 34.511 | | | 6132 | 521 | | | |
| 83 | 35.340 | | | 6139 | 680 | | | |
| 84 | 35.824 | | | 3006 | 331 | | | |
| 85 | 36.415 | | | 5824 | 1143 | | | |
| 86 | 37.428 | | | 2607 | 377 | | | |

Flags:
A - Peak quantitates above calibration range
a - Peak quantitates below reporting limit
H - User selected alternate compound hit
M - Peak manually integrated or manually identified
R - Peak fails recovery
U - User disabled peak ID: either peak quantitates below reporting limit or peak identification not confirmed on second column

## Target Compounds

| Peak RT | Expected RT | Target Compound |
|---|---|---|
| 5.384 | 5.391 | Tetrachloro-meta-xylene |
| 6.581 | 6.592 | BZ#8 |
| 7.690 | 7.698 | BZ#18 |
| 9.128 | 9.137 | BZ#28 |
| 10.332 | 10.341 | BZ#52 |
| 10.472 | 10.480 | BZ#49 |
| 11.303 | 11.312 | BZ#44 |
| 13.045 | 13.056 | BZ#66 |
| 13.905 | 13.914 | BZ#101 |
| 15.412 | 15.421 | BZ#87 |
| 15.412 | 15.421 | BZ#81 |
| 16.062 | 16.080 | BZ#77 |
| 16.935 | 16.946 | BZ#123 |
| 17.066 | 17.075 | BZ#118 |
| 17.645 | 17.656 | BZ#114 |
| 17.793 | 17.802 | BZ#184 |
| 17.986 | 17.995 | BZ#153 |
| 18.711 | 18.720 | BZ#105 |
| 19.704 | 19.713 | BZ#138 |
| 20.216 | 20.225 | BZ#126 |
| 20.216 | 20.225 | BZ#187 |
| 20.480 | 20.489 | BZ#183 |

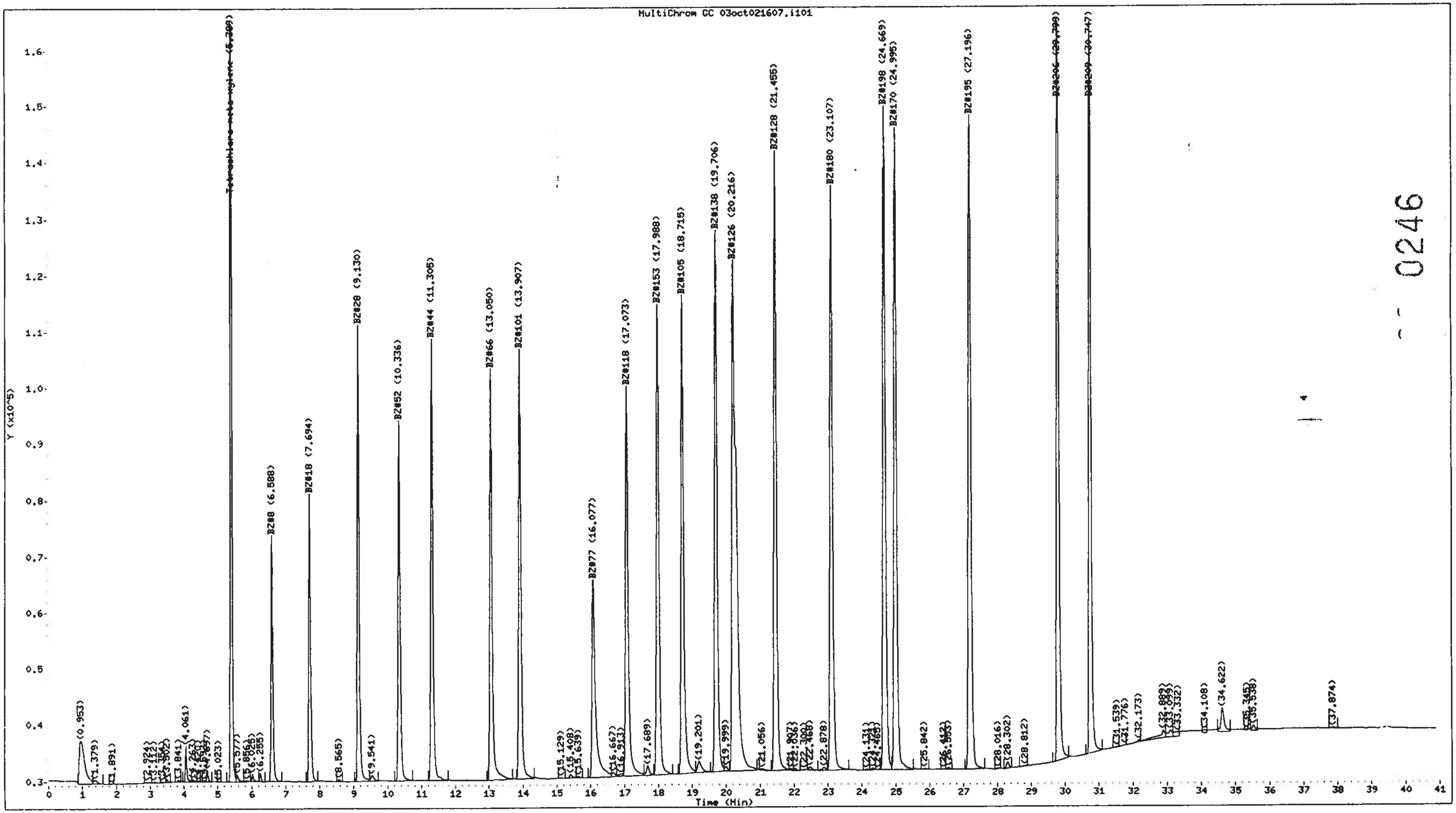
# STL Burlington - Target GC Injection Report

| Peak RT | Expected RT | Target Compound |
|---|---|---|
| 21.047 | 21.061 | BZ#167 |
| 21.453 | 21.462 | BZ#128 |
| 22.450 | 22.464 | BZ#156 |
| 22.872 | 22.885 | BZ#157 |
| 23.102 | 23.115 | BZ#180 |
| 24.443 | 24.461 | BZ#169 |
| 24.667 | 24.678 | BZ#198 |
| 24.991 | 25.004 | BZ#170 |
| 26.401 | 26.412 | BZ#189 |
| 27.192 | 27.203 | BZ#195 |
| 29.796 | 29.805 | BZ#206 |
| 30.745 | 30.754 | BZ#209 |

# STL Burlington - Target GC Chromatogram

**Lab Sample ID: 20ICV-50** **Client Sample ID: 20ICV-50**

| | | | |
|---|---|---|---|
| Matrix | : WATER | Sample Type | : CCALIB_6 |
| Analyst | : | Injection Date | : 03-OCT-2002 23:10 |
| Instrument | : 3327_2.i | Dilution Factor | : 1.00 |
| Column | : RTX-CLPII | Data File | : 03oct021607-r101.d |
| Integrator | : Falcon | Compound Sublist | : 20ICV |
| Method | : /var/chem/3327_2.i/100302_1/03OCT021607.b/32CONG_3327RTXCLPII_RAW.m | | |
| Reported | : 17-Oct-2002 14:58 rrm | | |



# STL Burlington - Target GC Injection Report

```
                                                              Extract
 Peak     Peak    Expected    Delta                            Conc.
  No.      RT        RT        RT        Area      Height      (ppb)     Flags         Peak Identification
=====  ========  ========  ========  ========  ========  ==========  =====  ====================================
   55    24.995    25.004    -0.009    623841    114094     49.0528          BZ#170
   56    25.842                          1099       157
   57    26.412                           601       129
   58    26.553                          1762       320
   59    27.196    27.203    -0.007    652631    116216     47.4886          BZ#195
   60    28.016                           575       123
   61    28.302                          5676      1121
   62    28.812                          1176       166
   63    29.799    29.805    -0.007    677240    146523     51.2146   M      BZ#206
   64    30.747    30.754    -0.007    612227    138573     50.8907   M      BZ#209
   65    31.539                           296        73
   66    31.776                           255        25
   67    32.173                          2123       378
   68    32.889                         19717      1399
   69    33.099                         11017      1221
   70    33.332                          8199       790
   71    34.108                          3966       505
   72    34.622                         29217      4213
   73    35.345                          1210       207
   74    35.538                          5290       928
   75    37.874                          1035       158

Flags:  A - Peak quantitates above calibration range
        a - Peak quantitates below reporting limit
        H - User selected alternate compound hit
        M - Peak manually integrated or manually identified
        R - Peak fails recovery
        U - User disabled peak ID: either peak quantitates below reporting limit or
            peak identification not confirmed on second column
```

## Target Compounds

```
   Peak      Expected
    RT          RT                Target Compound
 ========    ========    ====================================
    5.389       5.391    Tetrachloro-meta-xylene
    6.588       6.592    BZ#8
    7.694       7.698    BZ#18
    9.130       9.137    BZ#28
   10.336      10.341    BZ#52
   11.305      11.312    BZ#44
   13.050      13.056    BZ#66
   13.907      13.914    BZ#101
   16.077      16.080    BZ#77
   17.073      17.075    BZ#118
   17.988      17.995    BZ#153
   18.715      18.720    BZ#105
   19.706      19.713    BZ#138
   20.216      20.225    BZ#126
   20.216      20.225    BZ#187
   21.455      21.462    BZ#128
   23.107      23.115    BZ#180
   24.669      24.678    BZ#198
   24.995      25.004    BZ#170
   27.196      27.203    BZ#195
   29.799      29.805    BZ#206
   30.747      30.754    BZ#209
```

# STL Burlington - Target GC Injection Report

```
 Lab Sample ID: 20ICV-50                Client Sample ID: 20ICV-50

 Matrix       : WATER                   Sample Type      : CCALIB_6
 Analyst      :                         Injection Date   : 03-OCT-2002 23:10
 Instrument   : 3327_2.i                Dilution Factor  : 1.00
 Column       : RTX-CLPII               Data File        : 03oct021607-r101.d
 Integrator   : Falcon                  Compound Sublist: 20ICV
 Method       : /var/chem/3327_2.i/100302_1/03OCT021607.b/32CONG_3327RTXCLPII_RAW.m
 Reported     : 17-Oct-2002 09:13 rrm

 ______________________________________  Peaks  ______________________________________

                                                           Extract
 Peak     Peak    Expected    Delta                          Conc.
  No.      RT        RT         RT       Area     Height     (ppb)    Flags          Peak Identification
=====  ========  ========  ========  ========  ========  ==========  =====  ====================================
    1     0.953                         85728      7565
    2     1.379                          5096       641
    3     1.891                           191        40
    4     2.924                           876       153
    5     3.112                           865       170
    6     3.354                           682       140
    7     3.502                          1870       588
    8     3.841                          1376       357
    9     4.061                         19208      6292
   10     4.263                          2297       424
   11     4.420                           868       186
   12     4.593                          1086       218
   13     4.697                          5998      2020
   14     5.023                           227        76
$  15     5.389     5.391    -0.002    541839    183402     48.5737  R      Tetrachloro-meta-xylene
   16     5.577                          5664      1257
   17     5.856                          1515       194
   18     6.025                          4441      1303
   19     6.255                          4488      1556
   20     6.588     6.592    -0.004    154268     43801     50.1788         BZ#8
   21     7.694     7.698    -0.004    197373     51168     50.6319         BZ#18
   22     8.565                          1280       388
   23     9.130     9.137    -0.007    305759     81288     48.0128         BZ#28
   24     9.541                          6502       998
   25    10.336    10.341    -0.004    281190     64035     51.5754         BZ#52
   26    11.305    11.312    -0.007    348745     78640     50.0329         BZ#44
   27    13.050    13.056    -0.007    360942     73234     45.9956         BZ#66
   28    13.907    13.914    -0.007    382529     76557     51.1199         BZ#101
   29    15.129                           602       143
   30    15.408                          4327       652
   31    15.639                          1455       306
   32    16.077    16.080    -0.002    254670     35218     39.5427         BZ#77
   33    16.667                          5274       754
   34    16.913                          3827       402
   35    17.073    17.075    -0.002    390557     69406     42.2826         BZ#118
   36    17.689                         10639      1697
   37    17.988    17.995    -0.007    451620     83865     49.8612         BZ#153
   38    18.715    18.720    -0.004    453974     85202     43.2423  M      BZ#105
   39    19.201                         17681      1970
   40    19.706    19.713    -0.007    505457     96331     47.9827  M      BZ#138
   41    19.999                          4483       822
   42    20.216    20.225    -0.009    836631     91003     96.3562  M      BZ#126
   42    20.216    20.225    -0.009    836631     91003     96.3562  M      BZ#187
   43    21.056                          2789       301
   44    21.455    21.462    -0.007    574740    110133     49.3676  M      BZ#128
   45    21.907                          1876       308
   46    22.036                          1789       292
   47    22.300                           896       137
   48    22.468                          3833       562
   49    22.878                          3364       521
   50    23.107    23.115    -0.009    564561    104026     46.2252         BZ#180
   51    24.131                           868       172
   52    24.321                          1769       305
   53    24.465                           513       110
$  54    24.669    24.678    -0.009    636553    118010     49.5852  R      BZ#198
```

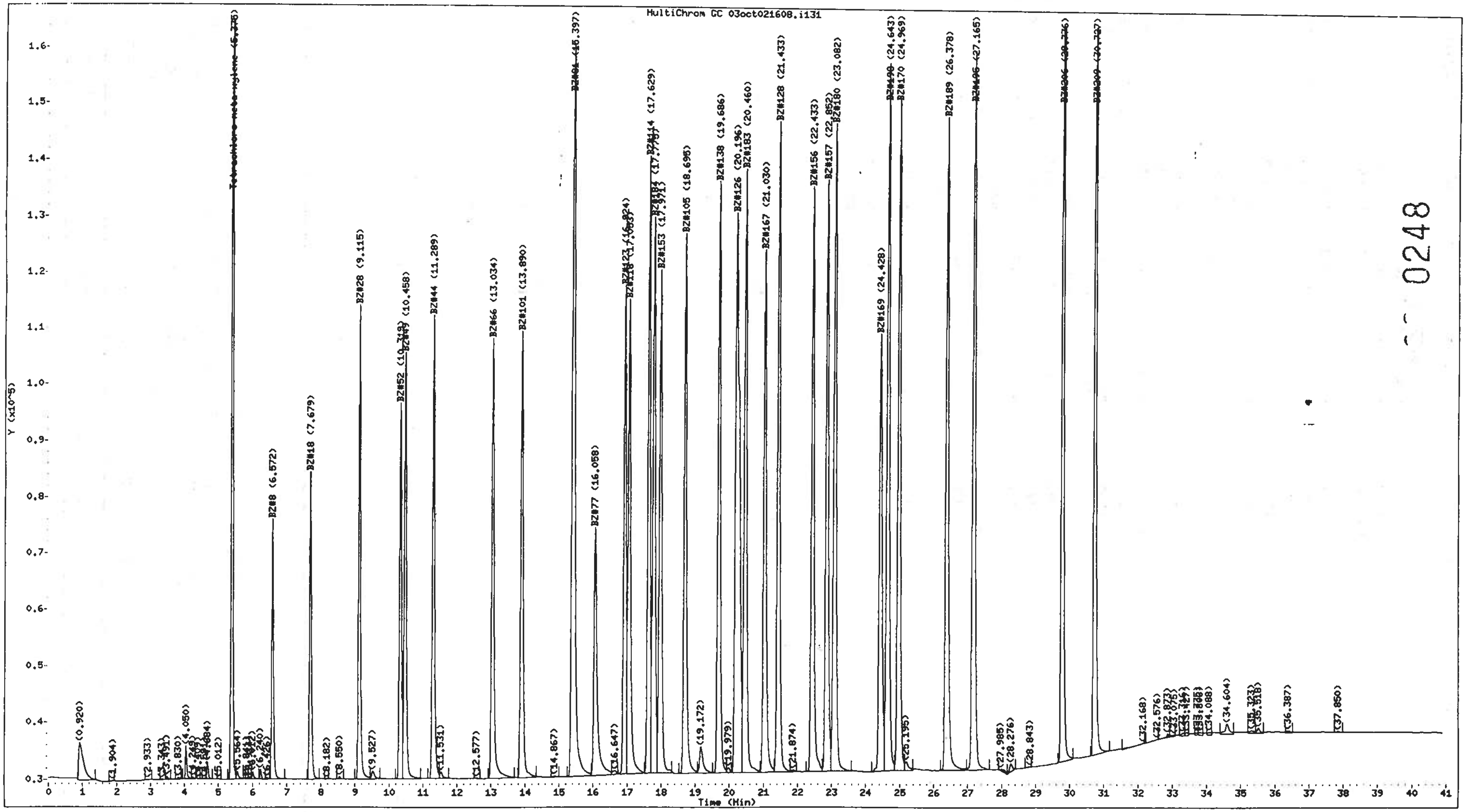
0247

# STL Burlington - Target GC Chromatogram

| Lab Sample ID: 32CONG-L3 | Client Sample ID: 32CONG-L3 |
|---|---|

Matrix : WATER
Analyst :
Instrument : 3327_2.i
Column : RTX-CLPII
Integrator : Falcon
Method : /var/chem/3327_2.i/100302_1/03OCT021608.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 09:55 rrm

Sample Type : CCALIB_3
Injection Date : 04-OCT-2002 08:55
Dilution Factor : 1.00
Data File : 03oct021608-r131.d
Compound Sublist: all



STL Burlington - Target GC Injection Report

Lab Sample ID: 32CONG-L3 Client Sample ID: 32CONG-L3

Matrix : WATER
Analyst : rrm
Instrument : 3327_2.i
Column : RTX-CLPII
Integrator : Falcon
Method : /var/chem/3327_2.i/100302_1/03OCT021608.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 09:55 rrm

Sample Type : CCALIB_3
Injection Date : 04-OCT-2002 08:55
Dilution Factor : 1.00
Data File : 03oct021608-r131.d
Compound Sublist: all

## Peaks

| | Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0.920 | | | 64359 | 6521 | | | |
| | 2 | 1.904 | | | 289 | 45 | | | |
| | 3 | 2.933 | | | 616 | 101 | | | |
| | 4 | 3.343 | | | 661 | 138 | | | |
| | 5 | 3.491 | | | 2047 | 618 | | | |
| | 6 | 3.830 | | | 1376 | 357 | | | |
| | 7 | 4.050 | | | 17908 | 5853 | | | |
| | 8 | 4.249 | | | 1629 | 352 | | | |
| | 9 | 4.409 | | | 664 | 146 | | | |
| | 10 | 4.591 | | | 687 | 145 | | | |
| | 11 | 4.684 | | | 8354 | 2981 | | | |
| | 12 | 5.012 | | | 280 | 96 | | | |
| $ | 13 | 5.375 | 5.391 | -0.016 | 580779 | 195973 | 51.8596 | R | Tetrachloro-meta-xylene |
| | 14 | 5.564 | | | 5113 | 1246 | | | |
| | 15 | 5.841 | | | 777 | 207 | | | |
| | 16 | 5.914 | | | 1318 | 319 | | | |
| | 17 | 6.012 | | | 4142 | 1234 | | | |
| | 18 | 6.240 | | | 4892 | 1685 | | | |
| | 19 | 6.426 | | | 854 | 267 | | | |
| | 20 | 6.572 | 6.592 | -0.020 | 163463 | 46064 | 52.8447 | | BZ#8 |
| | 21 | 7.679 | 7.698 | -0.020 | 211351 | 54485 | 54.0882 | | BZ#18 |
| | 22 | 8.182 | | | 498 | 104 | | | |
| | 23 | 8.550 | | | 1338 | 407 | | | |
| | 24 | 9.115 | 9.137 | -0.022 | 318505 | 84183 | 49.6846 | | BZ#28 |
| | 25 | 9.527 | | | 8810 | 1374 | | | |
| | 26 | 10.319 | 10.341 | -0.022 | 278685 | 66612 | 53.7404 | | BZ#52 |
| | 27 | 10.458 | 10.480 | -0.022 | 335799 | 75507 | 53.4056 | | BZ#49 |
| | 28 | 11.289 | 11.312 | -0.022 | 362664 | 82200 | 52.3383 | | BZ#44 |
| | 29 | 11.531 | | | 6998 | 1136 | | | |
| | 30 | 12.577 | | | 506 | 130 | | | |
| | 31 | 13.034 | 13.056 | -0.022 | 381371 | 78050 | 48.9100 | | BZ#66 |
| | 32 | 13.890 | 13.914 | -0.024 | 396670 | 79287 | 52.9876 | | BZ#101 |
| | 33 | 14.867 | | | 1148 | 231 | | | |
| | 34 | 15.397 | 15.421 | -0.024 | 834343 | 130361 | 101.406 | | BZ#81 |
| | 34 | 15.397 | 15.421 | -0.024 | 834343 | 130361 | 101.406 | M | BZ#87 |
| | 35 | 16.058 | 16.080 | -0.022 | 288688 | 44203 | 48.9910 | | BZ#77 |
| | 36 | 16.647 | | | 5140 | 674 | | | |
| | 37 | 16.924 | 16.946 | -0.022 | 416166 | 86893 | 50.9447 | | BZ#123 |
| | 38 | 17.053 | 17.075 | -0.022 | 465745 | 84432 | 51.2194 | | BZ#118 |
| | 39 | 17.629 | 17.656 | -0.027 | 512280 | 109715 | 48.3117 | | BZ#114 |
| | 40 | 17.775 | 17.802 | -0.027 | 518395 | 99002 | 53.4093 | | BZ#184 |
| | 41 | 17.971 | 17.995 | -0.024 | 482486 | 89611 | 53.3426 | | BZ#153 |
| | 42 | 18.695 | 18.720 | -0.024 | 486514 | 96099 | 48.4177 | | BZ#105 |
| | 43 | 19.172 | | | 34195 | 4641 | | | |
| | 44 | 19.686 | 19.713 | -0.027 | 545941 | 105307 | 52.4313 | | BZ#138 |
| | 45 | 19.979 | | | 4660 | 843 | | | |
| | 46 | 20.196 | 20.225 | -0.029 | 832899 | 99727 | 105.788 | | BZ#126 |
| | 46 | 20.196 | 20.225 | -0.029 | 832899 | 99727 | 105.788 | M | BZ#187 |
| | 47 | 20.460 | 20.489 | -0.029 | 594436 | 107521 | 52.7437 | | BZ#183 |
| | 48 | 21.030 | 21.061 | -0.031 | 513453 | 93206 | 52.8446 | | BZ#167 |
| | 49 | 21.433 | 21.462 | -0.029 | 598010 | 115900 | 51.9014 | | BZ#128 |
| | 50 | 21.874 | | | 2198 | 339 | | | |
| | 51 | 22.433 | 22.464 | -0.031 | 558175 | 104289 | 48.5970 | | BZ#156 |
| | 52 | 22.852 | 22.885 | -0.033 | 557772 | 105512 | 49.8614 | | BZ#157 |
| | 53 | 23.082 | 23.115 | -0.033 | 631171 | 115517 | 51.2824 | | BZ#180 |

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| 54 | 24.428 | 24.461 | -0.033 | 464111 | 77999 | 51.6920 | | BZ#169 |
| $ 55 | 24.643 | 24.678 | -0.035 | 691884 | 126334 | 53.0940 | R | BZ#198 |
| 56 | 24.969 | 25.004 | -0.035 | 643048 | 119627 | 51.3944 | | BZ#170 |
| 57 | 25.195 | | | 11331 | 1552 | | | |
| 58 | 26.378 | 26.412 | -0.033 | 647561 | 116626 | 51.2564 | | BZ#189 |
| 59 | 27.165 | 27.203 | -0.038 | 713968 | 128568 | 52.4934 | | BZ#195 |
| 60 | 27.985 | | | 4200 | 312 | | | |
| 61 | 28.276 | | | 7940 | 1367 | | | |
| 62 | 28.843 | | | 536 | 53 | | | |
| 63 | 29.776 | 29.805 | -0.029 | 723757 | 156717 | 54.8370 | M | BZ#206 |
| 64 | 30.727 | 30.754 | -0.027 | 674576 | 151895 | 55.9972 | M | BZ#209 |
| 65 | 32.168 | | | 3050 | 68 | | | |
| 66 | 32.576 | | | 571 | 31 | | | |
| 67 | 32.873 | | | 2618 | 553 | | | |
| 68 | 33.075 | | | 2046 | 251 | | | |
| 69 | 33.316 | | | 3249 | 529 | | | |
| 70 | 33.427 | | | 3284 | 583 | | | |
| 71 | 33.735 | | | 2416 | 421 | | | |
| 72 | 33.806 | | | 3482 | 505 | | | |
| 73 | 34.088 | | | 3643 | 449 | | | |
| 74 | 34.604 | | | 16497 | 1851 | | | |
| 75 | 35.323 | | | 4095 | 396 | | | |
| 76 | 35.518 | | | 5492 | 874 | | | |
| 77 | 36.387 | | | 2545 | 379 | | | |
| 78 | 37.850 | | | 1246 | 183 | | | |

Flags: A - Peak quantitates above calibration range
a - Peak quantitates below reporting limit
H - User selected alternate compound hit
M - Peak manually integrated or manually identified
R - Peak fails recovery
U - User disabled peak ID: either peak quantitates below reporting limit or peak identification not confirmed on second column

## Target Compounds

| Peak RT | Expected RT | Target Compound |
|---|---|---|
| 5.375 | 5.391 | Tetrachloro-meta-xylene |
| 6.572 | 6.592 | BZ#8 |
| 7.679 | 7.698 | BZ#18 |
| 9.115 | 9.137 | BZ#28 |
| 10.319 | 10.341 | BZ#52 |
| 10.458 | 10.480 | BZ#49 |
| 11.289 | 11.312 | BZ#44 |
| 13.034 | 13.056 | BZ#66 |
| 13.890 | 13.914 | BZ#101 |
| 15.397 | 15.421 | BZ#87 |
| 15.397 | 15.421 | BZ#81 |
| 16.058 | 16.080 | BZ#77 |
| 16.924 | 16.946 | BZ#123 |
| 17.053 | 17.075 | BZ#118 |
| 17.629 | 17.656 | BZ#114 |
| 17.775 | 17.802 | BZ#184 |
| 17.971 | 17.995 | BZ#153 |
| 18.695 | 18.720 | BZ#105 |
| 19.686 | 19.713 | BZ#138 |
| 20.196 | 20.225 | BZ#126 |
| 20.196 | 20.225 | BZ#187 |
| 20.460 | 20.489 | BZ#183 |
| 21.030 | 21.061 | BZ#167 |
| 21.433 | 21.462 | BZ#128 |
| 22.433 | 22.464 | BZ#156 |
| 22.852 | 22.885 | BZ#157 |
| 23.082 | 23.115 | BZ#180 |
| 24.428 | 24.461 | BZ#169 |
| 24.643 | 24.678 | BZ#198 |
| 24.969 | 25.004 | BZ#170 |

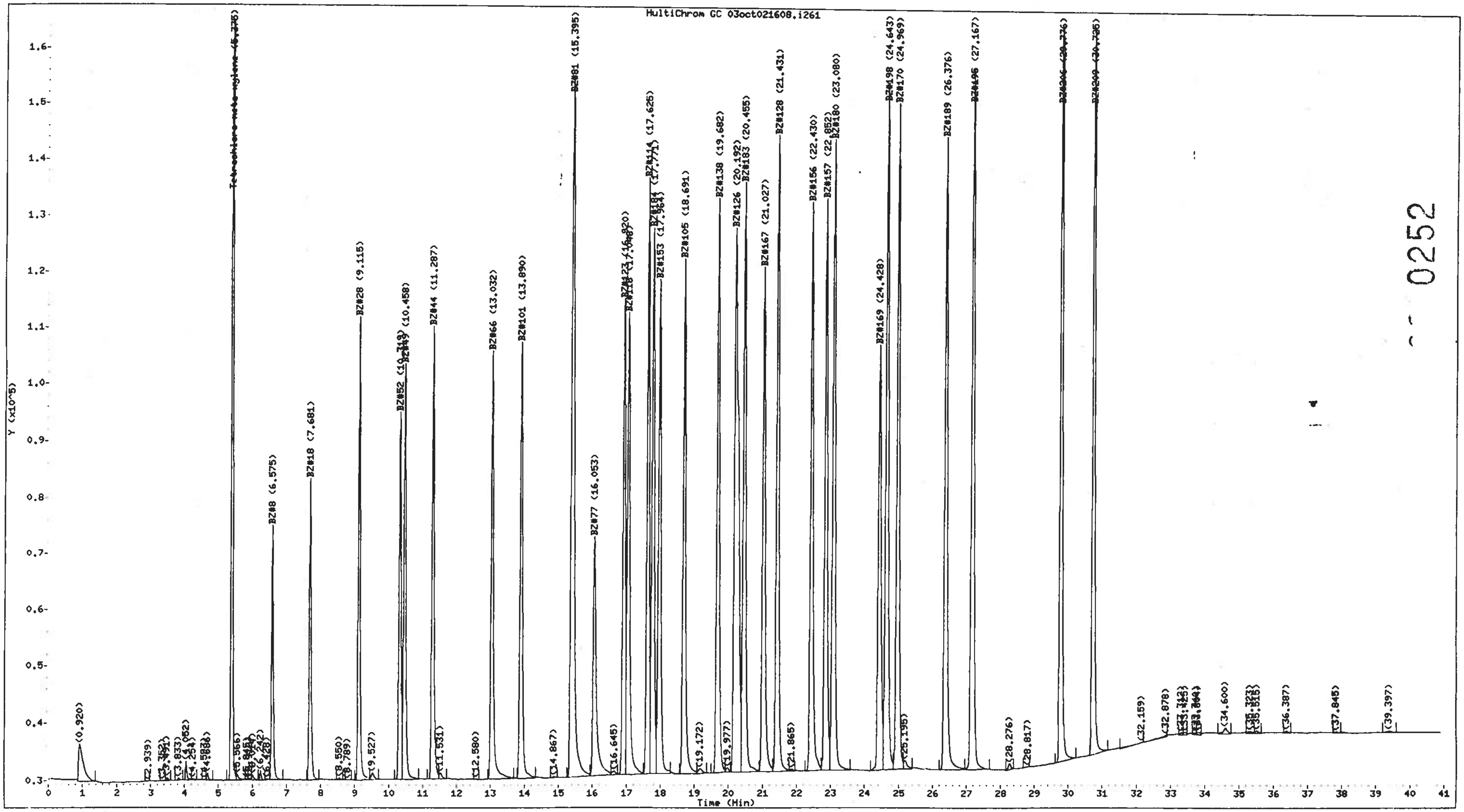
```
  Peak      Expected
   RT          RT                    Target Compound
========    ========    ======================================
  26.378      26.412    BZ#189
  27.165      27.203    BZ#195
  29.776      29.805    BZ#206
  30.727      30.754    BZ#209
```

# STL Burlington - Target GC Chromatogram

| | | | |
|---|---|---|---|
| Lab Sample ID: | 32CONG-L3 | Client Sample ID: | 32CONG-L3 |

Matrix : WATER
Analyst :
Instrument : 3327_2.i
Column : RTX-CLPII
Integrator : Falcon
Method : /var/chem/3327_2.i/100302_1/03OCT021608.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 09:58 rrm

Sample Type : CCALIB_3
Injection Date : 04-OCT-2002 18:41
Dilution Factor : 1.00
Data File : 03oct021608-r261.d
Compound Sublist: all



# STL Burlington - Target GC Injection Report

Lab Sample ID: 32CONG-L3 Client Sample ID: 32CONG-L3

| | | | |
|---|---|---|---|
| Matrix | : WATER | Sample Type | : CCALIB_3 |
| Analyst | : | Injection Date | : 04-OCT-2002 18:41 |
| Instrument | : 3327_2.i | Dilution Factor | : 1.00 |
| Column | : RTX-CLPII | Data File | : 03oct021608-r261.d |
| Integrator | : Falcon | Compound Sublist | : all |

Method : /var/chem/3327_2.i/100302_1/03OCT021608.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 09:58 rrm

## Peaks

| | Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0.920 | | | 64738 | 6498 | | | |
| | 2 | 2.939 | | | 243 | 48 | | | |
| | 3 | 3.352 | | | 458 | 95 | | | |
| | 4 | 3.491 | | | 2013 | 609 | | | |
| | 5 | 3.833 | | | 1692 | 379 | | | |
| | 6 | 4.052 | | | 10970 | 3324 | | | |
| | 7 | 4.254 | | | 1731 | 301 | | | |
| | 8 | 4.593 | | | 820 | 149 | | | |
| | 9 | 4.686 | | | 3895 | 1254 | | | |
| $ | 10 | 5.375 | 5.391 | -0.016 | 567376 | 190613 | 50.4586 | R | Tetrachloro-meta-xylene |
| | 11 | 5.566 | | | 5569 | 1041 | | | |
| | 12 | 5.845 | | | 866 | 210 | | | |
| | 13 | 5.916 | | | 1479 | 340 | | | |
| | 14 | 6.014 | | | 3408 | 939 | | | |
| | 15 | 6.242 | | | 4764 | 1642 | | | |
| | 16 | 6.428 | | | 864 | 265 | | | |
| | 17 | 6.575 | 6.592 | -0.018 | 160264 | 45095 | 51.7032 | | BZ#8 |
| | 18 | 7.681 | 7.698 | -0.018 | 207035 | 53375 | 52.9316 | | BZ#18 |
| | 19 | 8.550 | | | 1337 | 409 | | | |
| | 20 | 8.789 | | | 389 | 75 | | | |
| | 21 | 9.115 | 9.137 | -0.022 | 310526 | 81944 | 48.3916 | | BZ#28 |
| | 22 | 9.527 | | | 7284 | 1148 | | | |
| | 23 | 10.319 | 10.341 | -0.022 | 276578 | 64956 | 52.3491 | | BZ#52 |
| | 24 | 10.458 | 10.480 | -0.022 | 328493 | 73491 | 51.9347 | | BZ#49 |
| | 25 | 11.287 | 11.312 | -0.024 | 352765 | 80127 | 50.9959 | | BZ#44 |
| | 26 | 11.531 | | | 6423 | 1065 | | | |
| | 27 | 12.580 | | | 491 | 124 | | | |
| | 28 | 13.032 | 13.056 | -0.024 | 371825 | 75749 | 47.5176 | | BZ#66 |
| | 29 | 13.890 | 13.914 | -0.024 | 388283 | 77257 | 51.5988 | | BZ#101 |
| | 30 | 14.867 | | | 986 | 211 | | | |
| | 31 | 15.395 | 15.421 | -0.027 | 809681 | 124577 | 97.0218 | | BZ#81 |
| | 31 | 15.395 | 15.421 | -0.027 | 809681 | 124577 | 97.0218 | M | BZ#87 |
| | 32 | 16.053 | 16.080 | -0.027 | 277981 | 42477 | 47.1760 | | BZ#77 |
| | 33 | 16.645 | | | 4795 | 638 | | | |
| | 34 | 16.920 | 16.946 | -0.027 | 405350 | 84394 | 49.5150 | | BZ#123 |
| | 35 | 17.048 | 17.075 | -0.027 | 457104 | 81858 | 49.6885 | | BZ#118 |
| | 36 | 17.625 | 17.656 | -0.031 | 496145 | 105804 | 46.6810 | | BZ#114 |
| | 37 | 17.771 | 17.802 | -0.031 | 511893 | 96980 | 52.2909 | | BZ#184 |
| | 38 | 17.964 | 17.995 | -0.031 | 472709 | 87857 | 52.2799 | | BZ#153 |
| | 39 | 18.691 | 18.720 | -0.029 | 473413 | 91495 | 46.2311 | | BZ#105 |
| | 40 | 19.172 | | | 7380 | 853 | | | |
| | 41 | 19.682 | 19.713 | -0.031 | 531840 | 102094 | 50.8389 | | BZ#138 |
| | 42 | 19.977 | | | 4782 | 845 | | | |
| | 43 | 20.192 | 20.225 | -0.033 | 809994 | 96781 | 102.603 | | BZ#126 |
| | 43 | 20.192 | 20.225 | -0.033 | 809994 | 96781 | 102.603 | M | BZ#187 |
| | 44 | 20.455 | 20.489 | -0.033 | 583276 | 104819 | 51.4048 | | BZ#183 |
| | 45 | 21.027 | 21.061 | -0.033 | 500783 | 89813 | 50.9465 | | BZ#167 |
| | 46 | 21.431 | 21.462 | -0.031 | 584429 | 113182 | 50.7072 | | BZ#128 |
| | 47 | 21.865 | | | 2665 | 367 | | | |
| | 48 | 22.430 | 22.464 | -0.033 | 543456 | 101226 | 47.2394 | | BZ#156 |
| | 49 | 22.852 | 22.885 | -0.033 | 542760 | 101734 | 48.1441 | | BZ#157 |
| | 50 | 23.080 | 23.115 | -0.035 | 617879 | 112310 | 49.8710 | | BZ#180 |
| | 51 | 24.428 | 24.461 | -0.033 | 449669 | 75608 | 50.1409 | | BZ#169 |
| $ | 52 | 24.643 | 24.678 | -0.035 | 676653 | 122549 | 51.4985 | R | BZ#198 |
| | 53 | 24.969 | 25.004 | -0.035 | 627201 | 118748 | 51.0224 | | BZ#170 |

# STL Burlington - Target GC Injection Report

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| 54 | 25.195 | | | 11887 | 1551 | | | |
| 55 | 26.376 | 26.412 | -0.035 | 629862 | 112660 | 49.5577 | | BZ#189 |
| 56 | 27.167 | 27.203 | -0.035 | 695396 | 125244 | 51.1466 | | BZ#195 |
| 57 | 28.276 | | | 5561 | 1075 | | | |
| 58 | 28.817 | | | 347 | 51 | | | |
| 59 | 29.776 | 29.805 | -0.029 | 707878 | 152759 | 53.4305 | M | BZ#206 |
| 60 | 30.725 | 30.754 | -0.029 | 658513 | 147878 | 54.4575 | M | BZ#209 |
| 61 | 32.159 | | | 3032 | 101 | | | |
| 62 | 32.878 | | | 3610 | 266 | | | |
| 63 | 33.312 | | | 2560 | 505 | | | |
| 64 | 33.425 | | | 3074 | 556 | | | |
| 65 | 33.740 | | | 2236 | 376 | | | |
| 66 | 33.804 | | | 3324 | 461 | | | |
| 67 | 34.600 | | | 10180 | 1045 | | | |
| 68 | 35.323 | | | 2879 | 293 | | | |
| 69 | 35.515 | | | 2563 | 404 | | | |
| 70 | 36.387 | | | 1955 | 326 | | | |
| 71 | 37.845 | | | 862 | 139 | | | |
| 72 | 39.397 | | | 3062 | 251 | | | |

Flags:
A - Peak quantitates above calibration range
a - Peak quantitates below reporting limit
H - User selected alternate compound hit
M - Peak manually integrated or manually identified
R - Peak fails recovery
U - User disabled peak ID: either peak quantitates below reporting limit or peak identification not confirmed on second column

## Target Compounds

| Peak RT | Expected RT | Target Compound |
|---|---|---|
| 5.375 | 5.391 | Tetrachloro-meta-xylene |
| 6.575 | 6.592 | BZ#8 |
| 7.681 | 7.698 | BZ#18 |
| 9.115 | 9.137 | BZ#28 |
| 10.319 | 10.341 | BZ#52 |
| 10.458 | 10.480 | BZ#49 |
| 11.287 | 11.312 | BZ#44 |
| 13.032 | 13.056 | BZ#66 |
| 13.890 | 13.914 | BZ#101 |
| 15.395 | 15.421 | BZ#87 |
| 15.395 | 15.421 | BZ#81 |
| 16.053 | 16.080 | BZ#77 |
| 16.920 | 16.946 | BZ#123 |
| 17.048 | 17.075 | BZ#118 |
| 17.625 | 17.656 | BZ#114 |
| 17.771 | 17.802 | BZ#184 |
| 17.964 | 17.995 | BZ#153 |
| 18.691 | 18.720 | BZ#105 |
| 19.682 | 19.713 | BZ#138 |
| 20.192 | 20.225 | BZ#126 |
| 20.192 | 20.225 | BZ#187 |
| 20.455 | 20.489 | BZ#183 |
| 21.027 | 21.061 | BZ#167 |
| 21.431 | 21.462 | BZ#128 |
| 22.430 | 22.464 | BZ#156 |
| 22.852 | 22.885 | BZ#157 |
| 23.080 | 23.115 | BZ#180 |
| 24.428 | 24.461 | BZ#169 |
| 24.643 | 24.678 | BZ#198 |
| 24.969 | 25.004 | BZ#170 |
| 26.376 | 26.412 | BZ#189 |
| 27.167 | 27.203 | BZ#195 |
| 29.776 | 29.805 | BZ#206 |
| 30.725 | 30.754 | BZ#209 |

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# PCB CONGENERS

# RAW QC DATA

FORM 1
OTHER ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

PBLK08

Lab Name: STL BURLINGTON Contract: 22000

Lab Code: STLVT Case No.: 22000 SAS No.: SDG No.: 89891

Matrix: (soil/water) SOIL Lab Sample ID: PBLK08

Sample wt/vol: 30.0 (g/mL) G Lab File ID: 03OCT021608-R011

% Moisture: 0 decanted: (Y/N) N Date Received: ________

Extraction: (SepF/Cont/Sonc) SOXH Date Extracted: 09/26/02

Concentrated Extract Volume: 10(mL) Date Analyzed: 10/03/02

Injection Volume: 1.0(uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: ___ Sulfur Cleanup: (Y/N) Y

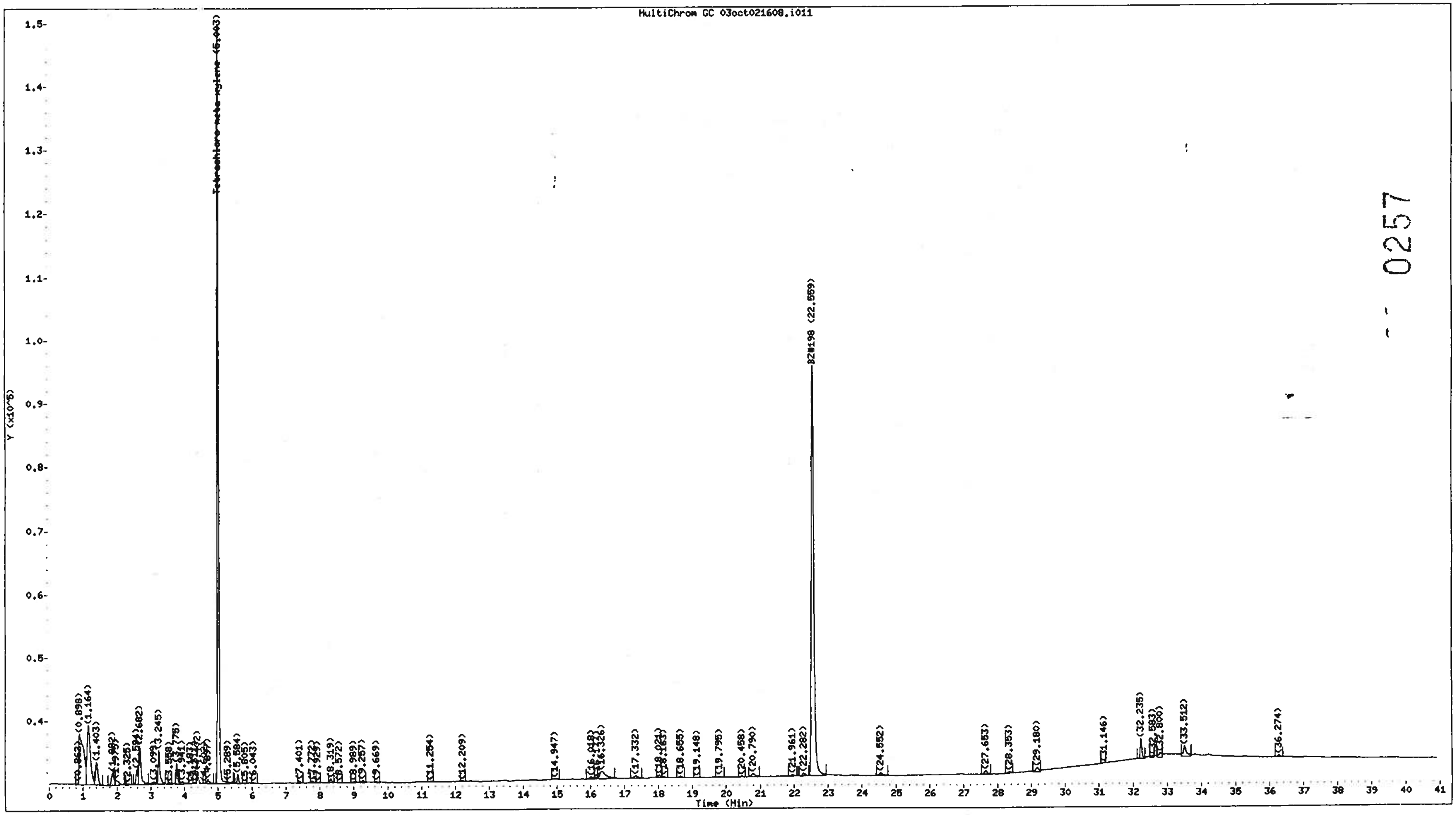
| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG | Q |
|---|---|---|---|
| 34883-43-7 | BZ#8 | 1.7 | U |
| 37680-65-2 | BZ#18 | 1.7 | U |
| 7012-37-5 | BZ#28 | 1.7 | U |
| 41464-39-5 | BZ#44 | 1.7 | U |
| 35693-99-3 | BZ#52 | 1.7 | U |
| 32598-10-0 | BZ#66 | 1.7 | U |
| 32598-13-3 | BZ#77 | 1.7 | U |
| 37680-73-2 | BZ#101 | 1.7 | U |
| 32598-14-4 | BZ#105 | 1.7 | U |
| 31508-00-6 | BZ#118 | 1.7 | U |
| 57465-28-8 | BZ#126 | 1.7 | U |
| 38380-07-3 | BZ#128 | 1.7 | U |
| 35065-28-2 | BZ#138 | 1.7 | U |
| 35065-27-1 | BZ#153 | 1.7 | U |
| 35065-30-6 | BZ#170 | 1.7 | U |
| 35065-29-3 | BZ#180 | 1.7 | U |
| 52663-68-0 | BZ#187 | 1.7 | U |
| 52663-78-2 | BZ#195 | 1.7 | U |
| 40186-72-9 | BZ#206 | 1.7 | U |
| 2051-24-3 | BZ#209 | 1.7 | U |

# STL Burlington - Target GC Chromatogram

| Lab Sample ID: PBLK08 | Client Sample ID: PBLK08 |
|---|---|

Matrix : SOIL
Analyst :
Instrument : 3327_1.i
Column : RTX-5
Integrator : Falcon
Method : /var/chem/3327_1.i/100302_1/03OCT021608.b/32CONG_3327RTX5_RAW.m
Reported : 17-Oct-2002 09:43 rrm

Sample Type : BLANK
Injection Date : 03-OCT-2002 23:55
Dilution Factor : 1.00
Data File : 03oct021608-r011.d
Compound Sublist: ENVNET



# STL Burlington - Target GC Injection Report

Lab Sample ID: PBLKO8 Client Sample ID: PBLKO8

Matrix : SOIL
Analyst :
Instrument : 3327_1.i
Column : RTX-5
Integrator : Falcon
Method : /var/chem/3327_1.i/100302_1/03OCT021608.b/32CONG_3327RTX5_RAW.m
Reported : 17-Oct-2002 09:43 rrm

Sample Type : BLANK
Injection Date : 03-OCT-2002 23:55
Dilution Factor : 1.00
Data File : 03oct021608-r011.d
Compound Sublist: ENVNET

## Peaks

| | Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0.862 | | | 775 | 338 | | | |
| | 2 | 0.898 | | | 76586 | 7903 | | | |
| | 3 | 1.164 | | | 61824 | 9228 | | | |
| | 4 | 1.403 | | | 17160 | 3465 | | | |
| | 5 | 1.882 | | | 9955 | 1919 | | | |
| | 6 | 1.975 | | | 5945 | 744 | | | |
| | 7 | 2.325 | | | 852 | 170 | | | |
| | 8 | 2.594 | | | 8726 | 2344 | | | |
| | 9 | 2.682 | | | 26803 | 5901 | | | |
| | 10 | 3.099 | | | 2855 | 391 | | | |
| | 11 | 3.245 | | | 19183 | 5194 | | | |
| | 12 | 3.558 | | | 650 | 218 | | | |
| | 13 | 3.775 | | | 9590 | 3137 | | | |
| | 14 | 3.941 | | | 2855 | 346 | | | |
| | 15 | 4.183 | | | 587 | 128 | | | |
| | 16 | 4.311 | | | 906 | 255 | | | |
| | 17 | 4.402 | | | 5502 | 1845 | | | |
| | 18 | 4.602 | | | 574 | 195 | | | |
| | 19 | 4.697 | | | 3247 | 653 | | | |
| $ | 20 | 5.003 | 5.001 | 0.002 | 348559 | 137649 | 43.6738 | | Tetrachloro-meta-xylene |
| | 21 | 5.289 | | | 2042 | 275 | | | |
| | 22 | 5.584 | | | 4379 | 1420 | | | |
| | 23 | 5.805 | | | 421 | 79 | | | |
| | 24 | 6.043 | | | 483 | 171 | | | |
| | 25 | 7.401 | | | 1095 | 375 | | | |
| | 26 | 7.772 | | | 1182 | 283 | | | |
| | 27 | 7.929 | | | 403 | 104 | | | |
| | 28 | 8.319 | | | 2023 | 600 | | | |
| | 29 | 8.572 | | | 273 | 75 | | | |
| | 30 | 8.989 | | | 581 | 119 | | | |
| | 31 | 9.257 | | | 1500 | 286 | | | |
| | 32 | 9.669 | | | 656 | 133 | | | |
| | 33 | 11.254 | | | 439 | 94 | | | |
| | 34 | 12.209 | | | 649 | 135 | | | |
| | 35 | 14.947 | | | 672 | 125 | | | |
| | 36 | 16.018 | | | 2247 | 316 | | | |
| | 37 | 16.177 | | | 674 | 149 | | | |
| | 38 | 16.326 | | | 14527 | 1134 | | | |
| | 39 | 17.332 | | | 2853 | 383 | | | |
| | 40 | 18.021 | | | 2243 | 460 | | | |
| | 41 | 18.163 | | | 1140 | 238 | | | |
| | 42 | 18.655 | | | 1669 | 290 | | | |
| | 43 | 19.148 | | | 439 | 89 | | | |
| | 44 | 19.795 | | | 1117 | 167 | | | |
| | 45 | 20.458 | | | 871 | 164 | | | |
| | 46 | 20.790 | | | 3803 | 521 | | | |
| | 47 | 21.961 | | | 1572 | 259 | | | |
| | 48 | 22.282 | | | 2363 | 412 | | | |
| $ | 49 | 22.559 | 22.559 | 0.000 | 340615 | 64730 | 43.3796 | | BZ#198 |
| | 50 | 24.552 | | | 2747 | 416 | | | |
| | 51 | 27.653 | | | 2736 | 499 | | | |
| | 52 | 28.353 | | | 1295 | 248 | | | |
| | 53 | 29.180 | | | 4741 | 677 | | | |
| | 54 | 31.146 | | | 195 | 54 | | | |
| | 55 | 32.235 | | | 10572 | 3153 | | | |

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| 56 | 32.583 | | | 1787 | 291 | | | |
| 57 | 32.800 | | | 4849 | 768 | | | |
| 58 | 33.512 | | | 11376 | 1661 | | | |
| 59 | 36.274 | | | 1339 | 284 | | | |

Flags:
- A - Peak quantitates above calibration range
- a - Peak quantitates below reporting limit
- H - User selected alternate compound hit
- M - Peak manually integrated or manually identified
- R - Peak fails recovery
- U - User disabled peak ID: either peak quantitates below reporting limit or peak identification not confirmed on second column

## Target Compounds

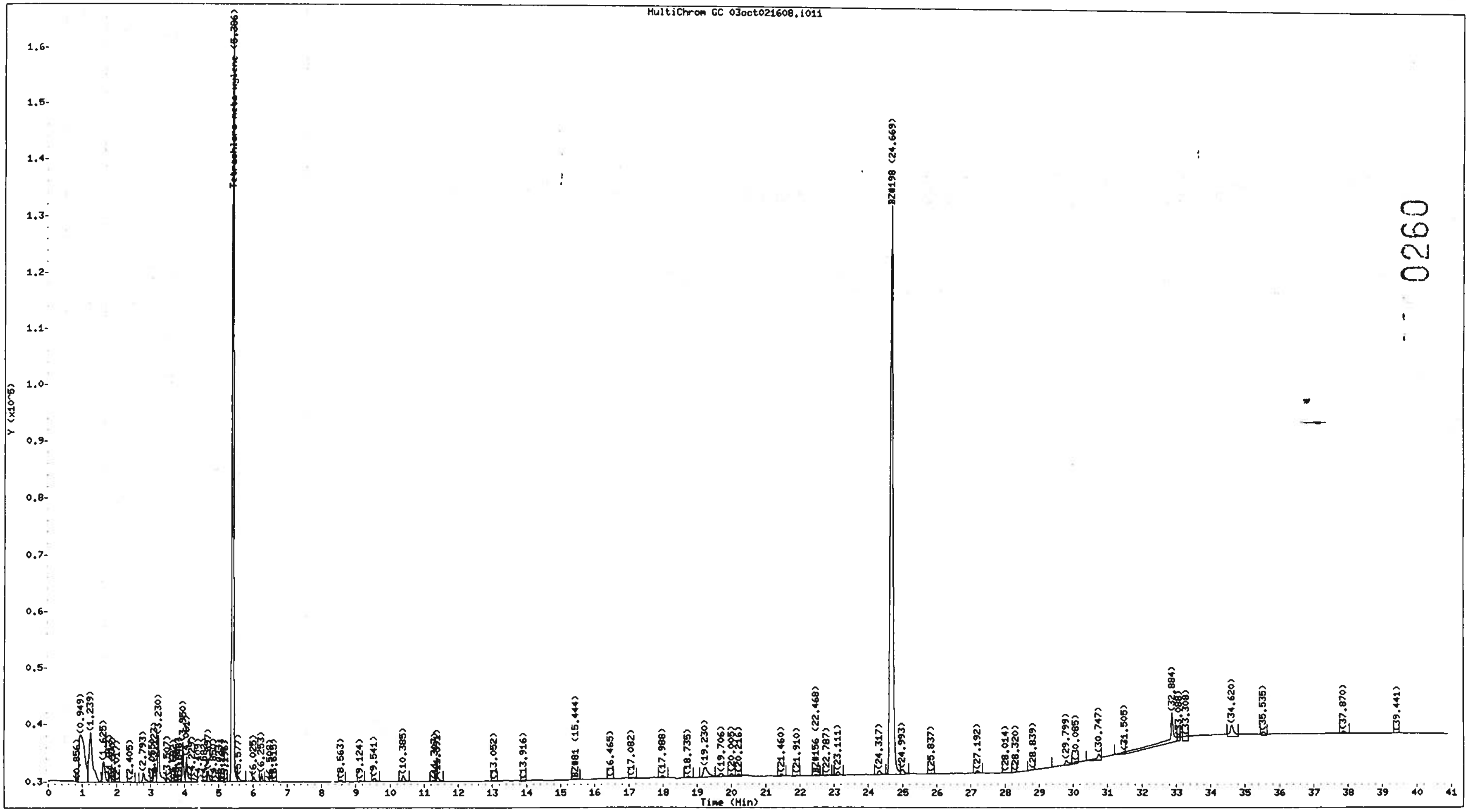
| Peak RT | Expected RT | Target Compound |
|---|---|---|
| 5.003 | 5.001 | Tetrachloro-meta-xylene |
| | 5.761 | BZ#8 |
| | 6.701 | BZ#18 |
| | 7.925 | BZ#28 |
| | 8.984 | BZ#52 |
| | 9.667 | BZ#44 |
| | 11.243 | BZ#66 |
| | 12.207 | BZ#101 |
| | 13.752 | BZ#77 |
| | 14.938 | BZ#118 |
| | 15.993 | BZ#153 |
| | 16.155 | BZ#105 |
| | 17.328 | BZ#138 |
| | 17.762 | BZ#126 |
| | 18.647 | BZ#128 |
| | 20.781 | BZ#180 |
| | 22.271 | BZ#170 |
| 22.559 | 22.559 | BZ#198 |
| | 24.552 | BZ#195 |
| | 27.655 | BZ#206 |
| | 29.180 | BZ#209 |

# STL Burlington - Target GC Chromatogram

| Lab Sample ID: PBLKO8 | Client Sample ID: PBLKO8 |
|---|---|

Matrix : SOIL
Analyst :
Instrument : 3327_2.i
Column : RTX-CLPII
Integrator : Falcon
Method : /var/chem/3327_2.i/100302_1/03OCT021608.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 09:53 rrm

Sample Type : BLANK
Injection Date : 03-OCT-2002 23:55
Dilution Factor : 1.00
Data File : 03oct021608-r011.d
Compound Sublist: ENVNET



# STL Burlington - Target GC Injection Report

Lab Sample ID: PBLK08 Client Sample ID: PBLK08

Matrix : SOIL
Analyst :
Instrument : 3327_2.i
Column : RTX-CLPII
Integrator : Falcon
Method : /var/chem/3327_2.i/100302_1/03OCT021608.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 09:53 rrm

Sample Type : BLANK
Injection Date : 03-OCT-2002 23:55
Dilution Factor : 1.00
Data File : 03oct021608-r011.d
Compound Sublist: ENVNET

## Peaks

| | Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0.856 | | | 469 | 202 | | | |
| | 2 | 0.949 | | | 95413 | 8172 | | | |
| | 3 | 1.239 | | | 63917 | 8585 | | | |
| | 4 | 1.625 | | | 17619 | 3549 | | | |
| | 5 | 1.813 | | | 3540 | 1010 | | | |
| | 6 | 1.900 | | | 2194 | 638 | | | |
| | 7 | 2.017 | | | 327 | 84 | | | |
| | 8 | 2.405 | | | 980 | 152 | | | |
| | 9 | 2.793 | | | 9249 | 1714 | | | |
| | 10 | 3.055 | | | 1086 | 327 | | | |
| | 11 | 3.123 | | | 11540 | 3214 | | | |
| | 12 | 3.230 | | | 35064 | 8122 | | | |
| | 13 | 3.507 | | | 4068 | 792 | | | |
| | 14 | 3.682 | | | 909 | 216 | | | |
| | 15 | 3.766 | | | 1973 | 425 | | | |
| | 16 | 3.846 | | | 2348 | 531 | | | |
| | 17 | 3.950 | | | 19437 | 6885 | | | |
| | 18 | 4.061 | | | 15641 | 4330 | | | |
| | 19 | 4.229 | | | 5120 | 657 | | | |
| | 20 | 4.409 | | | 2496 | 340 | | | |
| | 21 | 4.582 | | | 1606 | 300 | | | |
| | 22 | 4.697 | | | 6680 | 1966 | | | |
| | 23 | 4.850 | | | 1758 | 316 | | | |
| | 24 | 5.023 | | | 308 | 113 | | | |
| | 25 | 5.107 | | | 757 | 216 | | | |
| | 26 | 5.196 | | | 223 | 64 | | | |
| $ | 27 | 5.386 | 5.391 | -0.004 | 476174 | 163068 | 43.2586 | | Tetrachloro-meta-xylene |
| | 28 | 5.577 | | | 4995 | 929 | | | |
| | 29 | 6.025 | | | 3123 | 882 | | | |
| | 30 | 6.253 | | | 3964 | 1376 | | | |
| | 31 | 6.508 | | | 255 | 98 | | | |
| | 32 | 6.615 | | | 434 | 159 | | | |
| | 33 | 8.563 | | | 1290 | 362 | | | |
| | 34 | 9.124 | | | 989 | 185 | | | |
| | 35 | 9.541 | | | 3070 | 602 | | | |
| | 36 | 10.385 | | | 5442 | 1057 | | | |
| | 37 | 11.307 | | | 709 | 146 | | | |
| | 38 | 11.391 | | | 4319 | 724 | | | |
| | 39 | 13.052 | | | 550 | 108 | | | |
| | 40 | 13.916 | | | 1118 | 211 | | | |
| | 41 | 15.444 | | | 1284 | 141 | | | |
| | 42 | 16.465 | | | 444 | 89 | | | |
| | 43 | 17.082 | | | 1542 | 210 | | | |
| | 44 | 17.988 | | | 2696 | 414 | | | |
| | 45 | 18.735 | | | 1654 | 246 | | | |
| | 46 | 19.230 | | | 16678 | 1726 | | | |
| | 47 | 19.706 | | | 5237 | 583 | | | |
| | 48 | 20.005 | | | 2850 | 553 | | | |
| | 49 | 20.216 | | | 2655 | 423 | | | |
| | 50 | 21.460 | | | 2172 | 372 | | | |
| | 51 | 21.910 | | | 794 | 168 | | | |
| | 52 | 22.468 | | | 1417 | 241 | | | |
| | 53 | 22.787 | | | 1234 | 129 | | | |
| | 54 | 23.111 | | | 4004 | 639 | | | |
| | 55 | 24.317 | | | 4799 | 719 | | | |

# STL Burlington - Target GC Injection Report

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| $ 56 | 24.669 | 24.678 | -0.009 | 549928 | 101003 | 42.4161 | | BZ#198 |
| 57 | 24.993 | | | 6445 | 828 | | | |
| 58 | 25.837 | | | 1073 | 136 | | | |
| 59 | 27.192 | | | 2516 | 470 | | | |
| 60 | 28.014 | | | 906 | 115 | | | |
| 61 | 28.320 | | | 275 | 41 | | | |
| 62 | 28.839 | | | 590 | 52 | | | |
| 63 | 29.799 | | | 7306 | 929 | | | |
| 64 | 30.085 | | | 2876 | 369 | | | |
| 65 | 30.747 | | | 10099 | 1150 | | | |
| 66 | 31.505 | | | 3669 | 387 | | | |
| 67 | 32.884 | | | 57309 | 5226 | | | |
| 68 | 33.088 | | | 3643 | 704 | | | |
| 69 | 33.308 | | | 7502 | 818 | | | |
| 70 | 34.620 | | | 17728 | 2059 | | | |
| 71 | 35.535 | | | 3884 | 596 | | | |
| 72 | 37.870 | | | 2739 | 447 | | | |
| 73 | 39.441 | | | 641 | 95 | | | |

Flags: A - Peak quantitates above calibration range
a - Peak quantitates below reporting limit
H - User selected alternate compound hit
M - Peak manually integrated or manually identified
R - Peak fails recovery
U - User disabled peak ID: either peak quantitates below reporting limit or peak identification not confirmed on second column

## Target Compounds

| Peak RT | Expected RT | Target Compound |
|---|---|---|
| 5.386 | 5.391 | Tetrachloro-meta-xylene |
| | 6.592 | BZ#8 |
| | 7.698 | BZ#18 |
| | 9.137 | BZ#28 |
| | 10.341 | BZ#52 |
| | 11.312 | BZ#44 |
| | 13.056 | BZ#66 |
| | 13.914 | BZ#101 |
| | 16.080 | BZ#77 |
| | 17.075 | BZ#118 |
| | 17.995 | BZ#153 |
| | 18.720 | BZ#105 |
| | 19.713 | BZ#138 |
| | 20.225 | BZ#126 |
| | 21.462 | BZ#128 |
| | 23.115 | BZ#180 |
| 24.669 | 24.678 | BZ#198 |
| | 25.004 | BZ#170 |
| | 27.203 | BZ#195 |
| | 29.805 | BZ#206 |
| | 30.754 | BZ#209 |

FORM 1
OTHER ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

PIBLK_SCU

Lab Name: STL BURLINGTON Contract: 22000

Lab Code: STLVT Case No.: 22000 SAS No.: SDG No.: 89891

Matrix: (soil/water) SOIL Lab Sample ID: PIBLK_SCU

Sample wt/vol: 30.0 (g/mL) G Lab File ID: 03OCT021608-R141

% Moisture: 0 decanted: (Y/N) N Date Received: ________

Extraction: (SepF/Cont/Sonc) OTHER Date Extracted:

Concentrated Extract Volume: 10(mL) Date Analyzed: 10/04/02

Injection Volume: 1.0(uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: ___ Sulfur Cleanup: (Y/N) Y

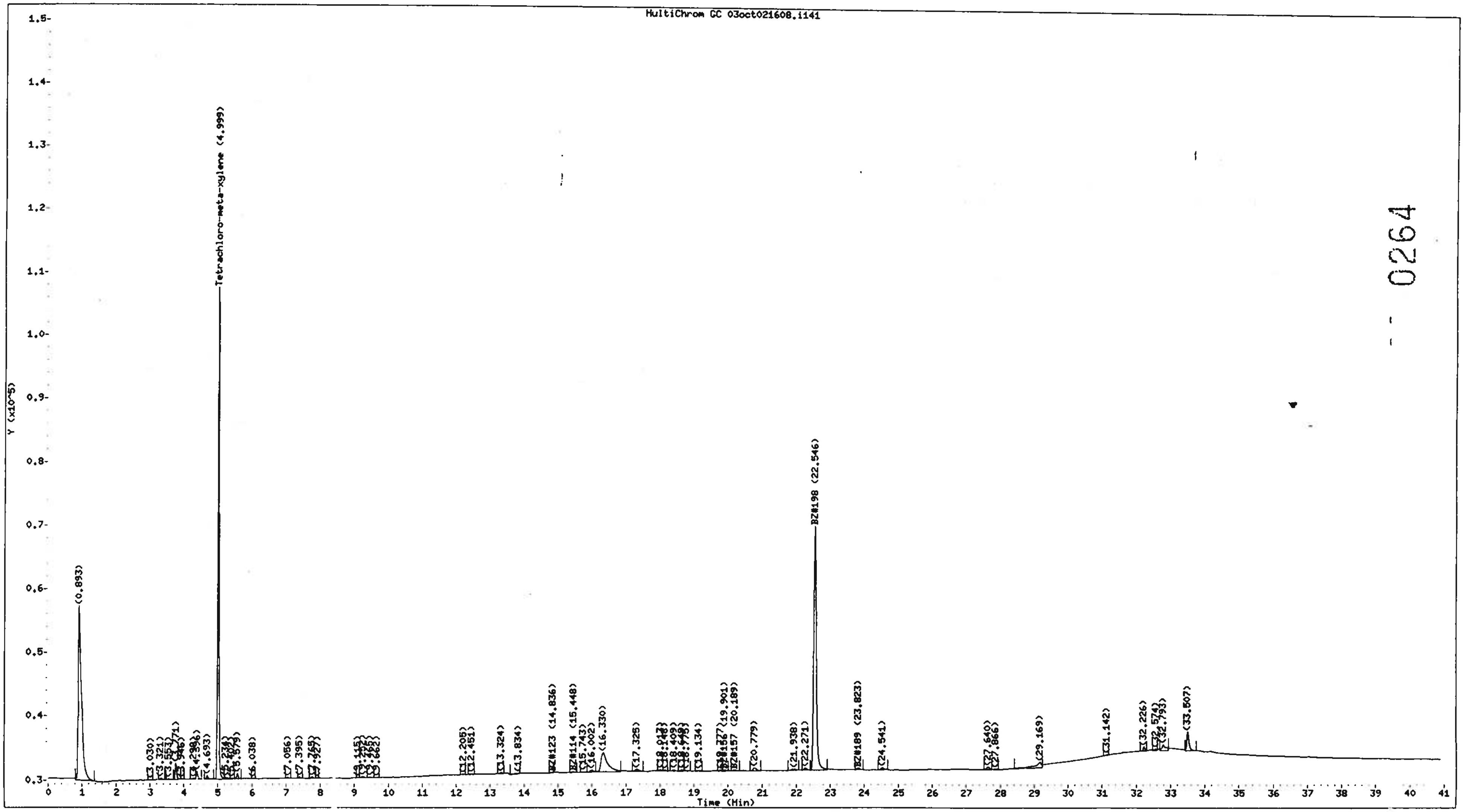
| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG | Q |
|---|---|---|---|
| 34883-43-7 | BZ#8 | 1.7 | U |
| 37680-65-2 | BZ#18 | 1.7 | U |
| 7012-37-5 | BZ#28 | 1.7 | U |
| 41464-39-5 | BZ#44 | 1.7 | U |
| 35693-99-3 | BZ#52 | 1.7 | U |
| 32598-10-0 | BZ#66 | 1.7 | U |
| 32598-13-3 | BZ#77 | 1.7 | U |
| 37680-73-2 | BZ#101 | 1.7 | U |
| 32598-14-4 | BZ#105 | 1.7 | U |
| 31508-00-6 | BZ#118 | 1.7 | U |
| 57465-28-8 | BZ#126 | 1.7 | U |
| 38380-07-3 | BZ#128 | 1.7 | U |
| 35065-28-2 | BZ#138 | 1.7 | U |
| 35065-27-1 | BZ#153 | 1.7 | U |
| 35065-30-6 | BZ#170 | 1.7 | U |
| 35065-29-3 | BZ#180 | 1.7 | U |
| 52663-68-0 | BZ#187 | 1.7 | U |
| 52663-78-2 | BZ#195 | 1.7 | U |
| 40186-72-9 | BZ#206 | 1.7 | U |
| 2051-24-3 | BZ#209 | 1.7 | U |

STL Burlington - Target GC Chromatogram

Lab Sample ID: PIBLK_SCU    Client Sample ID: PIBLK_SCU

Matrix : SOIL
Analyst :
Instrument : 3327_1.i
Column : RTX-5
Integrator : Falcon
Method : /var/chem/3327_1.i/100302_1/03OCT021608.b/32CONG_3327RTX5_RAW.m
Reported : 17-Oct-2002 10:24 rrm

Sample Type : BLANK
Injection Date : 04-OCT-2002 09:40
Dilution Factor : 1.00
Data File : 03oct021608-r141.d
Compound Sublist: ENVNET



# STL Burlington - Target GC Injection Report

**Lab Sample ID: PIBLK_SCU** **Client Sample ID: PIBLK_SCU**

Matrix : SOIL
Analyst :
Instrument : 3327_1.i
Column : RTX-5
Integrator : Falcon
Method : /var/chem/3327_1.i/100302_1/03OCT021608.b/32CONG_3327RTX5_RAW.m
Reported : 17-Oct-2002 10:24 rrm

Sample Type : BLANK
Injection Date : 04-OCT-2002 09:40
Dilution Factor : 1.00
Data File : 03oct021608-r141.d
Compound Sublist: ENVNET

## Peaks

| | Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0.893 | | | 179726 | 27276 | | | |
| | 2 | 3.030 | | | 260 | 59 | | | |
| | 3 | 3.321 | | | 1158 | 289 | | | |
| | 4 | 3.553 | | | 563 | 142 | | | |
| | 5 | 3.771 | | | 7336 | 2522 | | | |
| | 6 | 3.946 | | | 425 | 122 | | | |
| | 7 | 4.298 | | | 786 | 150 | | | |
| | 8 | 4.396 | | | 3483 | 1237 | | | |
| | 9 | 4.693 | | | 1995 | 587 | | | |
| $ | 10 | 4.999 | 5.001 | -0.002 | 194147 | 77368 | 24.5968 | | Tetrachloro-meta-xylene |
| | 11 | 5.234 | | | 1695 | 257 | | | |
| | 12 | 5.402 | | | 790 | 143 | | | |
| | 13 | 5.579 | | | 2893 | 855 | | | |
| | 14 | 6.038 | | | 421 | 115 | | | |
| | 15 | 7.056 | | | 586 | 159 | | | |
| | 16 | 7.395 | | | 670 | 222 | | | |
| | 17 | 7.765 | | | 927 | 243 | | | |
| | 18 | 7.927 | | | 212 | 60 | | | |
| | 19 | 9.115 | | | 221 | 69 | | | |
| | 20 | 9.252 | | | 1648 | 232 | | | |
| | 21 | 9.465 | | | 764 | 139 | | | |
| | 22 | 9.662 | | | 512 | 101 | | | |
| | 23 | 12.205 | | | 328 | 82 | | | |
| | 24 | 12.451 | | | 679 | 121 | | | |
| | 25 | 13.324 | | | 1297 | 197 | | | |
| | 26 | 13.834 | | | 1875 | 109 | | | |
| | 27 | 14.836 | | | 464 | 96 | | | |
| | 28 | 15.448 | | | 709 | 123 | | | |
| | 29 | 15.743 | | | 578 | 113 | | | |
| | 30 | 16.002 | | | 2324 | 302 | | | |
| | 31 | 16.330 | | | 41602 | 2984 | | | |
| | 32 | 17.325 | | | 2515 | 312 | | | |
| | 33 | 18.013 | | | 1285 | 252 | | | |
| | 34 | 18.148 | | | 804 | 179 | | | |
| | 35 | 18.409 | | | 1204 | 227 | | | |
| | 36 | 18.649 | | | 1189 | 224 | | | |
| | 37 | 18.775 | | | 1163 | 179 | | | |
| | 38 | 19.134 | | | 850 | 150 | | | |
| | 39 | 19.777 | | | 737 | 165 | | | |
| | 40 | 19.901 | | | 1123 | 183 | | | |
| | 41 | 20.189 | | | 1181 | 185 | | | |
| | 42 | 20.779 | | | 3475 | 474 | | | |
| | 43 | 21.938 | | | 1879 | 209 | | | |
| | 44 | 22.271 | | | 1775 | 320 | | | |
| $ | 45 | 22.546 | 22.559 | -0.013 | 208988 | 38651 | 25.2359 | | BZ#198 |
| | 46 | 23.823 | | | 1709 | 281 | | | |
| | 47 | 24.541 | | | 2334 | 342 | | | |
| | 48 | 27.640 | | | 2250 | 401 | | | |
| | 49 | 27.866 | | | 607 | 98 | | | |
| | 50 | 29.169 | | | 13434 | 826 | | | |
| | 51 | 31.142 | | | 342 | 88 | | | |
| | 52 | 32.226 | | | 2594 | 720 | | | |
| | 53 | 32.574 | | | 1730 | 273 | | | |
| | 54 | 32.793 | | | 7489 | 987 | | | |
| | 55 | 33.507 | | | 13889 | 2997 | | | |

Flags:
- A - Peak quantitates above calibration range
- a - Peak quantitates below reporting limit
- H - User selected alternate compound hit
- M - Peak manually integrated or manually identified
- R - Peak fails recovery
- U - User disabled peak ID: either peak quantitates below reporting limit or peak identification not confirmed on second column

## Target Compounds

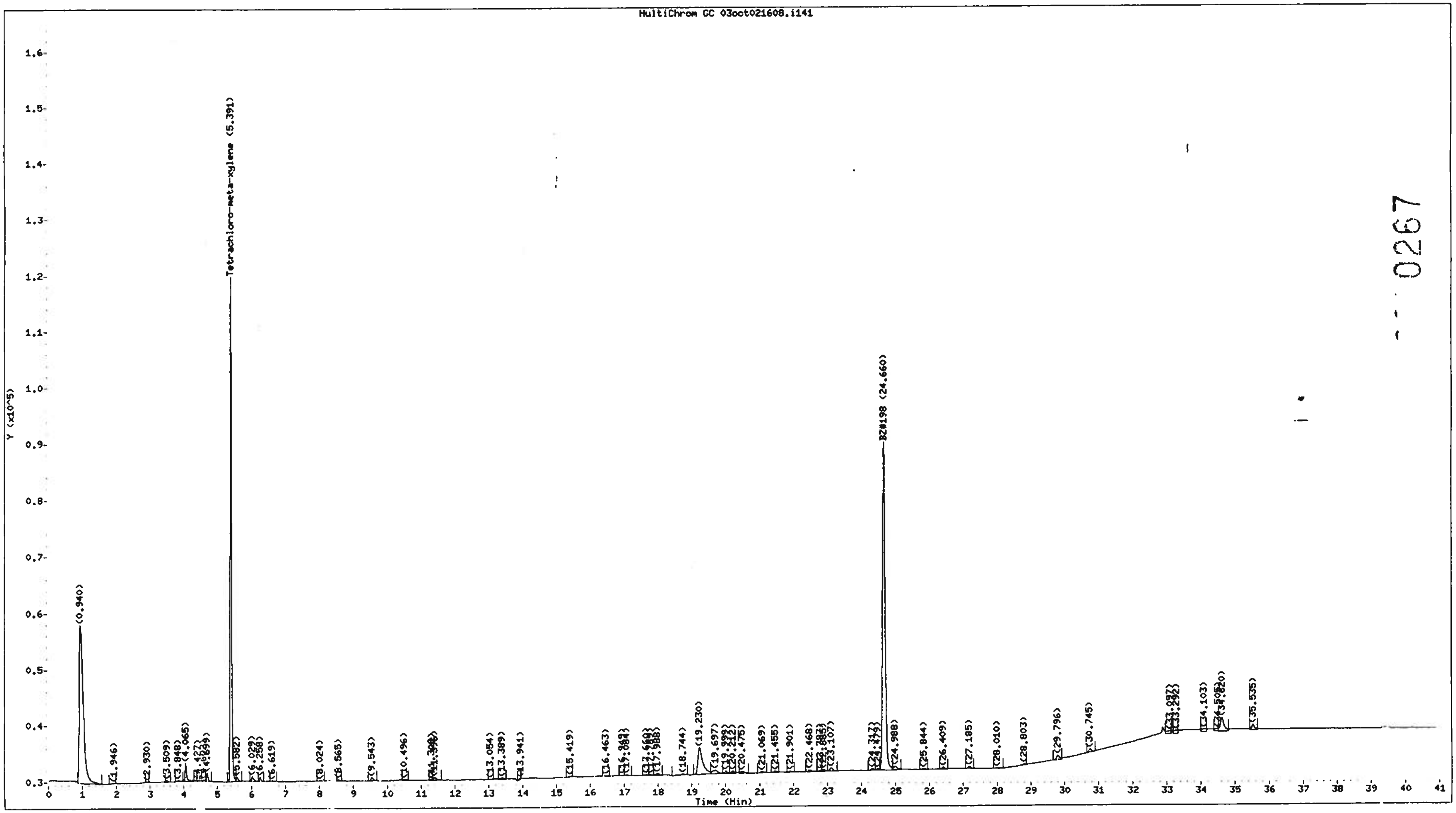
| Peak RT | Expected RT | Target Compound |
|---|---|---|
| 4.999 | 5.001 | Tetrachloro-meta-xylene |
| | 5.761 | BZ#8 |
| | 6.701 | BZ#18 |
| | 7.925 | BZ#28 |
| | 8.984 | BZ#52 |
| | 9.667 | BZ#44 |
| | 11.243 | BZ#66 |
| | 12.207 | BZ#101 |
| | 13.752 | BZ#77 |
| | 14.938 | BZ#118 |
| | 15.993 | BZ#153 |
| | 16.155 | BZ#105 |
| | 17.328 | BZ#138 |
| | 17.762 | BZ#126 |
| | 18.647 | BZ#128 |
| | 20.781 | BZ#180 |
| | 22.271 | BZ#170 |
| 22.546 | 22.559 | BZ#198 |
| | 24.552 | BZ#195 |
| | 27.655 | BZ#206 |
| | 29.180 | BZ#209 |

# STL Burlington - Target GC Chromatogram

Lab Sample ID: PIBLK_SCU
Client Sample ID: PIBLK_SCU

Matrix : SOIL
Analyst :
Instrument : 3327_2.i
Column : RTX-CLPII
Integrator : Falcon
Method : /var/chem/3327_2.i/100302_1/03OCT021608.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 10:24 rrm

Sample Type : BLANK
Injection Date : 04-OCT-2002 09:40
Dilution Factor : 1.00
Data File : 03oct021608-r141.d
Compound Sublist: ENVNET



# STL Burlington - Target GC Injection Report

Lab Sample ID: PIBLK_SCU Client Sample ID: PIBLK_SCU

Matrix : SOIL
Analyst :
Instrument : 3327_2.i
Column : RTX-CLPII
Integrator : Falcon
Method : /var/chem/3327_2.i/100302_1/03OCT021608.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 10:24 rrm

Sample Type : BLANK
Injection Date : 04-OCT-2002 09:40
Dilution Factor : 1.00
Data File : 03oct021608-r141.d
Compound Sublist: ENVNET

## Peaks

| | Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 0.940 | | | 233366 | 28157 | | | |
| | 2 | 1.946 | | | 487 | 47 | | | |
| | 3 | 2.930 | | | 375 | 98 | | | |
| | 4 | 3.509 | | | 1021 | 309 | | | |
| | 5 | 3.848 | | | 1400 | 214 | | | |
| | 6 | 4.065 | | | 12494 | 3348 | | | |
| | 7 | 4.427 | | | 688 | 158 | | | |
| | 8 | 4.602 | | | 1389 | 289 | | | |
| | 9 | 4.699 | | | 4549 | 1479 | | | |
| $ | 10 | 5.391 | 5.391 | 0.000 | 251377 | 89612 | 24.0577 | | Tetrachloro-meta-xylene |
| | 11 | 5.582 | | | 3315 | 820 | | | |
| | 12 | 6.029 | | | 3721 | 906 | | | |
| | 13 | 6.258 | | | 2311 | 801 | | | |
| | 14 | 6.619 | | | 457 | 92 | | | |
| | 15 | 8.024 | | | 658 | 151 | | | |
| | 16 | 8.565 | | | 805 | 222 | | | |
| | 17 | 9.543 | | | 2638 | 544 | | | |
| | 18 | 10.496 | | | 1320 | 179 | | | |
| | 19 | 11.309 | | | 263 | 81 | | | |
| | 20 | 11.396 | | | 3023 | 491 | | | |
| | 21 | 13.054 | | | 440 | 82 | | | |
| | 22 | 13.389 | | | 1982 | 270 | | | |
| | 23 | 13.941 | | | 686 | 123 | | | |
| | 24 | 15.419 | | | 1177 | 205 | | | |
| | 25 | 16.463 | | | 788 | 147 | | | |
| | 26 | 16.949 | | | 741 | 128 | | | |
| | 27 | 17.084 | | | 1183 | 156 | | | |
| | 28 | 17.660 | | | 1068 | 175 | | | |
| | 29 | 17.789 | | | 1126 | 193 | | | |
| | 30 | 17.988 | | | 2750 | 359 | | | |
| | 31 | 18.744 | | | 2769 | 225 | | | |
| | 32 | 19.230 | | | 48484 | 4770 | | | |
| | 33 | 19.697 | | | 8000 | 654 | | | |
| | 34 | 19.999 | | | 2589 | 413 | | | |
| | 35 | 20.212 | | | 2642 | 402 | | | |
| | 36 | 20.475 | | | 2904 | 351 | | | |
| | 37 | 21.069 | | | 1867 | 262 | | | |
| | 38 | 21.455 | | | 1896 | 302 | | | |
| | 39 | 21.901 | | | 973 | 195 | | | |
| | 40 | 22.468 | | | 2918 | 364 | | | |
| | 41 | 22.787 | | | 1265 | 213 | | | |
| | 42 | 22.885 | | | 2075 | 307 | | | |
| | 43 | 23.107 | | | 4482 | 624 | | | |
| | 44 | 24.317 | | | 2179 | 338 | | | |
| | 45 | 24.479 | | | 1547 | 257 | | | |
| $ | 46 | 24.660 | 24.678 | -0.018 | 316945 | 58202 | 24.3741 | | BZ#198 |
| | 47 | 24.988 | | | 5114 | 647 | | | |
| | 48 | 25.844 | | | 1403 | 188 | | | |
| | 49 | 26.409 | | | 2362 | 364 | | | |
| | 50 | 27.185 | | | 2068 | 390 | | | |
| | 51 | 28.010 | | | 965 | 140 | | | |
| | 52 | 28.803 | | | 3438 | 242 | | | |
| | 53 | 29.796 | | | 5517 | 890 | | | |
| | 54 | 30.745 | | | 2918 | 632 | | M | |
| | 55 | 33.097 | | | 4649 | 521 | | | |

0268

# STL Burlington - Target GC Injection Report

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| 56 | 33.292 | | | 4978 | 622 | | | |
| 57 | 34.103 | | | 4798 | 553 | | | |
| 58 | 34.505 | | | 2958 | 463 | | | |
| 59 | 34.620 | | | 18474 | 2433 | | | |
| 60 | 35.535 | | | 6122 | 982 | | | |

Flags:
- A - Peak quantitates above calibration range
- a - Peak quantitates below reporting limit
- H - User selected alternate compound hit
- M - Peak manually integrated or manually identified
- R - Peak fails recovery
- U - User disabled peak ID: either peak quantitates below reporting limit or peak identification not confirmed on second column

## Target Compounds

| Peak RT | Expected RT | Target Compound |
|---|---|---|
| 5.391 | 5.391 | Tetrachloro-meta-xylene |
| | 6.592 | BZ#8 |
| | 7.698 | BZ#18 |
| | 9.137 | BZ#28 |
| | 10.341 | BZ#52 |
| | 11.312 | BZ#44 |
| | 13.056 | BZ#66 |
| | 13.914 | BZ#101 |
| | 16.080 | BZ#77 |
| | 17.075 | BZ#118 |
| | 17.995 | BZ#153 |
| | 18.720 | BZ#105 |
| | 19.713 | BZ#138 |
| | 20.225 | BZ#126 |
| | 21.462 | BZ#128 |
| | 23.115 | BZ#180 |
| 24.660 | 24.678 | BZ#198 |
| | 25.004 | BZ#170 |
| | 27.203 | BZ#195 |
| | 29.805 | BZ#206 |
| | 30.754 | BZ#209 |

# FORM 1
# OTHER ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.

08LCS

Lab Name: STL BURLINGTON Contract: 22000

Lab Code: STLVT Case No.: 22000 SAS No.: SDG No.: 89891

Matrix: (soil/water) SOIL Lab Sample ID: 08LCS

Sample wt/vol: 30.0 (g/mL) G Lab File ID: 03OCT021608-R021

% Moisture: 0 decanted: (Y/N) N Date Received: ________

Extraction: (SepF/Cont/Sonc) SOXH Date Extracted: 09/26/02

Concentrated Extract Volume: 10(mL) Date Analyzed: 10/04/02

Injection Volume: 1.0(uL) Dilution Factor: 1.0

GPC Cleanup: (Y/N) N pH: ___ Sulfur Cleanup: (Y/N) Y

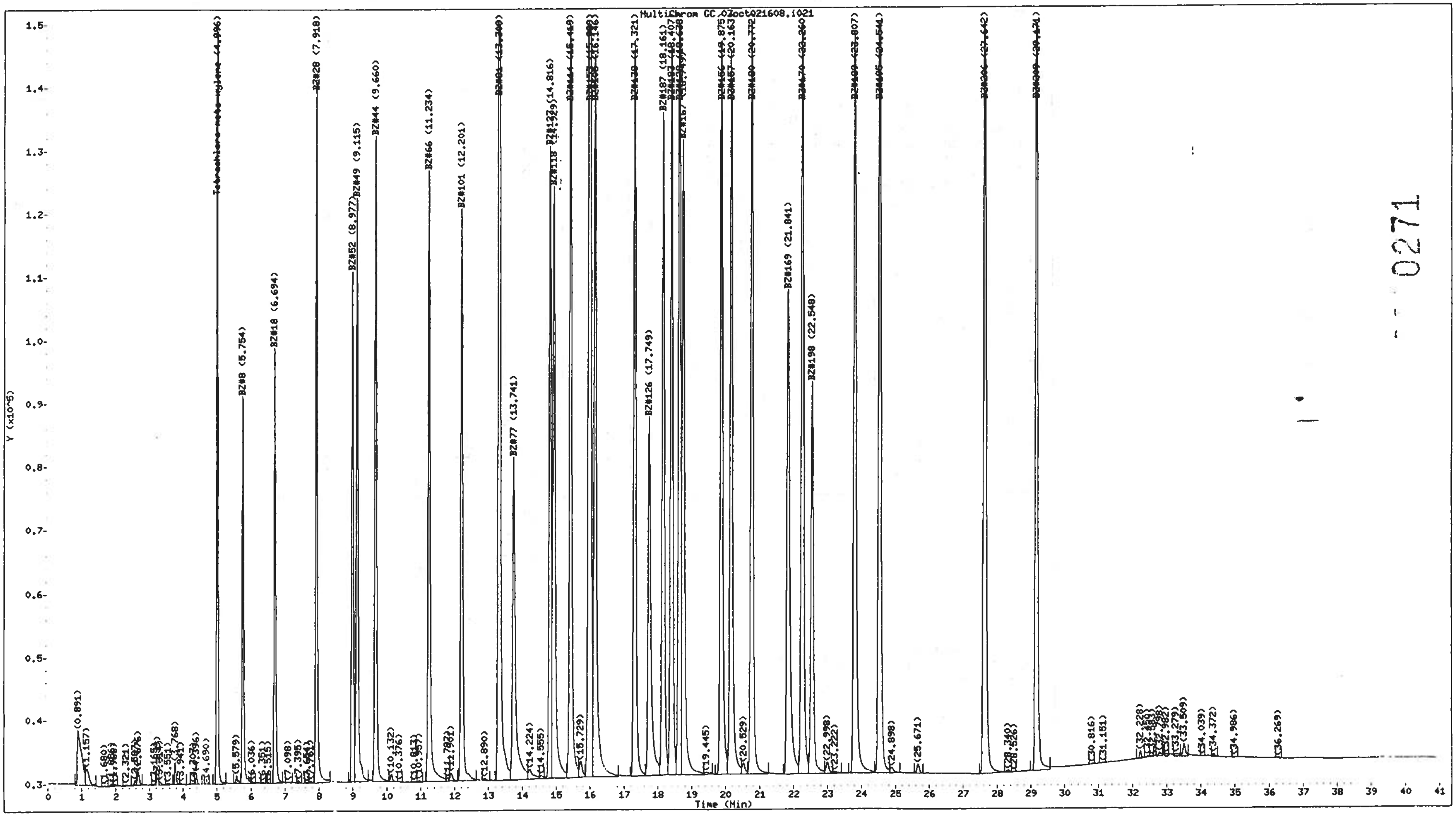
| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG | Q |
|---|---|---|---|
| 34883-43-7 | BZ#8 | 29 | |
| 37680-65-2 | BZ#18 | 29 | |
| 7012-37-5 | BZ#28 | 28 | |
| 41464-39-5 | BZ#44 | 29 | |
| 35693-99-3 | BZ#52 | 29 | |
| 32598-10-0 | BZ#66 | 28 | |
| 32598-13-3 | BZ#77 | 28 | |
| 37680-73-2 | BZ#101 | 29 | |
| 32598-14-4 | BZ#105 | 28 | |
| 31508-00-6 | BZ#118 | 28 | |
| 57465-28-8 | BZ#126 | 28 | P |
| 38380-07-3 | BZ#128 | 29 | |
| 35065-28-2 | BZ#138 | 29 | |
| 35065-27-1 | BZ#153 | 29 | P |
| 35065-30-6 | BZ#170 | 28 | |
| 35065-29-3 | BZ#180 | 28 | |
| 52663-68-0 | BZ#187 | 29 | P |
| 52663-78-2 | BZ#195 | 29 | |
| 40186-72-9 | BZ#206 | 29 | |
| 2051-24-3 | BZ#209 | 29 | |

STL Burlington - Target GC Chromatogram

| | |
|---|---|
| Lab Sample ID: O8LCS | Client Sample ID: O8LCS |

| | | | |
|---|---|---|---|
| Matrix | : SOIL | Sample Type | : LCS |
| Analyst | : | Injection Date | : 04-OCT-2002 00:40 |
| Instrument | : 3327_1.i | Dilution Factor | : 1.00 |
| Column | : RTX-5 | Data File | : 03oct021608-r021.d |
| Integrator | : Falcon | Compound Sublist | : ENVNET |

Method : /var/chem/3327_1.i/100302_1/03OCT021608.b/32CONG_3327RTX5_RAW.m
Reported : 17-Oct-2002 13:48 rrm



# STL Burlington - Target GC Injection Report

| Lab Sample ID: 08LCS | Client Sample ID: 08LCS |
|---|---|

Matrix : SOIL
Analyst : 
Instrument : 3327_1.i
Column : RTX-5
Integrator : Falcon
Method : /var/chem/3327_1.i/100302_1/03OCT021608.b/32CONG_3327RTX5_RAW.m
Reported : 17-Oct-2002 13:48 rrm

Sample Type : LCS
Injection Date : 04-OCT-2002 00:40
Dilution Factor : 1.00
Data File : 03oct021608-r021.d
Compound Sublist: ENVNET

## Peaks

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.891 | | | 74441 | 8519 | | | |
| 2 | 1.157 | | | 18927 | 2535 | | | |
| 3 | 1.680 | | | 535 | 118 | | | |
| 4 | 1.886 | | | 1453 | 357 | | | |
| 5 | 1.966 | | | 1061 | 259 | | | |
| 6 | 2.321 | | | 918 | 160 | | | |
| 7 | 2.587 | | | 2603 | 708 | | | |
| 8 | 2.676 | | | 8286 | 2024 | | | |
| 9 | 3.165 | | | 686 | 169 | | | |
| 10 | 3.239 | | | 3674 | 1153 | | | |
| 11 | 3.314 | | | 2194 | 516 | | | |
| 12 | 3.551 | | | 1307 | 227 | | | |
| 13 | 3.768 | | | 10398 | 3481 | | | |
| 14 | 3.941 | | | 948 | 204 | | | |
| 15 | 4.307 | | | 594 | 149 | | | |
| 16 | 4.396 | | | 4740 | 1714 | | | |
| 17 | 4.690 | | | 1985 | 708 | | | |
| $ 18 | 4.996 | 5.001 | -0.005 | 322406 | 127863 | 40.5768 | | Tetrachloro-meta-xylene |
| 19 | 5.579 | | | 4749 | 1270 | | | |
| 20 | 5.754 | 5.761 | -0.007 | 182002 | 61032 | 87.3679 | | BZ#8 |
| 21 | 6.036 | | | 1274 | 289 | | | |
| 22 | 6.351 | | | 343 | 90 | | | |
| 23 | 6.515 | | | 289 | 119 | | | |
| 24 | 6.694 | 6.701 | -0.007 | 216526 | 68628 | 87.8255 | | BZ#18 |
| 25 | 7.098 | | | 829 | 151 | | | |
| 26 | 7.395 | | | 963 | 338 | | | |
| 27 | 7.654 | | | 322 | 112 | | | |
| 28 | 7.761 | | | 1022 | 321 | | | |
| 29 | 7.918 | 7.925 | -0.007 | 362749 | 111064 | 84.3386 | | BZ#28 |
| 30 | 8.977 | 8.984 | -0.007 | 281603 | 80562 | 87.4736 | | BZ#52 |
| 31 | 9.115 | | | 348591 | 92213 | | | |
| 32 | 9.660 | 9.667 | -0.007 | 376038 | 102005 | 87.0403 | | BZ#44 |
| 33 | 10.132 | | | 5119 | 1179 | | | |
| 34 | 10.376 | | | 310 | 88 | | | |
| 35 | 10.813 | | | 340 | 88 | | | |
| 36 | 10.957 | | | 777 | 201 | | | |
| 37 | 11.234 | 11.243 | -0.009 | 406949 | 96494 | 84.7950 | | BZ#66 |
| 38 | 11.797 | | | 2620 | 529 | | | |
| 39 | 11.901 | | | 6592 | 1213 | | | |
| 40 | 12.201 | 12.207 | -0.007 | 392104 | 90275 | 87.3289 | | BZ#101 |
| 41 | 12.890 | | | 1672 | 364 | | | |
| 42 | 13.309 | | | 819146 | 177841 | | | |
| 43 | 13.741 | 13.752 | -0.011 | 304210 | 50890 | 84.7045 | | BZ#77 |
| 44 | 14.224 | | | 14680 | 1537 | | | |
| 45 | 14.555 | | | 3126 | 497 | | | |
| 46 | 14.816 | | | 418835 | 99939 | | | |
| 47 | 14.929 | 14.938 | -0.009 | 478993 | 93466 | 85.4173 | | BZ#118 |
| 48 | 15.419 | | | 589656 | 131406 | | | |
| 49 | 15.729 | | | 15710 | 2523 | | | |
| 50 | 15.989 | 15.993 | -0.004 | 887113 | 144357 | 172.873 | R | BZ#153 |
| 51 | 16.146 | 16.155 | -0.009 | 585317 | 114107 | 84.0502 | | BZ#105 |
| 52 | 17.321 | 17.328 | -0.007 | 550103 | 116240 | 87.0673 | | BZ#138 |
| 53 | 17.749 | 17.762 | -0.013 | 343687 | 56542 | 84.0790 | | BZ#126 |
| 54 | 18.161 | 18.170 | -0.009 | 510590 | 104729 | 88.0989 | | BZ#187 |
| 55 | 18.407 | | | 547956 | 115123 | | | |

# STL Burlington - Target GC Injection Report

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| 56 | 18.638 | 18.647 | -0.009 | 587164 | 130750 | 88.1655 | | BZ#128 |
| 57 | 18.749 | | | 536960 | 100306 | | | |
| 58 | 19.445 | | | 3281 | 317 | | | |
| 59 | 19.875 | | | 573448 | 115882 | | | |
| 60 | 20.163 | | | 595916 | 114332 | | | |
| 61 | 20.529 | | | 10854 | 1672 | | | |
| 62 | 20.772 | 20.781 | -0.009 | 610853 | 122628 | 87.4421 | | BZ#180 |
| 63 | 21.841 | | | 473573 | 76438 | | | |
| 64 | 22.260 | 22.271 | -0.011 | 649124 | 128887 | 87.3936 | | BZ#170 |
| $ 65 | 22.548 | 22.559 | -0.011 | 321127 | 61922 | 41.4260 | | BZ#198 |
| 66 | 22.998 | | | 11180 | 1734 | | | |
| 67 | 23.222 | | | 2158 | 250 | | | |
| 68 | 23.807 | | | 633204 | 117235 | | | |
| 69 | 24.541 | 24.552 | -0.011 | 696550 | 136192 | 88.0963 | | BZ#195 |
| 70 | 24.898 | | | 6545 | 859 | | | |
| 71 | 25.671 | | | 7125 | 1431 | | | |
| 72 | 27.642 | 27.655 | -0.013 | 698308 | 124566 | 88.1094 | | BZ#206 |
| 73 | 28.340 | | | 2039 | 331 | | | |
| 74 | 28.526 | | | 191 | 39 | | | |
| 75 | 29.171 | 29.180 | -0.009 | 630718 | 137060 | 91.3404 | | BZ#209 |
| 76 | 30.816 | | | 350 | 93 | | | |
| 77 | 31.151 | | | 572 | 96 | | | |
| 78 | 32.228 | | | 3735 | 1177 | | | |
| 79 | 32.450 | | | 879 | 252 | | | |
| 80 | 32.583 | | | 700 | 143 | | | |
| 81 | 32.798 | | | 3689 | 638 | | | |
| 82 | 32.982 | | | 2260 | 355 | | | |
| 83 | 33.279 | | | 3484 | 334 | | | |
| 84 | 33.509 | | | 9986 | 1893 | | | |
| 85 | 34.039 | | | 641 | 131 | | | |
| 86 | 34.372 | | | 1683 | 444 | | | |
| 87 | 34.986 | | | 517 | 108 | | | |
| 88 | 36.269 | | | 417 | 96 | | | |

Flags:
A - Peak quantitates above calibration range
a - Peak quantitates below reporting limit
H - User selected alternate compound hit
M - Peak manually integrated or manually identified
R - Peak fails recovery
U - User disabled peak ID: either peak quantitates below reporting limit or peak identification not confirmed on second column

## Target Compounds

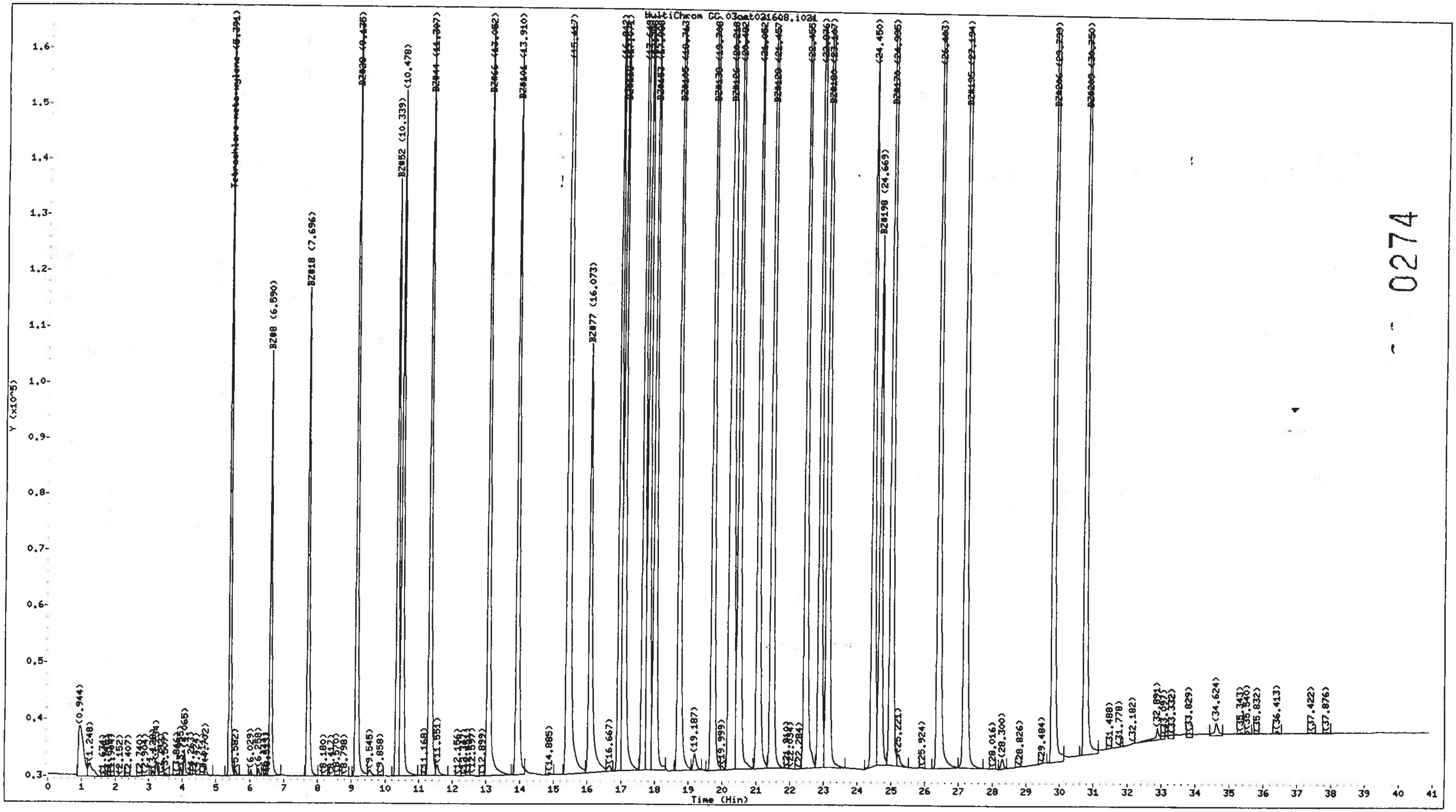
| Peak RT | Expected RT | Target Compound |
|---|---|---|
| 4.996 | 5.001 | Tetrachloro-meta-xylene |
| 5.754 | 5.761 | BZ#8 |
| 6.694 | 6.701 | BZ#18 |
| 7.918 | 7.925 | BZ#28 |
| 8.977 | 8.984 | BZ#52 |
| 9.660 | 9.667 | BZ#44 |
| 11.234 | 11.243 | BZ#66 |
| 12.201 | 12.207 | BZ#101 |
| 13.741 | 13.752 | BZ#77 |
| 14.929 | 14.938 | BZ#118 |
| 15.989 | 15.993 | BZ#153 |
| 16.146 | 16.155 | BZ#105 |
| 17.321 | 17.328 | BZ#138 |
| 17.749 | 17.762 | BZ#126 |
| 18.161 | 18.170 | BZ#187 |
| 18.638 | 18.647 | BZ#128 |
| 20.772 | 20.781 | BZ#180 |
| 22.260 | 22.271 | BZ#170 |
| 22.548 | 22.559 | BZ#198 |
| 24.541 | 24.552 | BZ#195 |
| 27.642 | 27.655 | BZ#206 |
| 29.171 | 29.180 | BZ#209 |

# STL Burlington - Target GC Chromatogram

Lab Sample ID: 08LCS    Client Sample ID: 08LCS

|  |  |  |  |
|---|---|---|---|
| Matrix | : SOIL | Sample Type | : LCS |
| Analyst | : | Injection Date | : 04-OCT-2002 00:40 |
| Instrument | : 3327_2.i | Dilution Factor | : 1.00 |
| Column | : RTX-CLPII | Data File | : 03oct021608-r021.d |
| Integrator | : Falcon | Compound Sublist | : ENVNET |

Method : /var/chem/3327_2.i/100302_1/03OCT021608.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 13:48 rrm



# STL Burlington - Target GC Injection Report

| | |
|---|---|
| Lab Sample ID: O8LCS | Client Sample ID: O8LCS |

Matrix : SOIL
Analyst :
Instrument : 3327_2.i
Column : RTX-CLPII
Integrator : Falcon
Method : /var/chem/3327_2.i/100302_1/03OCT021608.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 13:48 rrm

Sample Type : LCS
Injection Date : 04-OCT-2002 00:40
Dilution Factor : 1.00
Data File : 03oct021608-r021.d
Compound Sublist: ENVNET

## Peaks

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.944 | | | 93193 | 8874 | | | |
| 2 | 1.248 | | | 23410 | 2346 | | | |
| 3 | 1.634 | | | 625 | 155 | | | |
| 4 | 1.745 | | | 248 | 100 | | | |
| 5 | 1.815 | | | 1147 | 353 | | | |
| 6 | 1.904 | | | 1065 | 295 | | | |
| 7 | 2.152 | | | 324 | 71 | | | |
| 8 | 2.407 | | | 258 | 54 | | | |
| 9 | 2.740 | | | 490 | 129 | | | |
| 10 | 2.904 | | | 1179 | 180 | | | |
| 11 | 3.128 | | | 3042 | 928 | | | |
| 12 | 3.234 | | | 8273 | 2540 | | | |
| 13 | 3.392 | | | 648 | 157 | | | |
| 14 | 3.507 | | | 1802 | 501 | | | |
| 15 | 3.846 | | | 1186 | 294 | | | |
| 16 | 3.955 | | | 3984 | 1410 | | | |
| 17 | 4.065 | | | 14935 | 4560 | | | |
| 18 | 4.263 | | | 1513 | 396 | | | |
| 19 | 4.424 | | | 1098 | 241 | | | |
| 20 | 4.611 | | | 736 | 139 | | | |
| 21 | 4.702 | | | 6099 | 1945 | | | |
| $ 22 | 5.391 | 5.391 | 0.000 | 437086 | 150897 | 40.0771 | | Tetrachloro-meta-xylene |
| 23 | 5.582 | | | 3642 | 990 | | | |
| 24 | 6.029 | | | 3543 | 1086 | | | |
| 25 | 6.258 | | | 3546 | 1273 | | | |
| 26 | 6.444 | | | 1217 | 445 | | | |
| 27 | 6.513 | | | 1036 | 437 | | | |
| 28 | 6.590 | 6.592 | -0.002 | 271343 | 75605 | 87.6458 | | BZ#8 |
| 29 | 7.696 | 7.698 | -0.002 | 342689 | 87020 | 87.9893 | | BZ#18 |
| 30 | 8.180 | | | 702 | 114 | | | |
| 31 | 8.417 | | | 449 | 93 | | | |
| 32 | 8.570 | | | 1175 | 354 | | | |
| 33 | 8.798 | | | 581 | 144 | | | |
| 34 | 9.135 | 9.137 | -0.002 | 557819 | 145208 | 84.9248 | | BZ#28 |
| 35 | 9.545 | | | 8204 | 1078 | | | |
| 36 | 9.858 | | | 1276 | 267 | | | |
| 37 | 10.339 | 10.341 | -0.002 | 453942 | 106510 | 87.2602 | | BZ#52 |
| 38 | 10.478 | | | 554109 | 122365 | | | |
| 39 | 11.168 | | | 373 | 89 | | | |
| 40 | 11.307 | 11.312 | -0.004 | 613855 | 135128 | 86.6136 | | BZ#44 |
| 41 | 11.551 | | | 12015 | 1885 | | | |
| 42 | 12.156 | | | 299 | 75 | | | |
| 43 | 12.347 | | | 217 | 69 | | | |
| 44 | 12.451 | | | 252 | 76 | | | |
| 45 | 12.597 | | | 944 | 229 | | | |
| 46 | 12.899 | | | 285 | 72 | | | |
| 47 | 13.052 | 13.056 | -0.004 | 656195 | 136209 | 84.1041 | | BZ#66 |
| 48 | 13.910 | 13.914 | -0.004 | 645923 | 129459 | 87.3124 | | BZ#101 |
| 49 | 14.885 | | | 2003 | 423 | | | |
| 50 | 15.417 | | | 1403944 | 223440 | | | |
| 51 | 16.073 | 16.080 | -0.007 | 469164 | 76610 | 83.0690 | | BZ#77 |
| 52 | 16.667 | | | 7455 | 1028 | | | |
| 53 | 16.942 | | | 707672 | 148176 | | | |
| 54 | 17.071 | 17.075 | -0.004 | 782118 | 142341 | 85.6614 | | BZ#118 |
| 55 | 17.649 | | | 922332 | 196749 | | | |

# STL Burlington - Target GC Injection Report

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| 56 | 17.798 | | | 854441 | 160621 | | | |
| 57 | 17.988 | 17.995 | -0.007 | 791754 | 145728 | 87.3437 | | BZ#153 |
| 58 | 18.713 | 18.720 | -0.007 | 860218 | 171453 | 84.2062 | | BZ#105 |
| 59 | 19.187 | | | 18679 | 2886 | | | |
| 60 | 19.708 | 19.713 | -0.004 | 922235 | 175085 | 87.0138 | | BZ#138 |
| 61 | 19.999 | | | 3732 | 711 | | | |
| 62 | 20.218 | 20.225 | -0.007 | 1380749 | 161575 | 172.653 | R | BZ#126 |
| 62 | 20.218 | 20.225 | -0.007 | 1380749 | 161575 | 172.653 | MR | BZ#187 |
| 63 | 20.482 | | | 979379 | 176558 | | | |
| 64 | 21.052 | | | 846238 | 152209 | | | |
| 65 | 21.457 | 21.462 | -0.004 | 1026482 | 195355 | 86.8114 | | BZ#128 |
| 66 | 21.910 | | | 579 | 147 | | | |
| 67 | 22.034 | | | 600 | 134 | | | |
| 68 | 22.284 | | | 600 | 86 | | | |
| 69 | 22.455 | | | 977669 | 183820 | | | |
| 70 | 22.876 | | | 963267 | 182783 | | | |
| 71 | 23.107 | 23.115 | -0.009 | 1061132 | 192687 | 85.2446 | | BZ#180 |
| 72 | 24.450 | | | 764820 | 128504 | | | |
| $ 73 | 24.669 | 24.678 | -0.009 | 519301 | 95159 | 39.9527 | | BZ#198 |
| 74 | 24.995 | 25.004 | -0.009 | 1093291 | 200860 | 85.7738 | | BZ#170 |
| 75 | 25.221 | | | 13207 | 2100 | | | |
| 76 | 25.924 | | | 850 | 186 | | | |
| 77 | 26.403 | | | 1095397 | 195934 | | | |
| 78 | 27.194 | 27.203 | -0.009 | 1204472 | 213268 | 86.8124 | | BZ#195 |
| 79 | 28.016 | | | 482 | 99 | | | |
| 80 | 28.300 | | | 8999 | 1737 | | | |
| 81 | 28.826 | | | 360 | 54 | | | |
| 82 | 29.484 | | | 368 | 75 | | | |
| 83 | 29.799 | 29.805 | -0.007 | 1192612 | 249493 | 87.8054 | | BZ#206 |
| 84 | 30.750 | 30.754 | -0.004 | 1083940 | 235648 | 88.1011 | | BZ#209 |
| 85 | 31.488 | | | 272 | 78 | | | |
| 86 | 31.778 | | | 265 | 40 | | | |
| 87 | 32.182 | | | 894 | 125 | | | |
| 88 | 32.891 | | | 17674 | 2088 | | | |
| 89 | 33.097 | | | 4466 | 595 | | | |
| 90 | 33.332 | | | 6045 | 672 | | | |
| 91 | 33.829 | | | 6391 | 739 | | | |
| 92 | 34.624 | | | 17437 | 2209 | | | |
| 93 | 35.343 | | | 2171 | 286 | | | |
| 94 | 35.540 | | | 3141 | 595 | | | |
| 95 | 35.832 | | | 935 | 152 | | | |
| 96 | 36.413 | | | 2782 | 506 | | | |
| 97 | 37.422 | | | 1275 | 170 | | | |
| 98 | 37.876 | | | 1431 | 192 | | | |

Flags:
A - Peak quantitates above calibration range
a - Peak quantitates below reporting limit
H - User selected alternate compound hit
M - Peak manually integrated or manually identified
R - Peak fails recovery
U - User disabled peak ID: either peak quantitates below reporting limit or peak identification not confirmed on second column

## Target Compounds

| Peak RT | Expected RT | Target Compound |
|---|---|---|
| 5.391 | 5.391 | Tetrachloro-meta-xylene |
| 6.590 | 6.592 | BZ#8 |
| 7.696 | 7.698 | BZ#18 |
| 9.135 | 9.137 | BZ#28 |
| 10.339 | 10.341 | BZ#52 |
| 11.307 | 11.312 | BZ#44 |
| 13.052 | 13.056 | BZ#66 |
| 13.910 | 13.914 | BZ#101 |
| 16.073 | 16.080 | BZ#77 |
| 17.071 | 17.075 | BZ#118 |
| 17.988 | 17.995 | BZ#153 |

# STL Burlington - Target GC Injection Report

```
  Peak      Expected
   RT          RT                  Target Compound
========    ========    ======================================
 18.713      18.720     BZ#105
 19.708      19.713     BZ#138
 20.218      20.225     BZ#126
 20.218      20.225     BZ#187
 21.457      21.462     BZ#128
 23.107      23.115     BZ#180
 24.669      24.678     BZ#198
 24.995      25.004     BZ#170
 27.194      27.203     BZ#195
 29.799      29.805     BZ#206
 30.750      30.754     BZ#209
```

FORM 1
OTHER ORGANICS ANALYSIS DATA SHEET

CLIENT SAMPLE NO.
O8LCSD

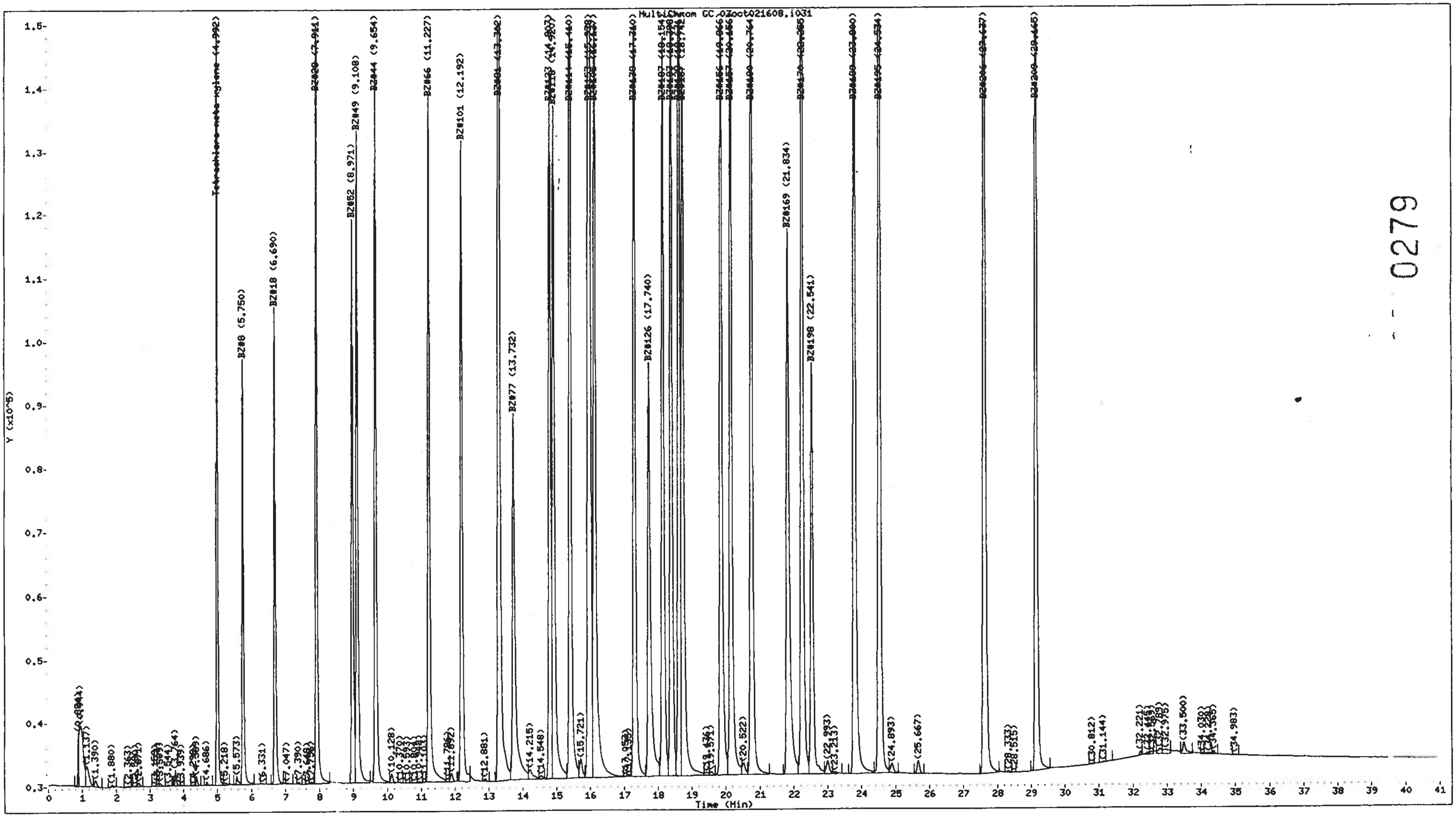
Lab Name: STL BURLINGTON    Contract: 22000
Lab Code: STLVT    Case No.: 22000    SAS No.:    SDG No.: 89891
Matrix: (soil/water) SOIL    Lab Sample ID: O8LCSD
Sample wt/vol: 30.0 (g/mL) G    Lab File ID: 03OCT021608-R031
% Moisture: 0    decanted: (Y/N) N    Date Received: ________
Extraction: (SepF/Cont/Sonc) OTHER    Date Extracted: 09/26/02
Concentrated Extract Volume: 10(mL)    Date Analyzed: 10/04/02
Injection Volume: 1.0(uL)    Dilution Factor: 1.0
GPC Cleanup: (Y/N) N    pH: ____    Sulfur Cleanup: (Y/N) Y

| CAS NO. | COMPOUND | CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG | Q |
|---|---|---|---|
| 34883-43-7 | BZ#8 | 32 | |
| 37680-65-2 | BZ#18 | 32 | |
| 7012-37-5 | BZ#28 | 32 | |
| 41464-39-5 | BZ#44 | 32 | |
| 35693-99-3 | BZ#52 | 32 | |
| 32598-10-0 | BZ#66 | 32 | |
| 32598-13-3 | BZ#77 | 31 | |
| 37680-73-2 | BZ#101 | 32 | |
| 32598-14-4 | BZ#105 | 32 | |
| 31508-00-6 | BZ#118 | 32 | |
| 57465-28-8 | BZ#126 | 32 | P |
| 38380-07-3 | BZ#128 | 33 | |
| 35065-28-2 | BZ#138 | 32 | |
| 35065-27-1 | BZ#153 | 32 | P |
| 35065-30-6 | BZ#170 | 32 | |
| 35065-29-3 | BZ#180 | 31 | |
| 52663-68-0 | BZ#187 | 33 | P |
| 52663-78-2 | BZ#195 | 32 | |
| 40186-72-9 | BZ#206 | 32 | |
| 2051-24-3 | BZ#209 | 32 | |

# STL Burlington - Target GC Chromatogram

| | |
|---|---|
| Lab Sample ID: O8LCSD | Client Sample ID: O8LCSD |

| | | | |
|---|---|---|---|
| Matrix | : SOIL | Sample Type | : LCSD |
| Analyst | : | Injection Date | : 04-OCT-2002 01:25 |
| Instrument | : 3327_1.i | Dilution Factor | : 1.00 |
| Column | : RTX-5 | Data File | : 03oct021608-r031.d |
| Integrator | : Falcon | Compound Sublist | : ENVNET |
| Method | : /var/chem/3327_1.i/100302_1/03OCT021608.b/32CONG_3327RTX5_RAW.m | | |
| Reported | : 17-Oct-2002 13:48 rrm | | |



# STL Burlington - Target GC Injection Report

Lab Sample ID: 08LCSD    Client Sample ID: 08LCSD

Matrix : SOIL
Analyst :
Instrument : 3327_1.i
Column : RTX-5
Integrator : Falcon
Method : /var/chem/3327_1.i/100302_1/03OCT021608.b/32CONG_3327RTX5_RAW.m
Reported : 17-Oct-2002 13:48 rrm

Sample Type : LCSD
Injection Date : 04-OCT-2002 01:25
Dilution Factor : 1.00
Data File : 03oct021608-r031.d
Compound Sublist: ENVNET

## Peaks

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.884 | | | 19035 | 8396 | | | |
| 2 | 0.944 | | | 78334 | 9583 | | | |
| 3 | 1.137 | | | 22005 | 3115 | | | |
| 4 | 1.390 | | | 4766 | 996 | | | |
| 5 | 1.880 | | | 2089 | 375 | | | |
| 6 | 2.363 | | | 932 | 188 | | | |
| 7 | 2.580 | | | 652 | 177 | | | |
| 8 | 2.671 | | | 2257 | 568 | | | |
| 9 | 3.159 | | | 584 | 150 | | | |
| 10 | 3.234 | | | 1694 | 502 | | | |
| 11 | 3.309 | | | 2038 | 484 | | | |
| 12 | 3.544 | | | 1029 | 224 | | | |
| 13 | 3.764 | | | 7339 | 2442 | | | |
| 14 | 3.939 | | | 474 | 132 | | | |
| 15 | 4.298 | | | 605 | 129 | | | |
| 16 | 4.389 | | | 3836 | 1389 | | | |
| 17 | 4.686 | | | 1876 | 616 | | | |
| $ 18 | 4.992 | 5.001 | -0.009 | 332904 | 132348 | 41.9962 | | Tetrachloro-meta-xylene |
| 19 | 5.218 | | | 2308 | 379 | | | |
| 20 | 5.573 | | | 5013 | 1324 | | | |
| 21 | 5.750 | 5.761 | -0.011 | 199450 | 66972 | 96.0701 | | BZ#8 |
| 22 | 6.331 | | | 674 | 118 | | | |
| 23 | 6.690 | 6.701 | -0.011 | 238101 | 75052 | 96.3492 | | BZ#18 |
| 24 | 7.047 | | | 1011 | 158 | | | |
| 25 | 7.390 | | | 1045 | 355 | | | |
| 26 | 7.648 | | | 432 | 154 | | | |
| 27 | 7.756 | | | 1084 | 324 | | | |
| 28 | 7.911 | 7.925 | -0.013 | 403434 | 125366 | 95.1817 | | BZ#28 |
| 29 | 8.971 | 8.984 | -0.013 | 311687 | 88747 | 96.6581 | | BZ#52 |
| 30 | 9.108 | | | 380458 | 102700 | | | |
| 31 | 9.654 | 9.667 | -0.013 | 416648 | 113076 | 96.6957 | | BZ#44 |
| 32 | 10.128 | | | 5946 | 1400 | | | |
| 33 | 10.370 | | | 325 | 95 | | | |
| 34 | 10.593 | | | 233 | 66 | | | |
| 35 | 10.804 | | | 442 | 121 | | | |
| 36 | 10.948 | | | 922 | 253 | | | |
| 37 | 11.103 | | | 265 | 94 | | | |
| 38 | 11.227 | 11.243 | -0.016 | 451034 | 108141 | 94.9248 | M | BZ#66 |
| 39 | 11.786 | | | 2857 | 592 | | | |
| 40 | 11.892 | | | 6207 | 1294 | | | |
| 41 | 12.192 | 12.207 | -0.016 | 428189 | 100956 | 97.9142 | M | BZ#101 |
| 42 | 12.881 | | | 1861 | 422 | | | |
| 43 | 13.302 | | | 911113 | 199937 | | | |
| 44 | 13.732 | 13.752 | -0.020 | 333365 | 57792 | 95.8952 | M | BZ#77 |
| 45 | 14.215 | | | 13396 | 1532 | | | |
| 46 | 14.548 | | | 3263 | 548 | | | |
| 47 | 14.807 | | | 475984 | 111408 | | | |
| 48 | 14.920 | 14.938 | -0.018 | 529395 | 106128 | 96.9925 | M | BZ#118 |
| 49 | 15.410 | | | 663878 | 148595 | | | |
| 50 | 15.721 | | | 17974 | 3043 | | | |
| 51 | 15.978 | 15.993 | -0.016 | 987002 | 162836 | 195.484 | MR | BZ#153 |
| 52 | 16.137 | 16.155 | -0.018 | 664672 | 129763 | 95.3374 | M | BZ#105 |
| 53 | 17.053 | | | 551 | 129 | | | |
| 54 | 17.135 | | | 1457 | 320 | | | |
| 55 | 17.310 | 17.328 | -0.018 | 615983 | 131334 | 98.4710 | M | BZ#138 |

# STL Burlington - Target GC Injection Report

| | Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|---|
| | 56 | 17.740 | 17.762 | -0.022 | 387246 | 65203 | 96.7034 | M | BZ#126 |
| | 57 | 18.154 | 18.170 | -0.016 | 567523 | 116497 | 98.2481 | M | BZ#187 |
| | 58 | 18.398 | | | 611611 | 128662 | | | |
| | 59 | 18.631 | 18.647 | -0.016 | 667691 | 145748 | 98.2904 | M | BZ#128 |
| | 60 | 18.742 | | | 601064 | 111432 | | | |
| | 61 | 19.436 | | | 3449 | 468 | | | |
| | 62 | 19.571 | | | 3571 | 575 | | | |
| | 63 | 19.866 | | | 646352 | 131358 | | | |
| | 64 | 20.156 | | | 668753 | 130235 | | | |
| | 65 | 20.522 | | | 12073 | 1869 | | | |
| | 66 | 20.764 | 20.781 | -0.018 | 680546 | 135623 | 96.8041 | | BZ#180 |
| | 67 | 21.834 | | | 525911 | 85833 | | | |
| | 68 | 22.255 | 22.271 | -0.016 | 725481 | 143169 | 97.1437 | | BZ#170 |
| $ | 69 | 22.541 | 22.559 | -0.018 | 339018 | 64792 | 43.4228 | | BZ#198 |
| | 70 | 22.993 | | | 13182 | 2046 | | | |
| | 71 | 23.213 | | | 2204 | 285 | | | |
| | 72 | 23.800 | | | 702411 | 129527 | | | |
| | 73 | 24.534 | 24.552 | -0.018 | 775109 | 149696 | 96.9603 | | BZ#195 |
| | 74 | 24.893 | | | 9544 | 1528 | | | |
| | 75 | 25.667 | | | 10275 | 2058 | | | |
| | 76 | 27.637 | 27.655 | -0.018 | 772832 | 137419 | 97.4310 | | BZ#206 |
| | 77 | 28.333 | | | 1488 | 263 | | | |
| | 78 | 28.515 | | | 267 | 60 | | | |
| | 79 | 29.165 | 29.180 | -0.016 | 689512 | 149018 | 99.6092 | M | BZ#209 |
| | 80 | 30.812 | | | 396 | 102 | | | |
| | 81 | 31.144 | | | 590 | 97 | | | |
| | 82 | 32.221 | | | 3371 | 747 | | | |
| | 83 | 32.445 | | | 2744 | 379 | | | |
| | 84 | 32.569 | | | 2676 | 452 | | | |
| | 85 | 32.789 | | | 6563 | 904 | | | |
| | 86 | 32.975 | | | 8438 | 693 | | | |
| | 87 | 33.500 | | | 12677 | 1891 | | | |
| | 88 | 34.030 | | | 848 | 182 | | | |
| | 89 | 34.228 | | | 2199 | 236 | | | |
| | 90 | 34.365 | | | 1993 | 501 | | | |
| | 91 | 34.983 | | | 618 | 123 | | | |

Flags:
A - Peak quantitates above calibration range
a - Peak quantitates below reporting limit
H - User selected alternate compound hit
M - Peak manually integrated or manually identified
R - Peak fails recovery
U - User disabled peak ID: either peak quantitates below reporting limit or peak identification not confirmed on second column

## Target Compounds

| Peak RT | Expected RT | Target Compound |
|---|---|---|
| 4.992 | 5.001 | Tetrachloro-meta-xylene |
| 5.750 | 5.761 | BZ#8 |
| 6.690 | 6.701 | BZ#18 |
| 7.911 | 7.925 | BZ#28 |
| 8.971 | 8.984 | BZ#52 |
| 9.654 | 9.667 | BZ#44 |
| 11.227 | 11.243 | BZ#66 |
| 12.192 | 12.207 | BZ#101 |
| 13.732 | 13.752 | BZ#77 |
| 14.920 | 14.938 | BZ#118 |
| 15.978 | 15.993 | BZ#153 |
| 16.137 | 16.155 | BZ#105 |
| 17.310 | 17.328 | BZ#138 |
| 17.740 | 17.762 | BZ#126 |
| 18.154 | 18.170 | BZ#187 |
| 18.631 | 18.647 | BZ#128 |
| 20.764 | 20.781 | BZ#180 |
| 22.255 | 22.271 | BZ#170 |
| 22.541 | 22.559 | BZ#198 |

# STL Burlington - Target GC Injection Report

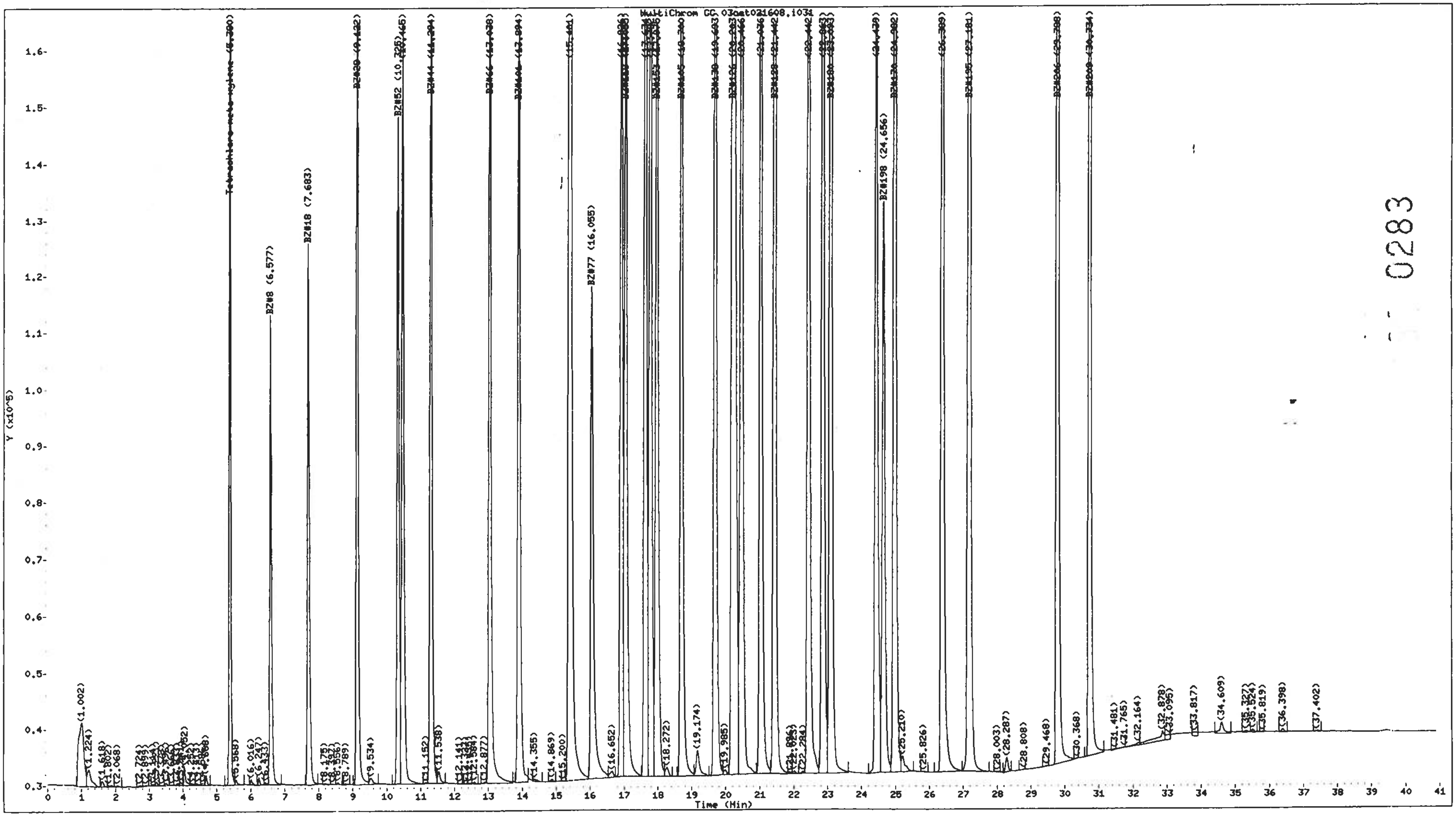
| Peak RT | Expected RT | Target Compound |
|---|---|---|
| 24.534 | 24.552 | BZ#195 |
| 27.637 | 27.655 | BZ#206 |
| 29.165 | 29.180 | BZ#209 |

STL Burlington - Target GC Chromatogram

Lab Sample ID: O8LCSD    Client Sample ID: O8LCSD

Matrix : SOIL
Analyst :
Instrument : 3327_2.i
Column : RTX-CLPII
Integrator : Falcon
Method : /var/chem/3327_2.i/100302_1/03OCT021608.b/32CONG_3327RTXCLPII_RAW.m
Reported : 17-Oct-2002 13:49 rrm

Sample Type : LCSD
Injection Date : 04-OCT-2002 01:25
Dilution Factor : 1.00
Data File : 03oct021608-r031.d
Compound Sublist: ENVNET



# STL Burlington - Target GC Injection Report

```
Lab Sample ID: 08LCSD                       Client Sample ID: 08LCSD

Matrix          : SOIL                      Sample Type       : LCSD
Analyst         :                           Injection Date    : 04-OCT-2002 01:25
Instrument      : 3327_2.i                  Dilution Factor   : 1.00
Column          : RTX-CLPII                 Data File         : 03oct021608-r031.d
Integrator      : Falcon                    Compound Sublist: ENVNET
Method          : /var/chem/3327_2.i/100302_1/03OCT021608.b/32CONG_3327RTXCLPII_RAW.m
Reported        : 17-Oct-2002 13:49 rrm

________________________________ Peaks ________________________________

                                                       Extract
 Peak    Peak    Expected   Delta                      Conc.
  No.     RT        RT        RT      Area     Height   (ppb)     Flags          Peak Identification
=====  ========  ========  ========  ========  ========  ==========  =====  =====================================
    1   1.002                          122589    11229
    2   1.224                           24714     2915
    3   1.618                            4286      947
    4   1.802                            1652      225
    5   2.068                            1183      208
    6   2.724                            1026      243
    7   2.899                             902      138
    8   3.114                             782      255
    9   3.221                            2207      696
   10   3.378                             530      108
   11   3.496                            1969      515
   12   3.666                             559      123
   13   3.833                            1877      384
   14   3.941                            2171      611
   15   4.052                           12099     3296
   16   4.252                            2455      361
   17   4.413                            1793      310
   18   4.586                            1571      315
   19   4.688                            5572     1699
$  20   5.380     5.391    -0.011      454183   156441    41.5263           Tetrachloro-meta-xylene
   21   5.568                            4514      927
   22   6.016                            3504      960
   23   6.247                            3907     1331
   24   6.433                            1485      486
   25   6.577     6.592    -0.016      298327    83044    96.4094           BZ#8
   26   7.683     7.698    -0.016      378342    95825    97.1640           BZ#18
   27   8.175                            1325      195
   28   8.397                             355       84
   29   8.556                            1260      354
   30   8.789                             896      205
   31   9.122     9.137    -0.016      627696   163239    95.3372           BZ#28
   32   9.534                            7852     1086
   33  10.325    10.341    -0.016      503231   118025    96.9344           BZ#52
   34  10.465                          614525   134564
   35  11.152                             745      169
   36  11.294    11.312    -0.018      668311   150927    96.8448           BZ#44
   37  11.538                           12097     2082
   38  12.141                             351       88
   39  12.327                             397      103
   40  12.435                             604      138
   41  12.584                            1332      312
   42  12.877                             905      212
   43  13.038    13.056    -0.018      740878   154013    94.8779           BZ#66
   44  13.894    13.914    -0.020      723611   143769    97.1025           BZ#101
   45  14.355                            3331      409
   46  14.869                            2178      472
   47  15.200                             347      100
   48  15.401                         1573002   250067
   49  16.055    16.080    -0.024      523311    87123    94.1241           BZ#77
   50  16.652                            7848     1103
   51  16.926                          797445   165665
   52  17.055    17.075    -0.020      880407   159752    96.0168           BZ#118
   53  17.634                         1051152   221631
   54  17.782                          958188   178759
   55  17.975    17.995    -0.020      882343   162493    9[illegible].[illegible]016           BZ#153
```

| Peak No. | Peak RT | Expected RT | Delta RT | Area | Height | Extract Conc. (ppb) | Flags | Peak Identification |
|---|---|---|---|---|---|---|---|---|
| 56 | 18.272 | | | 9944 | 1603 | | | |
| 57 | 18.700 | 18.720 | -0.020 | 981902 | 194640 | 95.2186 | | BZ#105 |
| 58 | 19.174 | | | 32361 | 4515 | | | |
| 59 | 19.693 | 19.713 | -0.020 | 1039510 | 195733 | 97.2471 | | BZ#138 |
| 60 | 19.985 | | | 4697 | 886 | | | |
| 61 | 20.203 | 20.225 | -0.022 | 1548680 | 180156 | 192.741 | R | BZ#126 |
| 61 | 20.203 | 20.225 | -0.022 | 1548680 | 180156 | 192.741 | MR | BZ#187 |
| 62 | 20.466 | | | 1097213 | 198017 | | | |
| 63 | 21.036 | | | 953405 | 171974 | | | |
| 64 | 21.442 | 21.462 | -0.020 | 1166056 | 221843 | 98.4494 | M | BZ#128 |
| 65 | 21.896 | | | 2184 | 360 | | | |
| 66 | 22.023 | | | 2873 | 509 | | | |
| 67 | 22.284 | | | 2061 | 391 | | | |
| 68 | 22.442 | | | 1114525 | 206895 | | | |
| 69 | 22.863 | | | 1096588 | 204414 | | | |
| 70 | 23.093 | 23.115 | -0.022 | 1200045 | 213680 | 94.4835 | M | BZ#180 |
| 71 | 24.439 | | | 867604 | 146103 | | | |
| $ 72 | 24.656 | 24.678 | -0.022 | 559824 | 101060 | 42.4402 | M | BZ#198 |
| 73 | 24.982 | 25.004 | -0.022 | 1246039 | 229146 | 97.7450 | M | BZ#170 |
| 74 | 25.210 | | | 22687 | 2763 | | | |
| 75 | 25.826 | | | 763 | 124 | | | |
| 76 | 26.389 | | | 1236617 | 219266 | | | |
| 77 | 27.181 | 27.203 | -0.022 | 1353225 | 236776 | 96.3374 | | BZ#195 |
| 78 | 28.003 | | | 571 | 112 | | | |
| 79 | 28.287 | | | 13054 | 2543 | | | |
| 80 | 28.808 | | | 366 | 51 | | | |
| 81 | 29.468 | | | 481 | 101 | | | |
| 82 | 29.788 | 29.805 | -0.018 | 1323218 | 274900 | 96.8338 | M | BZ#206 |
| 83 | 30.368 | | | 565 | 65 | | | |
| 84 | 30.734 | 30.754 | -0.020 | 1192117 | 260704 | 97.7055 | M | BZ#209 |
| 85 | 31.481 | | | 1612 | 194 | | | |
| 86 | 31.765 | | | 1725 | 128 | | | |
| 87 | 32.164 | | | 4568 | 406 | | | |
| 88 | 32.878 | | | 26539 | 1671 | | | |
| 89 | 33.095 | | | 8273 | 902 | | | |
| 90 | 33.817 | | | 6896 | 751 | | | |
| 91 | 34.609 | | | 18023 | 2007 | | | |
| 92 | 35.327 | | | 2624 | 325 | | | |
| 93 | 35.524 | | | 2892 | 531 | | | |
| 94 | 35.819 | | | 932 | 167 | | | |
| 95 | 36.398 | | | 2944 | 557 | | | |
| 96 | 37.402 | | | 1321 | 186 | | | |

Flags:
A - Peak quantitates above calibration range
a - Peak quantitates below reporting limit
H - User selected alternate compound hit
M - Peak manually integrated or manually identified
R - Peak fails recovery
U - User disabled peak ID: either peak quantitates below reporting limit or peak identification not confirmed on second column

## Target Compounds

| Peak RT | Expected RT | Target Compound |
|---|---|---|
| 5.380 | 5.391 | Tetrachloro-meta-xylene |
| 6.577 | 6.592 | BZ#8 |
| 7.683 | 7.698 | BZ#18 |
| 9.122 | 9.137 | BZ#28 |
| 10.325 | 10.341 | BZ#52 |
| 11.294 | 11.312 | BZ#44 |
| 13.038 | 13.056 | BZ#66 |
| 13.894 | 13.914 | BZ#101 |
| 16.055 | 16.080 | BZ#77 |
| 17.055 | 17.075 | BZ#118 |
| 17.975 | 17.995 | BZ#153 |
| 18.700 | 18.720 | BZ#105 |
| 19.693 | 19.713 | BZ#138 |

# STL Burlington - Target GC Injection Report

| Peak RT | Expected RT | Target Compound |
|---|---|---|
| 20.203 | 20.225 | BZ#126 |
| 20.203 | 20.225 | BZ#187 |
| 21.442 | 21.462 | BZ#128 |
| 23.093 | 23.115 | BZ#180 |
| 24.656 | 24.678 | BZ#198 |
| 24.982 | 25.004 | BZ#170 |
| 27.181 | 27.203 | BZ#195 |
| 29.788 | 29.805 | BZ#206 |
| 30.734 | 30.754 | BZ#209 |

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# SAMPLE PREPARATION

CLIENT: ENVNeT
CASE: 22000
SDG: 89891
ETR: 89891
DATE: 9/26/02 @1900

ANALYST: JKA
SPIKER: JKA
WITNESS: DVG

SURR LOT #
MTX LOT # 0P0807020Z
H2SO4 LOT # X086063
HEXANE LOT # V47E38
ACETONE LOT # X22E16

*LCSD required only if a MS/MD is not extracted in the batch.

Start time: 19:15 092602
Stop time: 13:15 092702

REVIEWED BY: RZ
DATE: 9/30/02

㉑

554/38

| STL ID | CLIENT ID | Sample Weight (30 grams soil) into a beaker | 60 gms. baked granular Na2SO4, mix, Transfer to a pre-cleaned thimble | Transfer to soxhlet extractor | Surr: 1.5ml of Congener Surr.(0.3 ppm) to all samples | MTX: 500ul of (2.0ppm) Congener Matrix (32cmpd) to MS/MD/LCS/LCSD. | Extract 18 hours w/ 400 mL 1:1 Acetone/Hexane | Transfer to K-D set-up | Hexane exchange w/ 60 mLs | Concentrate extract to 10.0ml w/ Hexane | H2SO4 Clean-up on 10 ml. | Cu clean-up on 10mls. | Trans. Hexane layer into a 16ml clear vial. | Give extract to GC w/paperwork |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| P | BLK 08 | 30.00 | JKA | JKA | ✓ | X | JKA | AT | DVG | DVG | DVG | DVG | DVG | DVG |
|  | LCS | 30.00 |  |  | ✓ | ✓ |  |  |  |  |  |  |  |  |
|  | LCSD* | 30.00 |  |  | ✓ |  |  |  |  |  |  |  |  |  |
| 502104 | F01009 LS 1,3 | 30.02 |  |  | ✓ | X |  |  |  |  |  |  |  |  |
| 502105 | F01009 LS 1,2 | 30.02 |  |  | ✓ | X |  |  |  |  |  |  |  |  |
| 502106 | F01009 LS 1,1 | 30.00 |  |  | ✓ | X |  |  |  |  |  |  |  |  |
| 502107 | F01009 LS 2,3 | 30.00 |  |  | ✓ | X |  |  |  |  |  |  |  |  |
| 502108 | F01009 LS 2,2 | 29.96 |  |  | ✓ | X |  |  |  |  |  |  |  |  |
| 502109 | F01009 LS 2,1 | 29.97 |  |  | ✓ | X |  |  |  |  |  |  |  |  |
| ★★ 502110 | F01009 LS 3,3 | 29.98 |  |  | ✓ | X |  |  |  |  |  |  |  |  |
| ★ 502111 | F01009 LS 3,2 | 30.01 |  |  | ✓ | X |  |  |  |  |  |  |  |  |
| ★ 502112 | F01009 LS 3,1 | 29.98 |  |  | ✓ | X |  |  |  |  |  |  |  |  |
| 502113 | F01009 LS 4,3 | 30.00 |  |  | ✓ | X |  |  |  |  |  |  |  |  |
| 502114 | F01009 LS 4,2 | 29.96 |  |  | ✓ | X |  |  |  |  |  |  |  |  |
| ★ 502115 | F01009 LS 4,1 | 30.01 |  |  | ✓ | X |  |  |  |  |  |  |  |  |
| 502116 | F01009 LS 5,3 | 30.05 |  |  | ✓ | X |  |  |  |  |  |  |  |  |
| 502117 | F01009 LS 5,2 | 30.02 |  |  | ✓ | X |  |  |  |  |  |  |  |  |
| 502118 | F01009 LS 5,1 | 30.03 |  |  | ✓ | X |  |  |  |  |  |  |  |  |
| ★ 502119 | F01009 LS 6,3 | 30.05 |  |  | ✓ | X |  |  |  |  |  |  |  |  |
| 502120 | F01009 LS 6,2 | 30.00 |  |  | ✓ | X |  |  |  |  |  |  |  |  |
| 502121 | F01009 LS 6,1 | 30.05 |  |  | ✓ | X |  |  |  |  |  |  |  |  |

DVG 9-25-02

★ = samples were filtered due to H2O.
★★ - sample required two filters to remove all H2O DVG 9/26/02

0288

P 1 of 2

# STL 8082 RUNLOG

**HP3327** CH. 03 & CH. 04 RTX-5 and RTX-CLP II (0.32mm ID) Injection volume 2.0 ul

DATE: 10/3/02 ANALYST: RRM PROJECT: 100102

TARGET DIRECTORY: 100302 -1 MULTICHROM INITIAL CALIBRATION FILENAME: 03OCT021607

| inj.# | Lab ID | Analysis Filename/ Batch | Dilution Factor | SDG | Matrix | Prep Batch | QC check | Int. By | Comments |
|---|---|---|---|---|---|---|---|---|---|
| 1 | PIBLK | 03OCT021607 | | | | | | | |
| 2 | PIBLK | | | | | | | | |
| 3 | PIBLK | | | | | | | | |
| 4 | 32 CONG-L1 | | | | | | | Rm | GC072302-06 |
| 5 | 32CONG-L2 | | | | | | | | -04 |
| 6 | 32CONG-L3 | | | | | | | | 03 |
| 7 | 32CONG-L4 | | | | | | | | -02 GR OK |
| 8 | 32CONG-L5 | | | | | | | | -01 |
| 9 | PIBLK | | | | | | | | |
| 10 | 20ICV-SD | | | | | | | | GC062702-11 |
| 1 | PBLK08 | 03OCT021608 | | 89891 | S | 0926 08 | Rm | Rm | ok - report |
| 2 | 08LCS | | | | | | | | |
| 3 | 08LCSD | | | | | | | | |
| 4 | 502104 | | | | | | | | |
| 5 | 502105 | | | | | | | | |
| 6 | 502106 | | | | | | | | |
| 7 | 502107 | | | | | | | | sulfur present - sample ND |
| 8 | 502108 | | | | | | | | |
| 9 | 502109 SCU | | | | | | | | SCU |
| 10 | 502110 | | | | | | | | |
| 11 | 502111 | | | | | | | | |
| 12 | PIBLK | | | | | | | | |
| 13 | 32-CONG-L3 | | | | | | r | Rm | ok ok [SS = 25ppb] |
| 14 | PIBLK - SCU | | | | | | Rm | | ok - report |
| 15 | 502112 | | | | | | | | |
| 16 | 502113 SCU | | | | | | | | SCU |
| 17 | 502114 SCU | | | | | | | | SCU |
| 18 | 502115 | | | | | | | | |

Severn Trent Laboratories - VT

# STL 8082 RUNLOG

p2 of 2

**HP3327** CH. 03 & CH. 04 RTX-5 and RTX-CLP II (0.32mm ID) Injection volume 2.0 ul

DATE: 10/3/02 ANALYST: RRM PROJECT: 100102

TARGET DIRECTORY: 100302 - 1 MULTICHROM INITIAL CALIBRATION FILENAME: 03OCT021607

| inj.# | Lab ID | Analysis Filename/ Batch | Dilution Factor | SDG | Matrix | Prep Batch | QC check | Int. By | Comments |
|---|---|---|---|---|---|---|---|---|---|
| 19 | 502116 | 03OCT021608 | | 89891 | S | 0926 08 | Rm | Rm | ok - report |
| 20 | 502117 | — | | | | | | | |
| 21 | 502118 | — | | | | | | | |
| 22 | 502119 | — | | | | | | | |
| 23 | 502120 | — | | | | | | | |
| 24 | 502121 | — | | | | | | | |
| 25 | PiBlk | | | | | | | | |
| 26 | 32-CONG-L3 | | | | | | | Rm | ok ok |

Severn Trent Laboratories - VT

RRM 10/16/02

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# SAMPLE HANDLING

**FedEx** Express USA Airbill

FedEx Tracking Number 835333[illegible]27221

Form I.D. No. 0200

**1 From**

[redacted]

Date 9-23-02

Sender's Name Matt Neal

Phone 808 833-3335

Company [illegible]

Address [illegible]

Dept./Floor/Suite/Room

City Honolulu

State HI

ZIP 96817

**2 Your Internal Billing Reference**

**3 To**

Recipient's Name [illegible]

Phone 802 655-1203

Company [illegible]

Address 208 South Park Drive, Suite 1

To "HOLD" at FedEx location, print FedEx address.

We cannot deliver to P.O. boxes or P.O. ZIP codes

Address

Dept./Floor/Suite/Room

City Colchester

State VT

ZIP 05446

8353 3342 7221

**4a Express Package Service**

*Packages up to 150 lbs.* Delivery commitment may be later in some areas.

☒ FedEx Priority Overnight Next business morning

☐ FedEx Standard Overnight Next business afternoon

☐ FedEx First Overnight Earliest next business morning delivery to select locations

☐ FedEx 2Day Second business day

☐ FedEx Express Saver Third business day

FedEx Envelope rate not available. Minimum charge: One pound rate

**4b Express Freight Service**

*Packages over 150 lbs.* Delivery commitment may be later in some areas.

☐ FedEx 1Day Freight* Next business day

☐ FedEx 2Day Freight Second business day

☐ FedEx 3Day Freight Third business day

* Call for Confirmation

**5 Packaging**

☐ FedEx Envelope*

☐ FedEx Pak* Includes FedEx Small Pak, FedEx Large Pak, and FedEx Sturdy Pak

☒ Other

* Declared value limit $500

**6 Special Handling**

Include FedEx address in Section 3

☒ SATURDAY Delivery Available only for FedEx Priority Overnight and FedEx 2Day to select ZIP codes

☐ HOLD Weekday at FedEx Location Not available for FedEx First Overnight

☐ HOLD Saturday at FedEx Location Available only for FedEx Priority Overnight and FedEx 2Day to select locations

Does this shipment contain dangerous goods? One box must be checked

☒ No

☐ Yes As per attached Shipper's Declaration

☐ Yes Shipper's Declaration not required

☐ Dry Ice Dry Ice, 9, UN 1845 ____ x ____ kg

Dangerous Goods (including Dry Ice) cannot be shipped in FedEx packaging

☐ Cargo Aircraft Only

**7 Payment** *Bill to:*

Enter FedEx Acct. No. or Credit Card No. below.

☒ Sender Acct. No. in Section 1 will be billed

☐ Recipient

☐ Third Party

☐ Credit Card

☐ Cash/Check

☐ Obtain Recip. Acct. No.

[redacted]

[redacted]

| Total Packages | Total Weight | Total Declared Value† | Total Charges |
|---|---|---|---|
| 1 | 47 | $ .00 | |

Credit Card Auth

†Our liability is limited to $100 unless you declare a higher value. See back for details

**8 Release Signature** *Sign to authorize delivery without obtaining signature*

By signing you authorize us to deliver this shipment without obtaining a signature and agree to indemnify and hold us harmless from any resulting claims.

**Questions? Visit our Web site at fedex.com**

or call 1.800.Go.FedEx® 800 463 3339

446

0930

9/25/02

# SEVERN TRENT LABORATORIES LOG-IN SHEET - Form DC-1

Lab Name: STL Burlington
Page 1 of 1

Received By (Print or Type Name): Kyle W. Sink
Log-in Date: 09/25/02

Received By (Signature): Kyle Sink

**Case Number:** 22000
**Sample Delivery Group No.:** 89891
**ETR Number:** 89891

**REMARKS:**

**1. Custody Seal** Absent*
**2. Custody Seal Nos:** NA
**3. Chain-of-Custody Records** Present
**4. Sample Information Sheets** Absent*
**5. Airbill Present** As Airbill
**6. Airbill Number(s):** 8353334~~0~~87221 PCd 9/26/02
**7. Sample Tags** Absent*
**8. Tag Nos. Listed on COC** N/A
**9. Sample Condition:** Intact
**10. VOA Vial Bubbles** N/A
**11. Does info on the custody records, sample info sheets, sample tags and labels agree?** Yes
**12. Date Received at Lab:** 09/25/02
**13. Time Received at Lab:** 0930
**14. Cooler Temperature(s):** 2 C

**SAMPLE TRANSFER:**
**Fraction(s):** ALL
**Area Number:** Level 4 Storage
**Transferred By:** KS1
**Transferred On:** 09/25/02

| CORRESPONDING | | | |
|---|---|---|---|
| CLIENT SAMPLE # | SAMPLE TAG # | ASSIGNED LAB # | REMARKS: CONDITION OF SAMPLE SHIPMENT ETC. |
| F01009 LS 1,3 | NA | 502104 | Samples received intact with |
| F01009 LS 1,2 | NA | 502105 | no custody seals present. |
| F01009 LS 1,1 | NA | 502106 | One cooler received at two |
| F01009 LS 2,3 | NA | 502107 | degrees. |
| F01009 LS 2,2 | NA | 502108 | |
| F01009 LS 2,1 | NA | 502109 | |
| F01009 LS 3,3 | NA | 502110 | |
| F01009 LS 3,2 | NA | 502111 | |
| F01009 LS 3,1 | NA | 502112 | |
| F01009 LS 4,3 | NA | 502113 | |
| F01009 LS 4,2 | NA | 502114 | |
| F01009 LS 4,1 | NA | 502115 | |
| F01009 LS 5,3 | NA | 502116 | |
| F01009 LS 5,2 | NA | 502117 | |
| F01009 LS 5,1 | NA | 502118 | |
| F01009 LS 6,3 | NA | 502119 | |
| F01009 LS 6,2 | NA | 502120 | |
| F01009 LS 6,1 | NA | 502121 | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | KS 9/25/02 |
| | | | |

* *Contact Project Director*

Reviewed By:________________ Date:________________

# ** COOLER RECEIPT CHECKLIST **

List ETR 89891

WERE CUSTODY SEALS PRESENT ON THE COOLERS?

YES [✓ NO]

WERE THE CUSTODY SEALS SIGNED?

YES [✓ NO]

WERE THERE CUSTODY SEAL NUMBERS?

YES [✓ NO]

LIST THE CUSTODY SEAL NUMBERS. ________ ________

WHAT TYPE OF COOLING WAS UTILIZED?

[✓ ICE] MELTED ICE PACKS NONE

COOLER TEMPERATURE (degrees c): 2 (2-6 °C Acceptable)

DATE AND TIME COOLER RECEIVED: 09-25-02 0930

DO SAMPLES APPEAR TO BE INTACT: [✓ YES] NO

DO ANY SAMPLES HAVE SHORT HOLDING TIMES?
(less than seven days)

WET CHEM YES [✓ NO]

EXTRACTABLES YES [✓ NO]

UNPRES VOA YES [✓ NO]

RADIATION SCREEN RESULTS <0.05 MR/HR [✓ YES] NO

SM02 Cooler Rpt Chklist
STL Burlington

## *C.3*
## *Historical Assessment of the Lagoon from Aerial Photographs*

# APPENDIX C.3

# HISTORICAL ASSESSMENT OF THE LAGOON FROM AERIAL PHOTOGRAPHS

A historical assessment of the lagoon environment was completed simultaneously with the historical assessment of the land area. A detailed description and visual analysis of the aerial photographs are included in Section 2.5 of the Ecosystem Restoration Report (ERR). The Commonwealth of the Northern Mariana Islands (CNMI) Division of Environmental Quality (DEQ) marine biology staff members were instrumental in the interpretation of changes in the lagoon environment apparent in the aerial photographs. The aerial photographs are included in Appendix C of the ERR.

## INTERPRETATION OF LAGOON ENVIRONMENT CHANGES

Upon review of the aerial photographs, it is apparent that the lagoon environment reacts to terrestrial changes on the adjacent shore. The nearshore *Enhalus* band is characteristically located in an area of freshwater infiltration and has remained fairly consistent throughout the past 70 years. The most significant changes have occurred in the mid-lagoon region, where *Halodule* and macroalgae are dominant. During periods when there was heavy development/land devoid of vegetation within the study area (1944, 1945, and 1999), abundant *Halodule* and macroalgae are apparent in the lagoon. During periods when development was suppressed due to minimal population and terrestrial vegetation was heavy, the lagoon appears to have more sandy-bottom areas and less macroalgae cover.

As discussed earlier, the 1945 image shows that Japanese development of the time was heavy. There are regions of exposed dirt/dredge material, many buildings, and numerous dirt “coral capped” roads throughout the region. This development and high population of the time were most likely associated with septic systems or other types of sewage disposal. Waste from these sources containing high levels of nutrients washing into the lagoon system affects the marine communities by supporting macroalgae and seagrass community growth (see Section 3.1.2.1 of the ERR). The 1945 photograph shows a band of what is most likely *Enhalus* seagrass closest to shore. This black band extends out to the deeper mid-lagoon region. The assumption is made that the *Enhalus* seagrass region, similar to all other photographs, extends only a couple hundred meters off-shore. The remaining portion of the black band in the 1945 image is probably *Halodule* seagrass or macroalgae stands. There is another bed of *Halodule* seagrass or macroalgae in the outer lagoon near the lighthouse. This is significant because the deeper mid-lagoon region is associated with stronger currents and tidal exchanges. These events would theoretically exchange high nutrient lagoon waters before they reach the outer lagoon. The large stand of seagrass or macroalgae present in the 1945 image suggests that nutrient rich groundwater may be affecting communities of the outer lagoon in the study area.

This high level of seagrass and macroalgae development is absent in later images from 1956, 1969, and 1976. All of these images show a band of *Enhalus* seagrass of varying width close to shore. None of the images show seagrass and macroalgae growth extending from shore to the mid-lagoon region. Furthermore, none of these images show any large development of seagrass or macroalgae in the outer lagoon. The majority of the lagoon as seen in the photographs shows a barren sandy bottom, which requires lower levels of nutrients in runoff water, and groundwater, to maintain.  Urban development and population levels had decreased during this time frame, with areas of former soil exposure replaced with vegetation growth, lessening nutrient transport to the lagoon.

The most recent (2009) image shows the most resemblance to the 1945 image in terms of seagrass and macroalgae stands associated with heavy urbanization and development within the watershed.  Furthermore, it is only in the 1945 and 2009 image where there is a *Halodule* and macroalgae stand development in the outer lagoon, near the lighthouse.  Thus the assumption can be made that increased development within the region during both the Japanese era and recent years have led the area susceptible to erosion and increased surface runoff, leading to an increase in contaminants, nutrients, and sediment washing into the lagoon, and ultimately altering the marine system.

## *C.4*

# *Inshore Lagoon Seagrass and Associated Fauna Survey*

# APPENDIX C.4

## INSHORE LAGOON SEAGRASS AND ASSOCIATED FAUNA SURVEY

The MMT Saipan Lagoon monitoring effort has completed an inventory of the lagoon, including the study area. Results of the initial assessment efforts in the study area indicate that the inner lagoon habitats are affected by increased nutrients associated with stormwater from the West Takpochau watershed reaching the drainages and shores in this region, and entering the lagoon. These habitats have high abundances of seasonal macroalgae growth when compared to outer lagoon habitats.

The MMT has designated 18 habitat classifications within the lagoon (Figure C.3). The focus of this study are the inshore habitats (Habitats 10, 12, 14, and 16) since they receive the majority of the fresh water pollution and serve as the first line of defense for the valuable coral reef and fisheries resources that lay further offshore.

Habitat 1: Consists of a hard bottom with encrusting coralline algae and encrusting coral, along with turf algae. The typical depth of this habitat is approximately 0 to 2 feet.

Habitat 2: Consists of a sandy bottom with a scattered abundance of live corals. The most common living benthic organism within this habitat is turf algae. The depth of this habitat is very shallow at approximately 1 to 3 feet.

Habitat 3: Consists of a hard bottom with scattered sandy patches and seasonal macroalgae. The typical depth of this habitat is approximately 1 to 3 feet.

Habitat 6: Consists of a sandy bottom with staghorn corals, *Acropora spp.*, in high abundances. Turf algae are also abundant. The typical depth of this habitat is approximately 5 to 7 feet. The framework resulting from accretion of the branching staghorn coral skeletons provides refuge for fish and other invertebrates. As a result, this habitat is heavily fished on a daily basis.

Habitat 7: Consists of a sandy bottom with sparse living and dead corals. This habitat is in the deeper lagoon waters at approximately 10 to 12 feet. Dead corals generally have either turf algae or coralline algae growing on their surfaces.

Habitat 10: Consists of a barren sand zone adjacent to shore. The common black sea cucumber, *Holothuria atra,* is abundant, and unattached seasonal macroalgae can be present dependant on local weather and oceanographic conditions. The typical depth of this habitat is approximately 1 to 2 feet.

Habitat 11: Consists of a sandy bottom with the small seagrass, *Halodule uninervis,* and the very tiny seagrass, *Halophila minor*. This habitat is in the deeper lagoon waters at approximately 10 to 12 feet. Abundance of the common black sea cucumber, *Holothuria atra*, is highest in this habitat, possibly due to the predominantly sandy bottom.

Habitat 12: Consists of the large seagrass, *Enhalus acoroides*. The typical depth of this habitat is approximately 2 to 4 feet. There are 81.8 (plus or minus [±] 17.1) roots per 0.25 square meter ($m^2$) in this habitat.

Habitat 13: Consists of a sandy bottom with the macroalgae, *Gelidiella acerosa* and turf algae. The average depth of this habitat is approximately 2 to 4 feet.

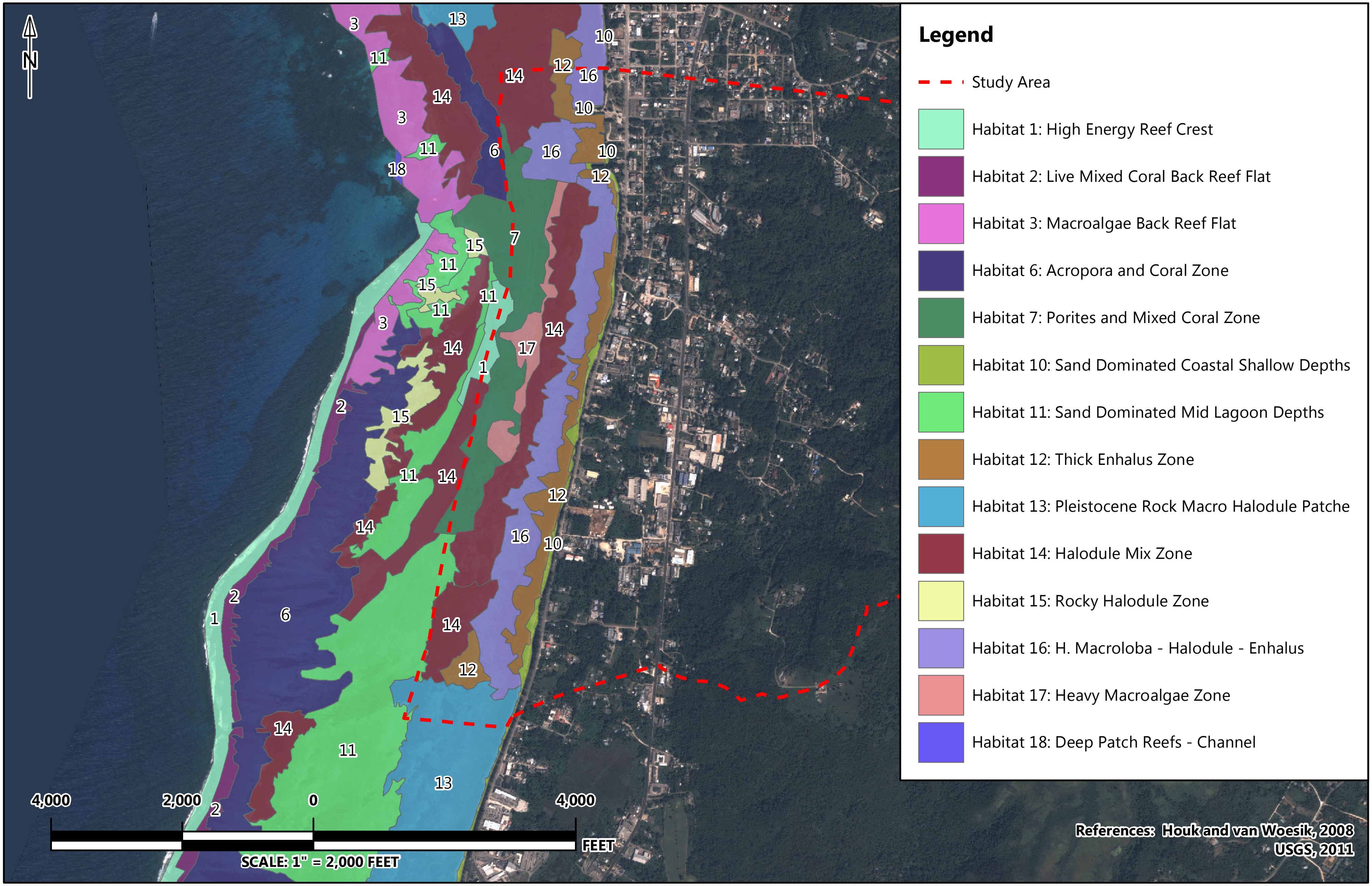
Habitat 14: Consists of the small seagrass, *Halodule uninervis*, and the macroalgae, *Halimeda opuntia* commonly occurring along with other seasonal macroalgae. The typical depth of this habitat is approximately 3 to 5 feet.

Habitat 15: Consists of a sandy bottom with abundant small seagrass, *Halodule uninervis*. The typical depth of this habitat is approximately 3 to 5 feet. Live and dead coral rocks are randomly located throughout this habitat, with less than 2 percent benthic coverage. This habitat is located adjacent to one or more barrier reef habitats.

Habitat 16: Consists of a sandy bottom with the large seagrass, *Enhalus acoroides*, intermixed with the smaller seagrass, *Halodule uninervis*. There is also a large abundance of seasonal macroalgae in this habitat. The typical depth is approximately 3 to 5 feet.

Habitat 17: This habitat is only located adjacent to the lighthouse channel and has not been found in any other Saipan Lagoon location. This habitat consists of a sandy bottom with a high abundance of seasonal macroalgae. The typical depth of this habitat is approximately 2 to 4 feet.

Habitat 18: This is a habitat unique to the deeper areas of the lighthouse channel in the study area. The habitat is dominated by a sandy bottom with patch reefs at depths of approximately 12 to 20 ft.



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| DATE: SEPTEMBER 20, 2012 | |
| DRAWN BY: CB | |
| REVIEWED BY: MA | |

ECOSYSTEM RESTORATION REPORT
SAIPAN LAGOON AQUATIC ECOSYSTEM RESTORATION STUDY

LAGOON HABITAT MAP
SAIPAN, CNMI

FIGURE
C.3

## *C.5*
## *Inventory of Potentially Contaminating Activities in Watershed*

# APPENDIX C.5

## INVENTORY OF POTENTIALLY CONTAMINATING ACTIVITIES IN WATERSHED

An integral part of this aquatic ecosystem restoration study was to identify land-based sources of pollution that could potentially contribute nutrients, sediments, or contaminants to the lagoon. Potentially contaminating activities (PCAs) within the study area were inventoried and subjected to a susceptibility analysis.

### METHODOLOGY

Protocol for conducting the PCA inventory was based on guidelines included in the Source Water Assessment Program (SWAP) that was part of the Safe Drinking Water Act amendment in 1996. The objective of the SWAP program was to assess the susceptibility of all drinking water sources to activities that have significant potential to release contaminants to water sources. Although drinking water is not the primary focus of this study, the same principles were applied during the assessment of PCAs that affect the lagoon water. Therefore, for this study, a PCA is defined as a facility or activity that 1) stores, transmits, uses, or produces contaminants, chemicals or by-products; and 2) has the potential to release contaminants that may impact the quality of the lagoon water. The purpose of the inventory was to identify and locate all significant PCAs that are situated within the study area.

### TECHNICAL APPROACH

The three basic steps of a PCA inventory are as follows:

1. **delineation** of the assessment area around the water source;
2. **inventory** of the assessment area to identify PCAs; and
3. **susceptibility** of the lagoon water to become contaminated from the identified PCAs.

#### Delineation

The purpose of delineating the assessment area is to determine the area around the lagoon that has a direct influence on the water quality of the lagoon. The area of concern for this study consists of the entire watershed within the study area, stretching from the shoreline to the west, the ridgeline to the east, Garapan Fishing dock to the north, and Quartermaster Road to the south.

#### Inventory

Prior to conducting an inventory within the delineated assessment area, a list of PCAs was developed and each PCA was assigned to one of four categories: very high, high, medium and low potential to contaminate the lagoon. The PCA category list is presented in Table C.8.

PCAs were identified during a survey of the study area that was aided by a review of aerial photographs and maps of the study area.  A field investigation was conducted to verify the existence, location, and nature of the PCAs identified during the data search described above.

### Susceptibility Analysis

Each individual PCA was categorized according to its class of contaminant.  Four classes of contaminants were identified:

1. Sedimentation – Any site or activity that could contribute unnaturally high sediment loads to the lagoon.
2. Hazardous Constituents – Any site or activity that could contribute hazardous materials, chemicals, and/or waste to the lagoon.
3. Nutrient Sources - Any site or activity that could contribute nutrient-laden materials to the lagoon.
4. Runoff – Any site that is covered with a significant impervious surface (i.e. pavement) that produces unnaturally high freshwater runoff during storm events.

The health of the lagoon aquatic ecosystem is potentially adversely affected by all four of these contaminant types (hazardous, sediment, nutrient, and runoff).  These contaminant classes are interrelated in that all are transported to the lagoon via stormwater runoff. Certain features within the watershed facilitate runoff (paved surfaces), certain activities contribute sediment and nutrients (de-vegetated land, agricultural land, malfunctioning sewage systems), and certain activities contribute hazardous contaminants (auto repair shops, surface spills, and light industrial facilities).  Based on the high percentage of de-vegetated land area within the study area, contaminants such as nitrates, phosphates, and other nutrients found in soil and sediment are of the most concern because of their susceptibility to be transported to the lagoon via stormwater runoff.  As discussed previously, elevated nutrient levels entering the lagoon have a deleterious effect on various components of the ecosystem and on the general function of the ecosystem as a whole.

### GENERAL LAND USE ANALYSIS

The study area is characterized by a highly urbanized band located between Beach Road and Middle Road.  Development in this area consists of garment factories, light industrial buildings, and residences.  The Gualo Rai residential area lies upslope and inland of Middle Road.  Many of the small side roads and lots are unpaved.  There are storm drains along Middle Road and Beach Road, but there is no comprehensive collection and conveyance system designed to control stormwater within the developed areas in the Gualo Rai district and between Middle and Beach Roads.  The storm drains that are present are poorly maintained and culverts are often clogged with sediment and debris.

De-vegetated, unpaved, and exposed soil surfaces, and impervious paved surfaces, coupled with the absence of a stormwater collection system leads to increased sediment loads entering the lagoon during storm events.  During a storm event, roadways and paved lots serve as surface flow channels for rainwater runoff, enabling the transport of

## Table C.8: PCA Category List

The potential for contamination is based on the nature of the activities, contaminants associated with those activities, and past record of groundwater and/or surface water contamination regardless of whether any environmental standards were exceeded. The potential for contamination does not reflect toxicity of the contaminant and should not be utilized as a means of assessing risk. These rankings do not take into account any site-specific practices such as pollution prevention or protection measures such as BMPs. PCAs utilizing BMPs that may mitigate potential contamination will be acknowledged in the assessment summary.

| **Very High** | **High** | **Medium** | **Low** |
|---|---|---|---|
| RCRA & CERCLA sites<br>Large Quantity Hazardous Waste Generators<br>RCRA TSD sites<br>Gas stations<br>Chemical/petroleum processing/storage<br>Chemical/petroleum pipeline<br>Dry cleaners/processing<br>Metal plating/finishing/fabricating<br>Plastics/synthetic fabricators<br>Pesticides/herbicides mixing and loading sites<br>Airports – maintenance fueling areas<br>Landfills/dumps/historic dumps<br>Cesspools – High density >1/acre (VH in Zone A and B, M in Zone C)*<br>Wastewater treatment plants (VH in Zone A and B, otherwise H)*<br>Underground injection of commercial/industrial discharges<br>Injection wells/dry wells/sumps<br>Military installations<br>Leaking underground storage tanks<br>Confined animal feeding facilities (VH in Zone A, otherwise H) >25 head/acre beef cattle, dairy cattle, pigs, horses, others >200 fowl/acre*<br>Pineapple & sugarcane cultivation<br>Feral animals including rats, pigs, goats, and birds (surface water sources)*<br>Improperly abandoned wells<br>Wood treatment facilities<br>Power plants<br>Illegal activities/unauthorized dumping<br>Recorded spills<br>Other crops using soil fumigants (direct application into soil) | Small Quantity Hazardous Waste Generators<br>Auto body shops<br>Automobile repair shops<br>Boat services/repair/refinishing<br>Fleet/trucking/bus terminals<br>Furniture repair/manufacturing<br>Junk/scrap/salvage yards<br>Machine shops<br>Photo processing/printing<br>Research laboratories<br>Sewer lines (H in Zones A and B, M in Zone C)*<br>Utility stations/maintenance areas<br>Wastewater treatment plants (VH in Zones A and B, otherwise H)*<br>Confined animal feeding operations (VH in Zones A and B, otherwise H)*<br>Pesticide distributors/professional applicators<br>Construction or farm machinery repair/maintenance<br>Septic systems (H in Zones A and B, M in Zone C)*<br>Lagoons/liquid wastes*<br>Wells- geothermal (production and injection)<br>Reclaimed water irrigation (R2 Water)*<br>Grazing – surface water source*<br>Underground storage tanks (non-regulated, not yet upgraded or registered)<br>Cultivated agricultural land (crops not using fumigants)<br>Golf courses<br>Diversified agriculture (orchards, silviculture) | Car washes<br>Parking lots/malls (>50 spaces)<br>Cement/concrete plants<br>Food processing*<br>Funeral services/graveyards<br>Hardware/lumber/parts stores<br>Residential parcels<br>Sewer lines (H, in Zones A and B, otherwise M)*<br>Motor pools<br>Parks<br>Waste transfer /recycling stations<br>Sewage sludge (biosolids) land applications*<br>Reclaimed wastewater irrigation (R1 Water)*<br>Above ground storage tanks<br>Wells – improperly maintained water supply, monitoring, and test holes<br>Contractor or government agency equipment storage yards<br>Transportation corridors (freeways, state highways, road right-of-ways)<br>Hospitals<br>Storm drain discharge points<br>Stormwater detention facilities<br>Stormwater drainage - dry wells<br>Artificial recharge projects (non-potable water)<br>Schools (high school and higher)<br>Campgrounds | Office buildings/complexes<br>Equipment rental yards<br>Apartments and condominiums<br>Fire stations<br>Schools (pre- up to intermediate/middle)<br>Underground storage tanks (decommissioned-inactive)<br>Roads/streets<br>Veterinary offices/clinics<br>Medical/dental clinics<br>Storm drains (concrete lined) |

*PCAs associated with microbial contamination.

sediment and surface contaminants to the lagoon. Large deposits of sediment create unnaturally large deltas in the lagoon, destroying the nearshore lagoon habitat. In addition, the sediment generally contains high levels of nutrients, such as nitrates and phosphates, which can have a deleterious effect on the lagoon water quality and ecosystem components in general. Stormwater runoff also transports surficial contaminants, such as spilled petroleum products from auto shops and parking lots, and microbiological contaminants from overflowing septic systems and sewer system leach fields, to the lagoon.

## DETAILED SITE INVENTORY

Fifty four (54) sites were identified during the PCA inventory. A summary of the PCA inventory is provided in Table C.9 while detailed individual PCA information is presented in Table C.10. Figure C.4 depicts the location of each of the PCAs within the study area. The numbers presented in Table C.9 were used during the evaluation of the proposed detention basin sites (see Section 5.5of the ERR).

**Table C.9: PCA Summary**

| **Possible Contaminant Sources** | **Sedimentation** | **Hazardous** | **Nutrients** | **Runoff** |
|---|---|---|---|---|
| Number of Sites | 6 | 32 | 2 | 26 |

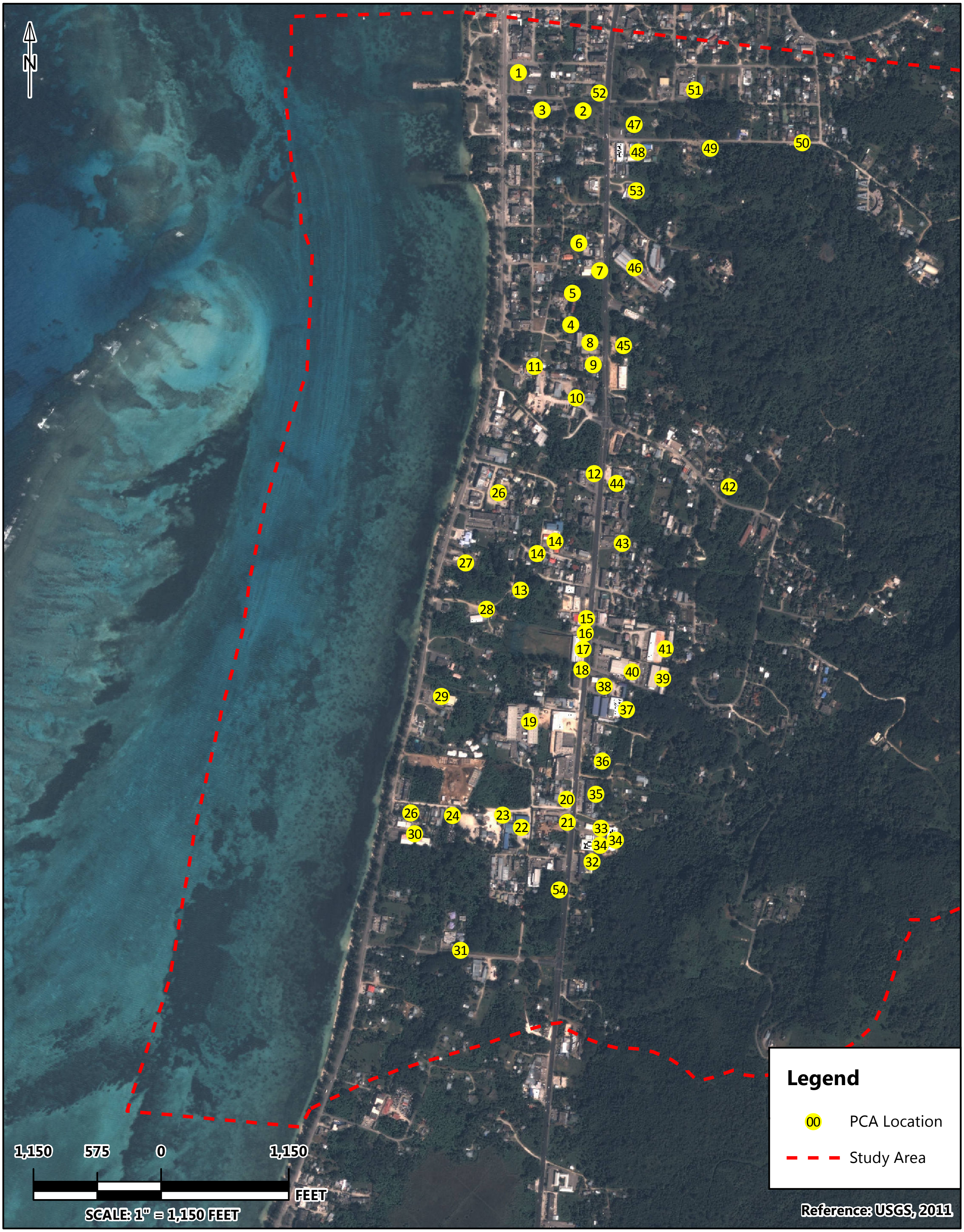
Note: Some sites contained more than one possible contaminant source.

## Table C.10: Detailed PCA List

| PCA # | PCA Name | PCA Description | Contaminant Type (Sed, Haz, Nut, Runoff) |
|---|---|---|---|
| 1 | Catholic Church Parking Lot | Parking lot with ~80 parking stalls | Runoff |
| 2 | Old Japanese Hospital Park | Park area | Haz |
| 3 | Hariguchi Bldg AST | Back-up generator/AST~1,000 Gallon | Haz |
| 4 | S2 Club Auto and Boat Repair Shop | Auto/boat repair facility | Haz |
| 5 | Apartment Complex/Parking Lot | Unnamed apartment complex | Runoff/Haz |
| 6 | Old Japanese Jail Park/Open Area | ~20,000 ft$^2$ park area/Archaeology site | Haz |
| 7 | Mid-Pac Auto Parts and Rentals | Equipment rental and auto parts store | Haz |
| 8 | Luen Fung Enterprises | Wholesale distributor, meat/household Goods | Haz |
| 9 | Top Development Inc | Auto repair/bus storage/air conditioning | Haz |
| 10 | Construction and Material Supply Inc | Auto repair/construction storage | Haz |
| 11 | Y.J.C. Automotive Repair Shop | Auto repair | Haz |
| 12 | J.E.Tenorio Building Complex | Parking lot and building complex | Runoff |
| 13 | Pest X Exterminators | Pesticide storage | Haz |
| 14 | Chinese Christian Church-Saipan/Jehovah Witness | Parking lots and school building | Runoff |
| 15 | Pacific Air conditioning and Refrigeration | Air conditioning repair | Haz |
| 16 | Shell Gasoline Station | Gas station with 3 pumps | Haz |
| 17 | Golf Course | Unpaved driving range | Runoff/ Sed |
| 18 | Single Story Office Complex | Parking lot and building complex | Runoff |
| 19 | Former Garment Factory/Warehouse Units | Former factory and large paved surface | Runoff/Haz |
| 20 | XO Market-Adjacent Complex Unpaved Parking Lot | Large unpaved parking lot surface | Runoff/ Sed |
| 21 | Marianas Repairs Company | Equipment rental and repair | Haz |
| 22 | Former Garment Factory/Housing Units | Large former garment factory with housing units | Haz |
| 23 | Brick Making Facility | Unconsolidated piles of sediment | Sed |
| 24 | Motion Automotive Repair | Numerous vehicles, repair area, unpaved lot | Haz/Sed |
| 25 | JJJ Motors | Car lot/repair facility/batteries and oil storage | Haz |
| 26 | USP Club Unpaved Parking Lot | Large unpaved parking lot at USP Club | Sed |
| 27 | Wendys Parking Lot | Large paved parking lot | Runoff |
| 28 | Taotao Marine Sports | Boat storage and repair facility, unpaved lot | Haz/Runoff/Sed |
| 29 | National Office Supply | Large paved parking lot, building footprint | Runoff |
| 30 | Closed Retail and Warehouse Facility | Large paved parking lot | Runoff |
| 31 | Seventh Day Adventist Dental and Eye Care Center | Large paved parking lot | Runoff |
| 32 | Transamerica Corporation Construction Supply | Hardware store and paved parking lot | Haz/Runoff |
| 33 | East West Center Rental | Rental store for heavy equipment | Haz |
| 34 | Pearl River Wholesale | Large warehouse facility/large paved areas | Runoff |
| 35 | H-Mart | Large paved parking lot/commercial center | Runoff |
| 36 | Aims Plus Auto Repair Facility | Auto repair facility | Haz |
| 37 | Former Garment Factory | Large former garment factory with dormitories | Haz/Runoff |
| 38 | Shell Gasoline Station | Gas Station with 4 pumps | Haz |
| 39 | Ace Hardware | Hardware store and paved parking lot | Haz/Runoff |

| PCA # | PCA Name | PCA Description | Contaminant Type (Sed, Haz, Nut, Runoff) |
|---|---|---|---|
| 40 | Gualo Rai Commercial Center-Pizza Hut and Napa | Commercial center with paved parking lot | Runoff |
| 41 | Former Garment Factory | Large former garment factory with dormitories | Runoff |
| 42 | Pacific Printing Press Inc. | Printing press facility | Haz |
| 43 | Transpac Business Center | Large paved parking lot | Runoff |
| 44 | Sewage Lift Station CUC-GR-1 | Lift Station with 50 gallon diesel fuel tank | Nut/Haz |
| 45 | Pacific Medical Center | Large paved parking lot | Runoff |
| 46 | Former Garment Factory | Large former garment factory with dormitories | Haz |
| 47 | Sugar King Park | Large grass area | Haz |
| 48 | Taro Sue Corp Car Air Condition Shop | Air condition repair | Haz |
| 49 | Carr-Haus | Auto repair facility | Haz |
| 50 | Road Master Auto Shop | Auto repair facility | Haz |
| 51 | Dept of Community & Cultural Affairs: Office on Aging | Large paved parking lot | Runoff |
| 52 | Strip Mall | Large paved parking lot | Runoff |
| 53 | Cockfight Arena | Large unpaved/grass area | Runoff/Nut |
| 54 | Parking Lot | Large paved parking lot | Runoff |

Notes:
Haz=Hazardous
Nut=Nutrients
Sed=Sedimentation



| Environet, Inc. | PROJECT NO.: 1057 | ECOSYSTEM RESTORATION REPORT<br>SAIPAN LAGOON AQUATIC ECOSYSTEM RESTORATION STUDY | FIGURE C.4 |
|---|---|---|---|
| | DATE: SEPTEMBER 20, 2012 | | |
| | DRAWN BY: CB | PCA LOCATIONS WITHIN STUDY AREA<br>SAIPAN, CNMI | |
| | REVIEWED BY: MA | | |

# *C.6*
# *Groundwater Investigation*

# APPENDIX C.6

## GROUNDWATER INVESTIGATION

Nearshore groundwater samples were collected along the entire length of the study area and beyond in March, June, and August, 2002, in an effort to determine the impact of on-shore surface contaminants on the lagoon via groundwater infiltration. Samples were collected at low tide by manually digging holes on the shoreline and collecting the groundwater infiltrating to the shoreline. Four rounds of samples were collected and field analyzed for nitrate/nitrite and phosphate as well as water quality parameters. Nitrate concentrations in groundwater infiltrating at the shoreline ranged from 0 to 2.61 milligrams per liter (mg/L) (Table C.11). The Commonwealth of the Northern Mariana Islands (CNMI) water quality standard for nitrates in Class AA marine waters is less than (<) 0.20 mg/L (DEQ, 2010). Although this standard does not apply to groundwater, it is useful to apply to the nearshore groundwater samples due to their adjacent proximity to lagoon waters.

**Table C.11: Nearshore Groundwater Nitrate Results (Field Test)**

| Sample ID | March 12, 2002 Nitrate (mg/L) | June 26, 2002 Nitrate (mg/L) | June 30, 2002 Nitrate (mg/L) | August 9, 2002 Nitrate (mg/L) |
|---|---|---|---|---|
| GWI-26 | 0 | 0 | 0 | 0.1 |
| GWI-25 | | | 0.08 | **0.3** |
| GWI-24 | 0 | 0 | 0.04 | 0.05 |
| GWI-12 | | | **1.4** | **1.6** |
| GWI-13 | | | **0.45** | **0.4** |
| GWI-14 | **2.21** | **1.73** | **1.5** | **1.4** |
| GWI-32 | | | | **1** |
| GWI-27 | | | | 0 |
| GWI-31 | | | | **0.8** |
| GWI-15 | | | **0.6** | 0.15 |
| GWI-29 | **1.5** | **0.46** | | **0.9** |
| GWI-28 | **0.51** | | | **0.2** |
| GWI-30 | | | | **0.6** |
| GWI-16 | | | | **0.7** |
| GWI-17 | **2.61** | **0.78** | **1** | **1.2** |
| GWI-18 | | | | NA |
| GWI-19 | **1.51** | **0.72** | 0 | **1.2** |
| GWI-20 | | | | **0.2** |
| GWI-21 | 0 | **0.72** | 0.02 | **0.2** |
| GWI-22 | | | | **0.6** |
| GWI-23 | 0 | 0 | | **0.8** |

**Bold** values exceed the CNMI water quality standard for Class AA Marine Waters.

The 2002 analytical results indicate that there are elevated nitrate levels in nearshore groundwater infiltrating to the lagoon. Nitrate levels of nearshore coastal marine waters may be affected by activities within the watershed.

Although semi-annual groundwater monitoring, including monitoring for nitrate indicators, has been required by the CNMI Division of Environmental Quality (DEQ) for many years, more recent groundwater data collected within the study area are not available due to the lack of a comprehensive groundwater management plan that includes methods for analyzing the collected samples and actions to be taken based on the data collected (DEQ, 2010).

## REFERENCES

DEQ, 2010. Commonwealth of the Northern Mariana Islands Integrated 305(b) and 303 (d) Water Quality Assessment Report. November.

# *C.7*
# *Hydrologic Study of Runoff Processes in Watershed*

# APPENDIX C.7

# HYDROLOGIC STUDY OF RUNOFF PROCESSES IN WATERSHED

## C.7.1 RAINFALL AND RUNOFF DATA COLLECTION

In order to acquire quantitative rainfall and runoff data, monitoring instruments were installed at several locations throughout the study area. Three tipping bucket rain gauges were installed on building rooftops, one on the Harabuchi Federal Building roof top at the northern end of the study area, one on the Pizza Hut Building roof top on Middle Road, and one on the Geotesting Building roof top at the southern end of the study area. These tipping bucket rain gauges recorded every 0.01 inch of rainfall on an automated recorder. Data was downloaded periodically during 2002.

Two pressure transducers were installed, one in a storm drain beneath Middle Road at the Quartermaster Road intersection and another in a storm drain beneath Middle Road, across from the Subway sandwich shop. These transducers measured and recorded the pressure and temperature of stormwater surface flow during rain events. For redundancy's sake, several stormwater events were measured manually throughout the year to augment the data collected by the transducers and rain gauges.

Data collected from the rain gauges, transducers, and by manual measurements was compiled in order to help determine general comprehensive hydrologic processes within the study area. Due to the logistical difficulties involved with collecting field data, the number of readings is limited. In an effort to compare data from the three monitoring efforts (rain gauges, transducers, and manual measurements), data from seven discrete rain events is compiled in Table C.12 through Table C.18.

Manual measurements of stormwater runoff were recorded most consistently from the intersection of Middle Road and Quartermaster Road. Based on average flow rates and duration of measurement intervals, discharge amounts were calculated ranging from 150 gallons over 12 minutes (on February 13, 2002) to 69,696 gallons over four hours and two minutes (September 20, 2002).

During the August 12, 2002 rain event, peak flow rates were measured at nine drains along Beach Road. Peak flow rates ranged from 12 gallons per minute (gpm) at Drain 13 to 1000 gpm at Drain 6. Table C.19 presents estimated stormwater runoff flow to the lagoon during this rain event.

## Table C.12: Rain Event 1 (February 13, 2002)

| Monitor Location | | Date | Time | Duration (minutes) | Rainfall Volume (inches) | Average Pressure (psi) | Peak Pressure (psi) | Average Runoff Water Temperature (°C) | Average Flow (gpm) | Peak Flow (gpm) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Rainguage Data** | Harabuchi Building | 2/13/2002 | 4:15-4:43 | 28 | 0.14 | - | - | - | - | - |
| | Pizza Hut Building | 2/13/2002 | 11:07-11:11 | 4 | 0.02 | - | - | - | - | - |
| **Transducer Data** | Subway Site | 2/13/2002 | - | - | - | - | - | - | - | - |
| | Quartermaster Site | 2/13/2002 | - | - | - | 3.1 | - | 29.78 | - | - |
| **Middle Road Manual Measurements** | Commonwealth | - | - | - | - | - | - | - | - | - |
| | Pizza Hut | - | - | - | - | - | - | - | - | - |
| | Subway | - | - | - | - | - | - | - | - | - |
| | Quartermaster | 2/13/2002 | 11:13-11:36 | 23 | - | - | - | - | 15 | 27 |

°C = degrees Celsius

**Table C.13: Rain Event 2 (February 13, 2002)**

| Monitor Location | | Date | Time | Duration (minutes) | Rainfall Volume (inches) | Average Pressure (psi) | Peak Pressure (psi) | Average Runoff Water Temperature (°C) | Average Flow (gpm) | Peak Flow (gpm) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Rainguage Data** | Harabuchi Building | 2/13/2002 | 18:53-20:32 | 39 | 0.18 | - | - | - | - | - |
| | Pizza Hut Building | 2/13/2002 | 18:48-20:23 | 35 | 0.1 | - | - | - | - | - |
| | Geotesting Building | - | - | - | - | - | - | - | - | |
| **Transducer Data** | Subway Site | - | - | - | - | - | - | - | - | - |
| | Quartermaster Site | 2/13/2002 | - | - | - | 3.07 | - | 28.62 | - | - |
| **Middle Rd Manual Measurements** | Commonwealth | - | - | - | - | - | - | - | - | - |
| | Pizza Hut | - | - | - | - | - | - | - | - | - |
| | Subway | - | - | - | - | - | - | - | - | - |
| | Quartermaster | 2/13/2002 | 20:34-20:46 | 12 | - | - | - | - | 12.5 | 19 |
| **Beach Road Manual Measurements** | Drain 2 | - | - | - | - | - | - | - | - | - |
| | Drain 3 | - | - | - | - | - | - | - | - | - |
| | Drain 4 | - | - | - | - | - | - | - | - | - |
| | Drain 5 | - | - | - | - | - | - | - | - | - |
| | Drain 6 | 2/13/2002 | 20:25 | one reading | - | - | - | - | - | 3 |
| | Drain 7 | - | - | - | - | - | - | - | - | - |
| | Drain 11 | 2/13/2002 | 20:15 | one reading | - | - | - | - | - | 30 |
| | Drain 12 | - | - | - | - | - | - | - | - | - |
| | Drain 13 | - | - | - | - | - | - | - | - | - |
| | Drain 14 | 2/13/2002 | 20:30 | one reading | - | - | - | - | - | 30 |

**Table C.14: Rain Event 3 (May 8-9, 2002)**

| Monitor Location | | Date | Time | Duration (minutes) | Rainfall Volume (inches) | Average Pressure (psi) | Peak Pressure (psi) | Average Runoff Water Temperature (°C) | Average Flow (gpm) | Peak Flow (gpm) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Rainguage Data** | Harabuchi Building | 5/8/2002-5/9/2002 | 9:43 (5/8)-5:25 (5/9) | 1182 | 0.49 | - | - | - | - | - |
| | Pizza Hut Building | 5/8/2002-5/9/2002 | 00:15-11:55 | 660 | 0.86 | - | - | - | - | - |
| | Geotesting Building | - | - | - | - | - | - | - | - | - |
| **Transducer Data** | Subway Site | - | - | - | - | - | - | - | - | - |
| | Quartermaster Site | 5/8/2002-5/9/2002 | - | - | - | 2.82 | - | 26.74 | - | - |
| **Middle Rd Manual Measurements** | Commonwealth | - | - | - | - | - | - | - | - | - |
| | Pizza Hut | - | - | - | - | - | - | - | - | - |
| | Subway | 5/9/2002 | 7:18-7:30 | 12 | - | - | - | - | 200 | 300 |
| | Quartermaster | 5/9/2002 | 6:20-7:00 | 40 | - | - | - | - | 50 | 140 |
| **Beach Road Manual Measurments** | Drain 2 | - | - | - | - | - | - | - | - | - |
| | Drain 3 | - | - | - | - | - | - | - | - | - |
| | Drain 4 | - | - | - | - | - | - | - | - | - |
| | Drain 5 | - | - | - | - | - | - | - | - | - |
| | Drain 6 | 5/9/2002 | 6:10 | one reading | - | - | - | - | - | 1200-1500 |
| | Drain 7 | - | - | - | - | - | - | - | - | - |
| | Drain 11 | 5/9/2002 | 6:17 | one reading | - | - | - | - | - | 200 |
| | Drain 12 | - | - | - | - | - | - | - | - | - |
| | Drain 13 | 5/9/2002 | 6:21 | one reading | - | - | - | - | - | 10 |

**Table C.15: Rain Event 4 (July 1, 2002)**

| Monitor Location | | Date | Time | Duration (minutes) | Rainfall Volume (inches) | Average Pressure (psi) | Peak Pressure (psi) | Average Runoff Water Temperature (°C) | Average Flow (gpm) | Peak Flow (gpm) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Rainguage Data** | Harabuchi Building | - | - | - | - | - | - | - | - | - |
| | Pizza Hut Building | - | - | - | - | - | - | - | - | - |
| | Geotesting Building | - | - | - | - | - | - | - | - | - |
| **Transducer Data** | Subway Site | 7/1/2002 | - | - | - | 2.95 | - | 30.03 | - | - |
| | Quartermaster Site | 7/1/2002 | - | - | - | 2.82 | - | 30.65 | - | - |
| **Middle Road Manual Measurements** | Commonwealth | - | - | - | - | - | - | - | - | - |
| | Pizza Hut | - | - | - | - | - | - | - | - | - |
| | Subway | - | - | - | - | - | - | - | - | - |
| | Quartermaster | - | - | - | - | - | - | - | - | - |
| **Beach Road Manual Measurments** | Drain 2 | - | - | - | - | - | - | - | - | - |
| | Drain 3 | - | - | - | - | - | - | - | - | - |
| | Drain 4 | 7/1/2002 | 1:15 | - | - | - | - | - | - | 106 |
| | Drain 5 | - | - | - | - | - | - | - | - | - |
| | Drain 6 | 7/1/2002 | 1:08 | - | - | - | - | - | - | 40 |
| | Drain 7 | - | - | - | - | - | - | - | - | - |
| | Drain 11 | 7/1/2002 | 1:25 | - | - | - | - | - | - | 15 |
| | Drain 12 | - | - | - | - | - | - | - | - | - |
| | Drain 13 | - | - | - | - | - | - | - | - | - |

## Table C.16: Rain Event 5 (August 12, 2002)

| Monitor Location | | Date | Time | Duration (minutes) | Rainfall Volume (inches) | Average Pressure (psi) | Peak Pressure (psi) | Average Runoff Water Temperature (°C) | Average Flow (gpm) | Peak Flow (gpm) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Rainguage Data** | Harabuchi Building | - | - | - | - | - | - | - | - | - |
| | Pizza Hut Building | - | - | - | - | - | - | - | - | - |
| | Geotesting Building | - | - | - | - | - | - | - | - | - |
| **Transducer Data** | Subway Site | - | - | - | - | - | - | - | - | - |
| | Quartermaster Site | 8/12/2002 | - | - | - | 2.81 | - | 29.55 | - | - |
| **Middle Road Manual Measurements** | Commonwealth | - | - | - | - | - | - | - | - | - |
| | Pizza Hut | - | - | - | - | - | - | - | - | - |
| | Subway | - | - | - | - | - | - | - | - | - |
| | Quartermaster | 8/12/2002 | 9:36-9:55 | 19 | - | - | - | - | 80.5 | 200 |
| **Beach Road Manual Measurements** | Drain 2 | 8/12/2002 | 9:15 | One reading | - | - | - | - | - | 75 |
| | Drain 3 | 8/12/2002 | 9:17 | One reading | - | - | - | - | - | 300 |
| | Drain 4 | 8/12/2002 | 9:21 | One reading | - | - | - | - | - | 428 |
| | Drain 5 | 8/12/2002 | 9:24 | One reading | - | - | - | - | - | 150 |
| | Drain 6 | 8/12/2002 | 9:27 | One reading | - | - | - | - | - | 1000 |
| | Drain 7 | 8/12/2002 | 9:29 | One reading | - | - | - | - | - | 37.5 |
| | Drain 11 | 8/12/2002 | 9:30 | One reading | - | - | - | - | - | 150 |
| | Drain 12 | 8/12/2002 | 9:31 | One reading | - | - | - | - | - | 60 |
| | Drain 13 | 8/12/2002 | 9:32 | One reading | - | - | - | - | - | 12 |

**Table C.17: Rain Event 6 (September 18-19, 2002)**

| Monitor Location | | Date | Time | Duration (minutes) | Rainfall Volume (inches) | Average Pressure (psi) | Peak Pressure (psi) | Average Runoff Water Temperature (°C) | Average Flow (gpm) | Peak Flow (gpm) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Rainguage Data** | Harabuchi Building | 9/18/2002-<br>9/19/2002 | 23:35 (9/18)-<br>9:47 (9/19) | 10:12 | 0.82 | - | - | - | - | - |
| | Pizza Hut Building | - | - | - | - | - | - | - | - | - |
| | Geotesting Building | 9/18/2002-<br>9/19/2002 | 23:50 (9/18)-<br>9:44 (9/19) | 9:54 | 1.82 | - | - | - | - | - |
| **Transducer Data** | Subway Site | - | - | - | - | - | - | - | - | - |
| | Quartermaster Site | - | - | - | - | 2.86 | - | 27.03 | - | - |
| **Middle Road Manual Measurements** | Commonwealth | - | - | - | - | - | - | - | - | - |
| | Pizza Hut | - | - | - | - | - | - | - | - | - |
| | Subway | - | - | - | - | - | - | - | - | - |
| | Quartermaster | 9/19/2002 | 9:45-10:00 | 15 min | - | - | - | - | 150 | 200 |
| **Beach Road Manual Measurments** | Drain 2 | - | - | - | - | - | - | - | - | - |
| | Drain 3 | - | - | - | - | - | - | - | - | - |
| | Drain 4 | - | - | - | - | - | - | - | - | - |
| | Drain 5 | - | - | - | - | - | - | - | - | - |
| | Drain 6 | - | - | - | - | - | - | - | - | - |
| | Drain 7 | - | - | - | - | - | - | - | - | - |
| | Drain 11 | - | - | - | - | - | - | - | - | - |
| | Drain 12 | - | - | - | - | - | - | - | - | - |
| | Drain 13 | - | - | - | - | - | - | - | - | - |

### Table C.18: Rain Event 7 (September 20, 2002)

| Monitor Location | | Date | Time | Duration (minutes) | Rainfall Volume (inches) | Average Pressure (psi) | Peak Pressure (psi) | Average Runoff Water Temperature (°C) | Average Flow (gpm) | Peak Flow (gpm) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Rainguage Data** | Harabuchi Building | 9/20/2002 | 1:16-9:40 | 504 | 1.74 | - | - | - | - | - |
| | Pizza Hut Building | - | - | - | - | - | - | - | - | - |
| | Geotesting Building | 9/20/2002 | 1:12-10:26 | 554 | 2.68 | - | - | - | - | - |
| **Transducer Data** | Subway Site | - | - | - | - | - | - | - | - | - |
| | Quartermaster Site | 9/20/2002 | - | - | - | 2.56 | - | 26.2 | - | - |
| **Middle Road Manual Measurements** | Commonwealth | 9/20/2002 | 8:41-11:45 | 184 | - | - | - | - | 1150 | >2000 |
| | Pizza Hut | 9/20/2002 | 7:35 | one reading | - | - | - | - | - | 75 |
| | Subway | 9/20/2002 | 7:31 | one reading | - | - | - | - | - | 75 |
| | Quartermaster | 9/20/2002 | 6:58-11:00 | 242 | - | - | - | - | 288 | 600 |
| **Beach Road Manual Measurments** | Drain 2 | 9/20/2002 | 7:20-11:38 | 258 | - | - | - | - | 43 | 43 |
| | Drain 3 | - | - | - | - | - | - | - | - | - |
| | Drain 4 | 9/20/2002 | 7:16-11:36 | 260 | - | - | - | - | 51.5 | 60 |
| | Drain 5 | - | - | - | - | - | - | - | - | - |
| | Drain 6 | 9/20/2002 | 7:12-11:34 | 262 | - | - | - | - | 637 | 1200 |
| | Drain 7 | 9/20/2002 | 7:08-11:29 | 261 | - | - | - | - | 600 | 1200 |
| | Drain 11 | - | - | - | - | - | - | - | - | - |
| | Drain 12 | - | - | - | - | - | - | - | - | - |
| | Drain 13 | 9/20/2002 | 7:06-11:02 | 236 | - | - | - | - | 300 | 600 |

**Table C.19: Projected Stormwater Runoff at Beach Road Drains**

| Location | Actual Peak Flow (gpm) | Projected Influx to Lagoon (gallons) | | | | |
|---|---|---|---|---|---|---|
| | | 5-minute | 10-minute | 20-minute | 30-minute | 1-hour |
| Drain 2 | 75 | 375 | 750 | 1,500 | 2,250 | 4,500 |
| Drain 3 | 300 | 1,500 | 3,000 | 6,000 | 9,000 | 18,000 |
| Drain 4 | 428 | 2,140 | 4,280 | 8,560 | 12,840 | 25,680 |
| Drain 5 | 150 | 750 | 1,500 | 3,000 | 4,500 | 9,000 |
| Drain 6 | 1000 | 5,000 | 10,000 | 20,000 | 30,000 | 60,000 |
| Drain 7 | 37.5 | 188 | 375 | 750 | 1,125 | 2,250 |
| Drain 11 | 150 | 750 | 1,500 | 3,000 | 4,500 | 9,000 |
| Drain 12 | 60 | 300 | 600 | 1,200 | 1,800 | 3,600 |
| Drain 13 | 12 | 60 | 120 | 240 | 360 | 720 |
| CUMULATIVE | | 11,063 | 22,125 | 44,250 | 66,375 | 132,750 |

During two rain events, field measurements of average and peak flow at the intersection of Quartermaster Road and Middle Road can be compared to the cumulative amount of rainfall recorded at the raingauge at the Geotesting Building. Within the 10-hour interval during the September 18-19, 2002 rain event, the raingauge at the Geotesting Building recorded 1.82 inches of cumulative rainfall (Table C.17). The peak and average runoff flow during the last 15 minutes of this rain interval were 200 gpm and 150 gpm, respectively. This translates to a stormwater runoff volume of 2,250 gallons over 15 minutes. If the average flow rate of 150 gpm was applied to half of the 10-hour interval, the resulting estimate would be 45,000 gallons over five hours.

During a nine-hour interval on September 20, 2002, the raingauge at the Geotesting Building recorded 2.68 inches of cumulative rainfall (Table C.18). The peak and average runoff flow during the last four hours of this interval were 600 gpm and 288 gpm, respectively. This translates to a stormwater runoff volume of nearly 700,000 gallons over four hours. Although no additional rainfall data has been collected at the study area since 2002, the 2002 data indicates that large volumes of runoff from the steep upper/inland portion of the watershed flows down onto Beach Road and enters the lagoon via surface sheet flow during large rain events.

### C.7.2 SEDIMENT DELTA SURVEYS

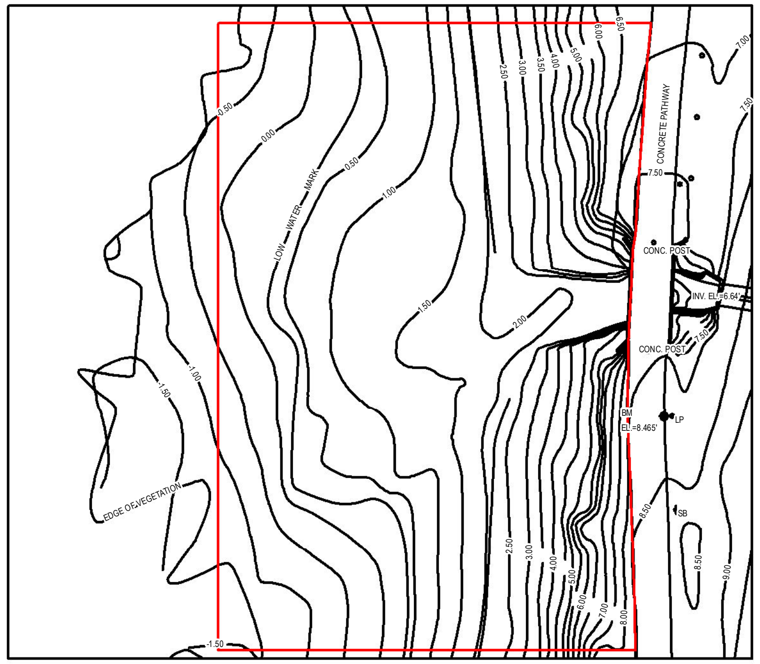
In an effort to quantify the sediment load entering the lagoon via stormwater runoff, three sediment deltas were surveyed five times from 2001 to 2002, during both the wet and dry seasons. Sediment deltas at Drains 4, 6, and 11 were surveyed. The approximate volumes of the sediment deltas are presented in Table C.20. Figures C.5 through C.7 depict sediment delta contours based on survey points established during five discrete monitoring events and present a comparison between the measured delta volumes and the corresponding monthly rainfall data during each monitoring event.

**Table C.20: Sediment Delta Volumes**

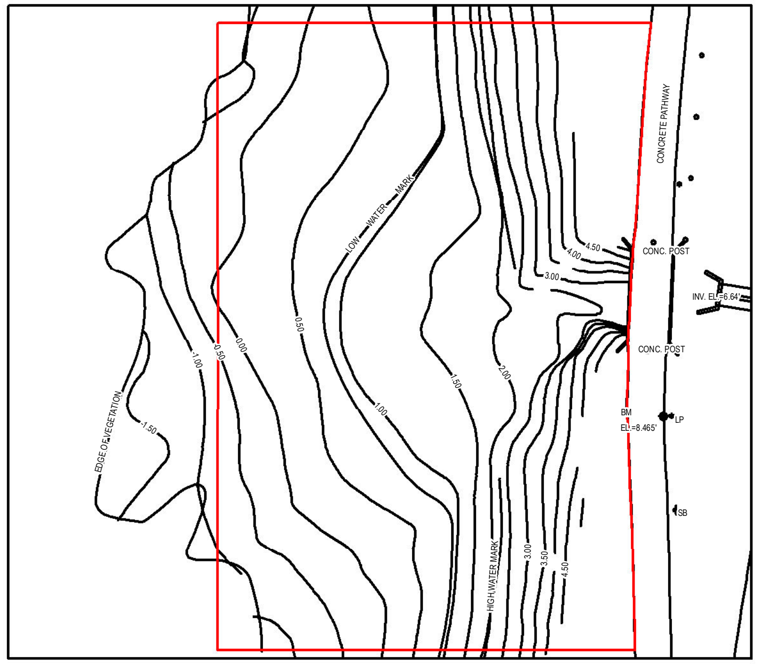
| DRAIN LOCATION | DATE OF MEASUREMENT | SEASON | APPROXIMATE DELTA VOLUME (cubic yards) | CHANGE OF VOLUME (cubic yards) | |
|---|---|---|---|---|---|
| | | | | Net | From Previous |
| Drain 4 | Oct-01 | Wet | 2473 | NA | NA |
| | Jun-02 | Dry | 2478 | 5 | 5 |
| | Aug-02 | Wet | 2778 | 305 | 300 |
| | Oct-02 | Wet | 2442 | -31 | -336 |
| | Dec-02 | Dry | 2438 | -35 | -4 |
| Drain 6 | Oct-01 | Wet | 2286 | NA | NA |
| | Jun-02 | Dry | 2416 | 130 | 130 |
| | Aug-02 | Wet | 2336 | 50 | -80 |
| | Oct-02 | Wet | 2332 | 46 | -4 |
| | Dec-02 | Dry | 2383 | 97 | 51 |
| Drain 11 | Oct-01 | Wet | 1705 | NA | NA |
| | Jun-02 | Dry | 1757 | 52 | 52 |
| | Aug-02 | Wet | 1786 | 81 | 29 |
| | Oct-02 | Wet | 1732 | 27 | -54 |
| | Dec-02 | Dry | 1750 | 45 | 18 |

NA = not applicable

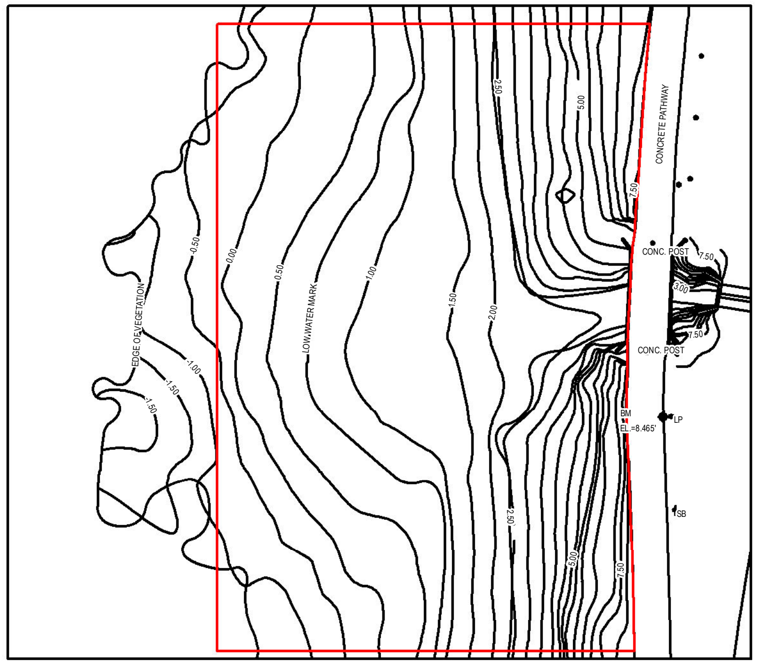
The change in sediment delta volume throughout the study interval was notable, particularly at Drain 4. The sediment delta adjacent to Drain 4 increased by nearly 300 cubic yards from June 2002 to August 2002, and then decreased by 336 cubic yards from August 2002 until October 2002. The monthly rainfall in August 2002 was 11.46 inches, which likely contributed to the loss of sediment from this delta. The volume of sediment lost was most likely washed into the lagoon during the two-month period. The sediment deltas at Drain 6 and Drain 11 also experienced gains and losses of sediment, although



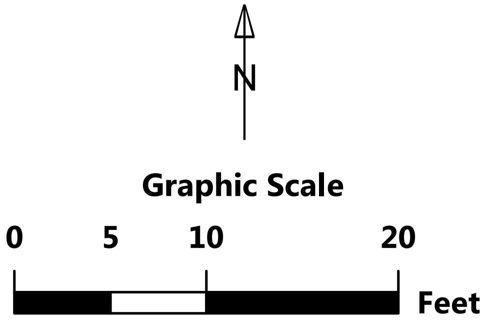
**OCTOBER 2001**



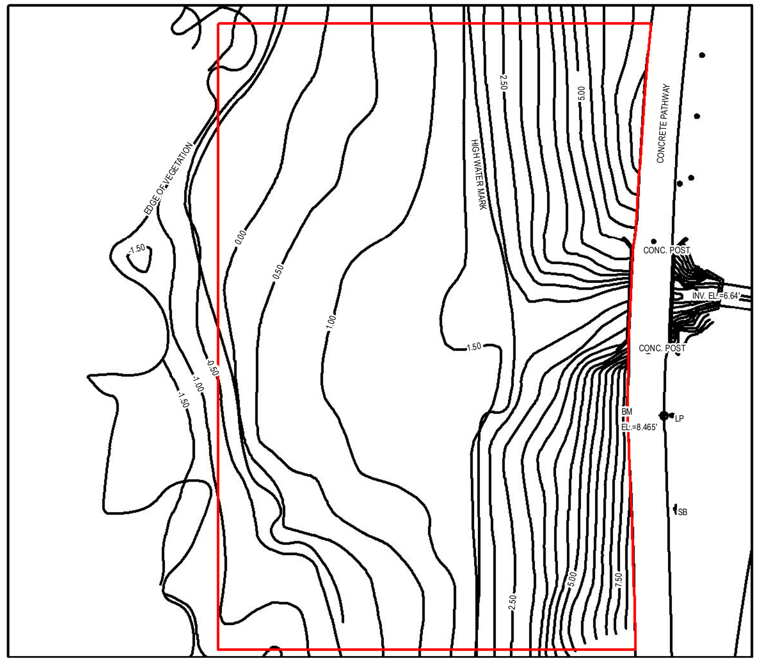
**JUNE 2002**



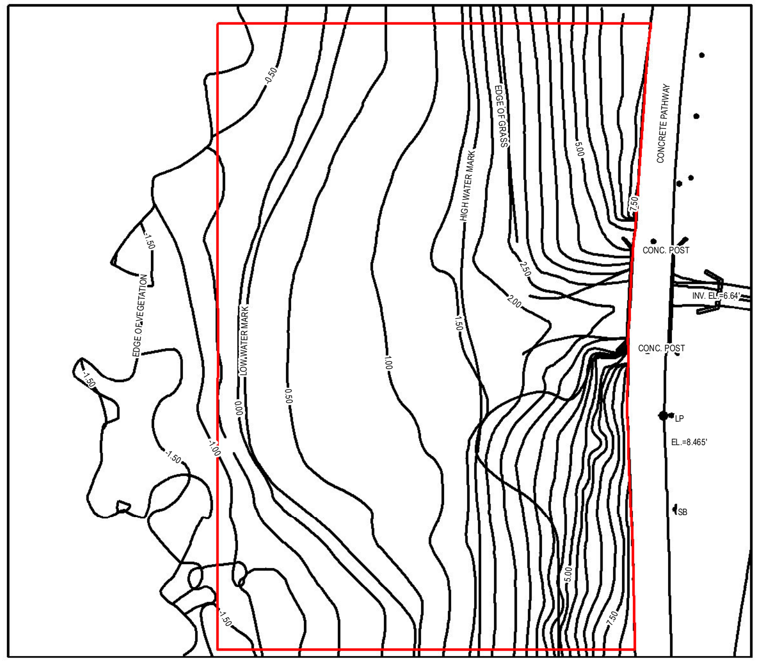
**AUGUST 2002**



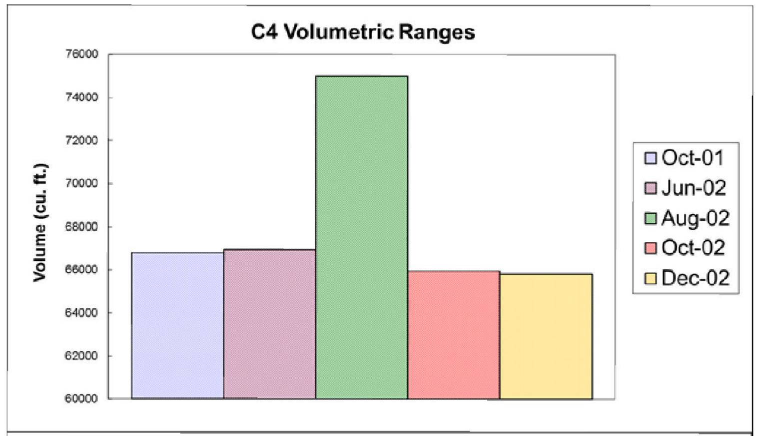
SCALE: 1" = 10 FEET

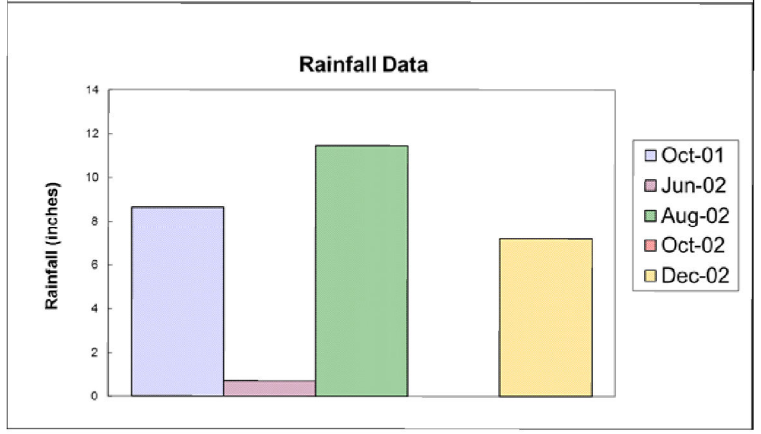


**OCTOBER 2002**



**DECEMBER 2002**



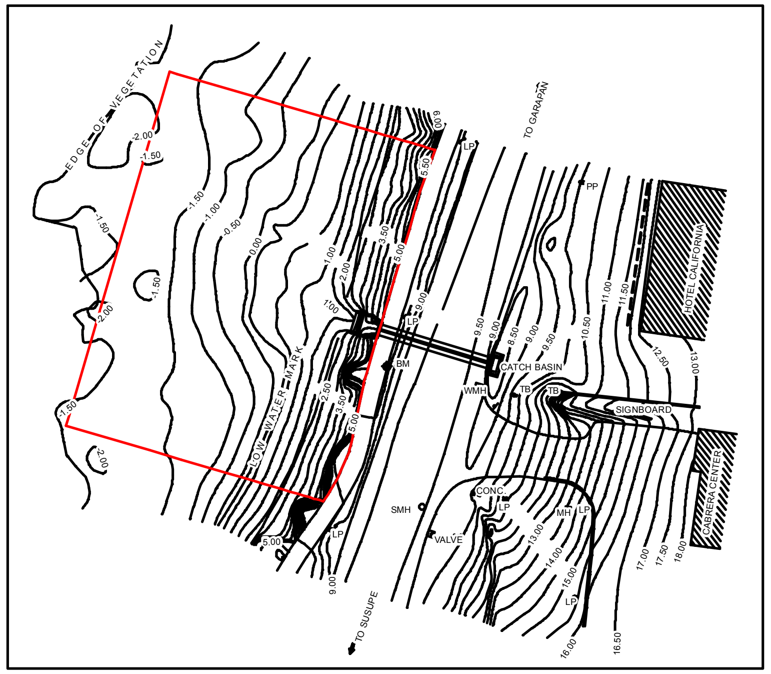


**Legend**

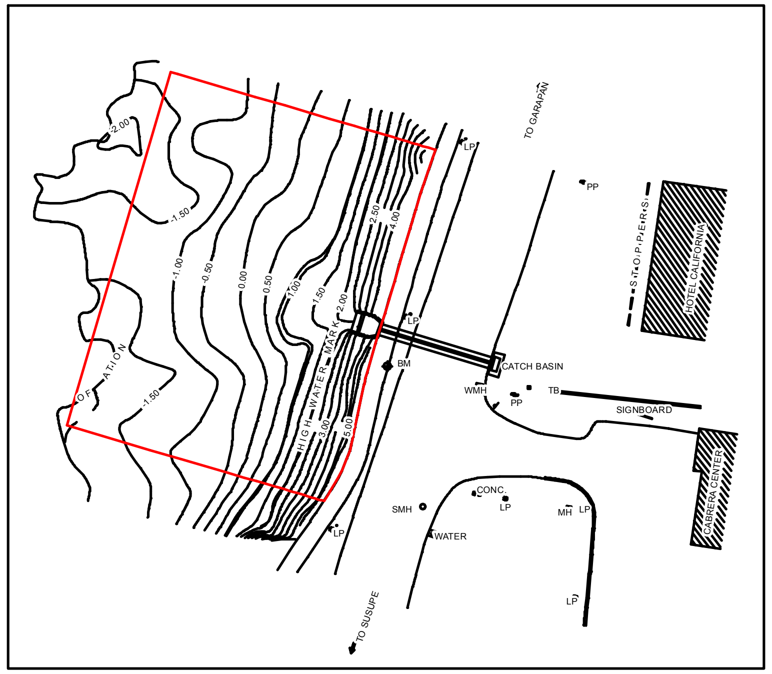
🟥 **Area of Delta Volume Comparision**

Environet, Inc.

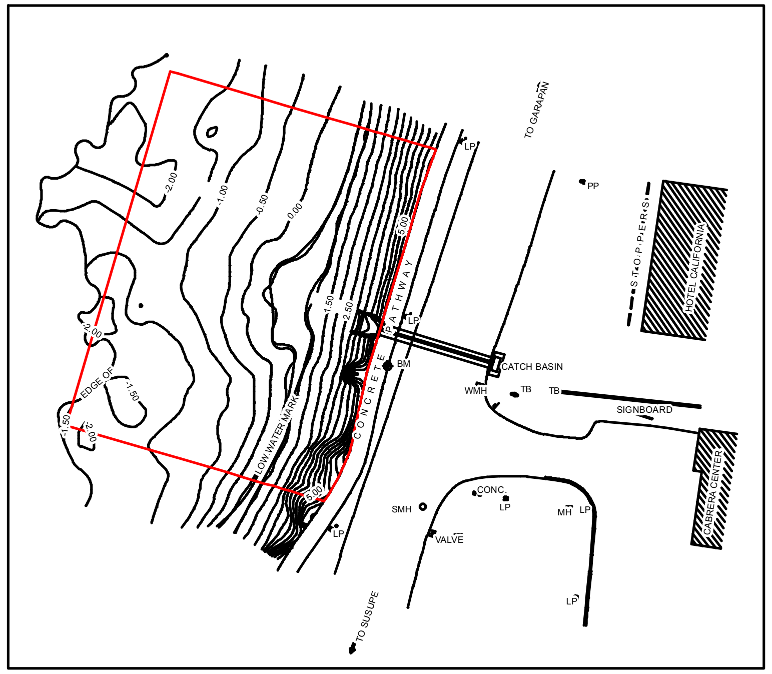
| | | |
|---|---|---|
| PROJECT NO.: 1057 | ECOSYSTEM RESTORATION REPORT<br>SAIPAN LAGOON AQUATIC ECOSYSTEM RESTORATION STUDY | FIGURE<br>C.5 |
| DATE: SEPTEMBER 20, 2012 | | |
| DRAWN BY: CB | DRAIN 4 SEDIMENT DELTA SURVEYS<br>SAIPAN, CNMI | |
| REVIEWED BY: MA | | |



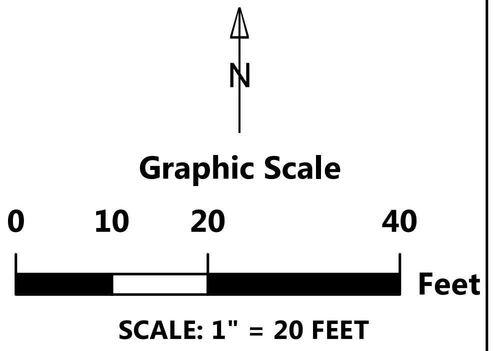
October 2001

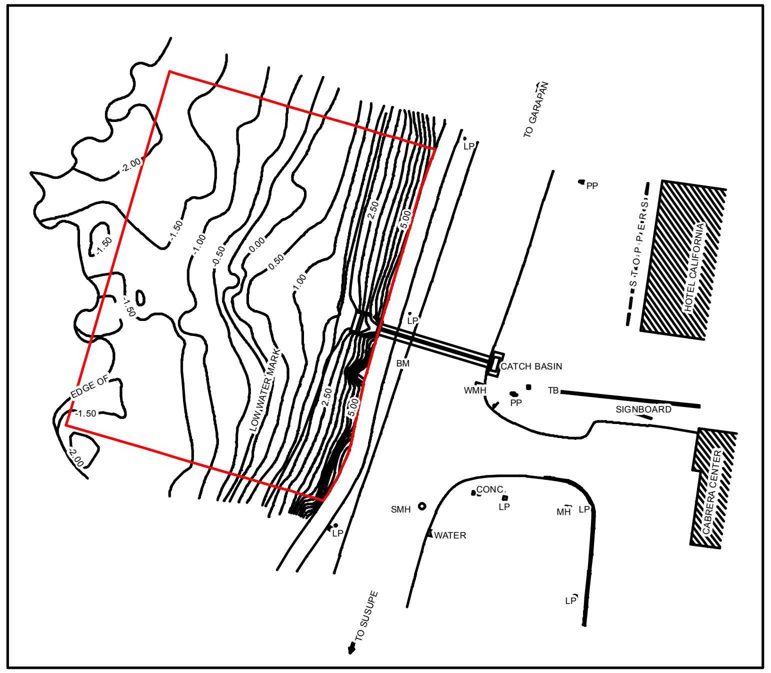


June 2002

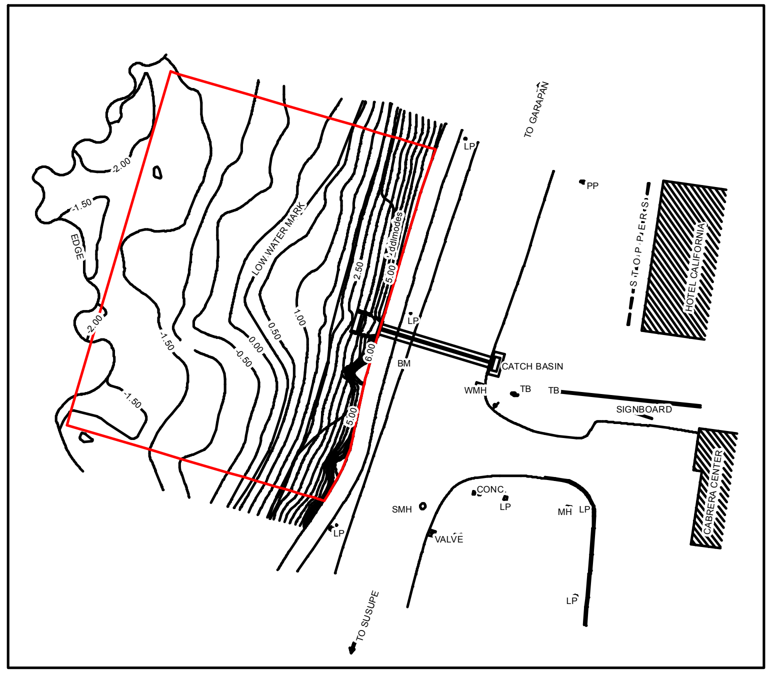


August 2002

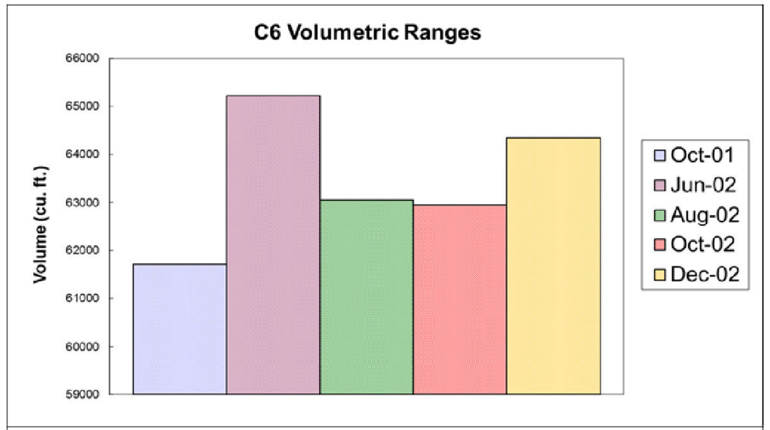


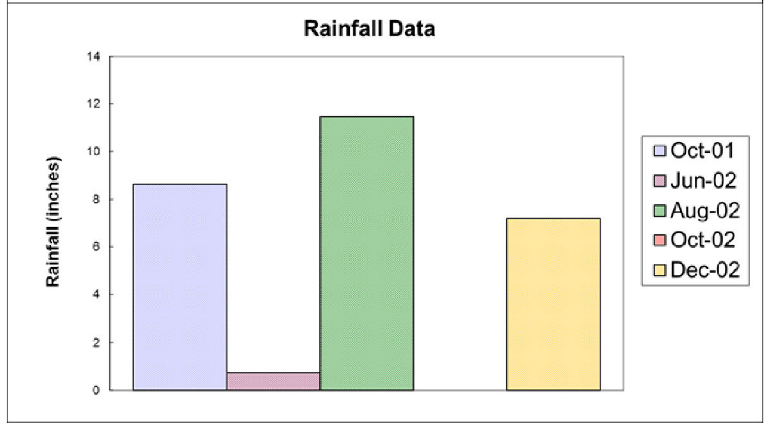


October 2002



December 2002


C6 Volumetric Ranges


Rainfall Data

**Legend**

Area of Delta Volume Comparision

Environet, Inc.

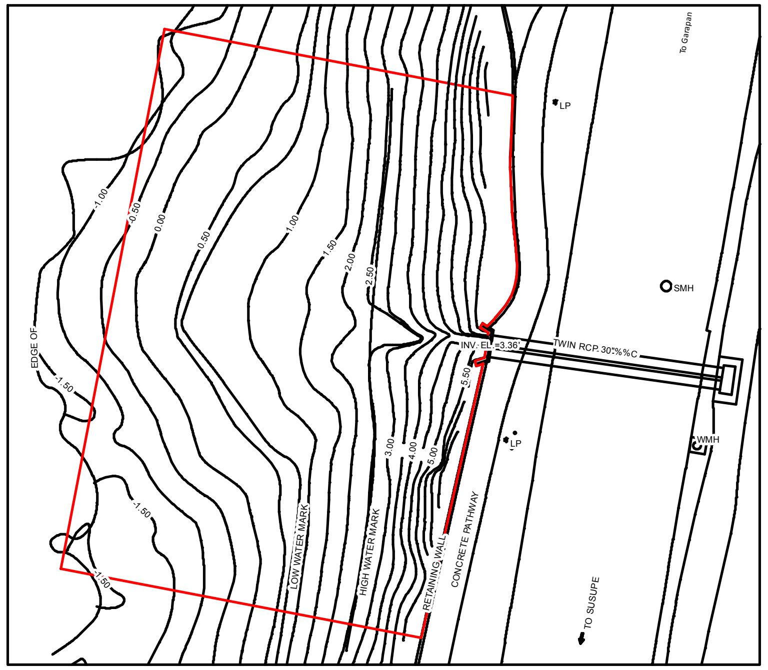
PROJECT NO.: 1057
DATE: SEPTEMBER 20, 2012
DRAWN BY: CB
REVIEWED BY: MA

ECOSYSTEM RESTORATION REPORT
SAIPAN LAGOON AQUATIC ECOSYSTEM RESTORATION STUDY

DRAIN 6 SEDIMENT DELTA SURVEYS
SAIPAN, CNMI

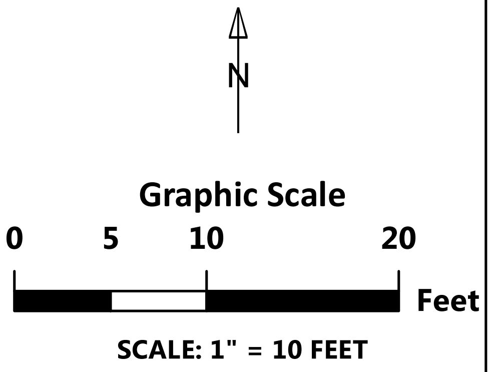
FIGURE
C.6

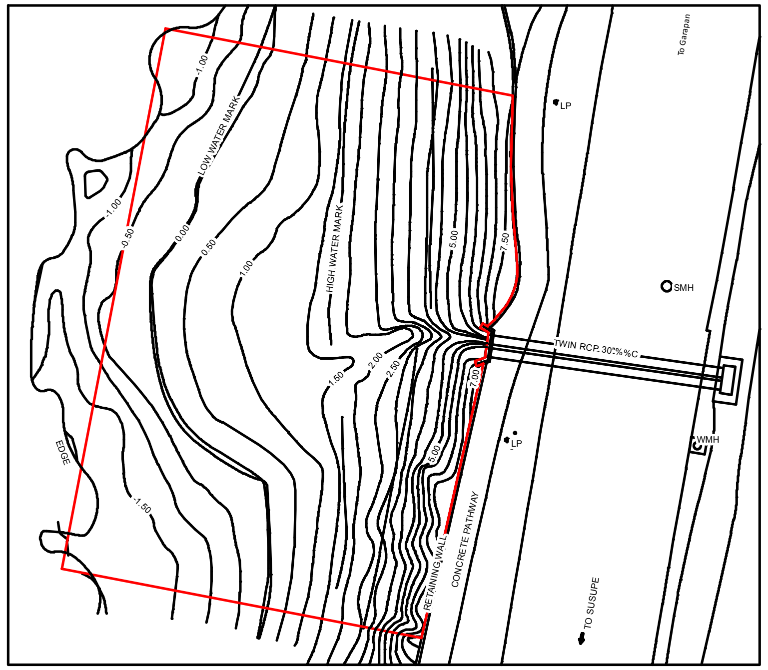
October 2001



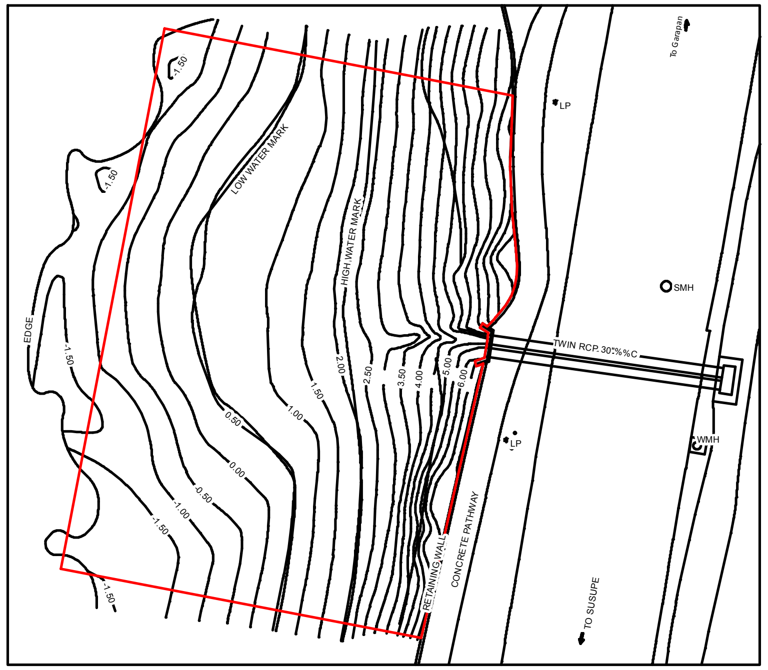
June 2002

August 2002

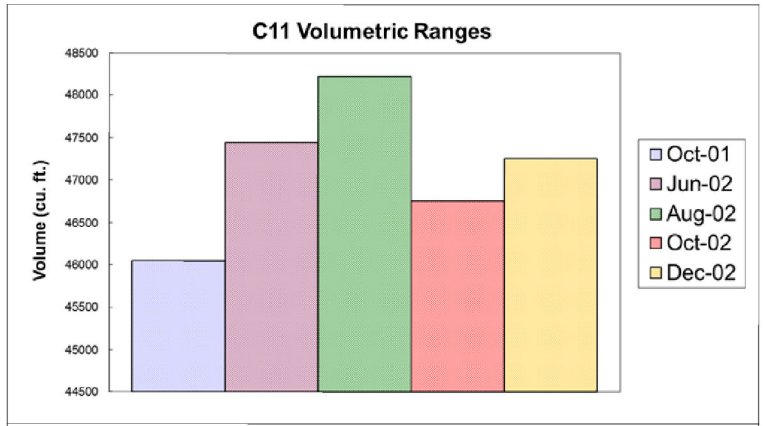


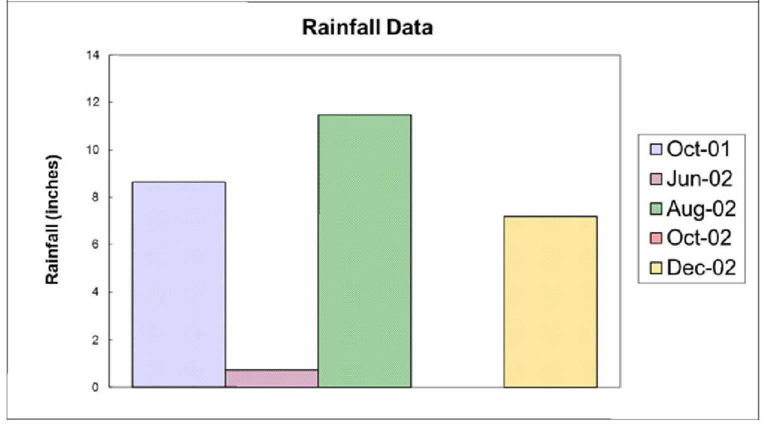


October 2002



December 2002





**Legend**

🟥 Area of Delta Volume Comparision

Environet, Inc.

PROJECT NO.: 1057
DATE: SEPTEMBER 20, 2012
DRAWN BY: CB
REVIEWED BY: MA

ECOSYSTEM RESTORATION REPORT
SAIPAN LAGOON AQUATIC ECOSYSTEM RESTORATION STUDY

DRAIN 11 SEDIMENT DELTA SURVEYS
SAIPAN, CNMI

FIGURE
C.7

not as much as Drain 4 and at different times of the year. The sediment delta volume at Drain 6 decreased from June 2002 to October 2002, and increased from October 2002 to December 2002. The total volume of sediment lost from the three deltas during the study interval was 478 cubic yards.

In addition to the field studies collected during this portion of the study, a watershed analysis was performed for the site using the computer software program Hydrologic Modeling System HEC-HMS (Community Planning & Engineering, Inc., 2012). The watershed analysis used storm event data from the *Rainfall-Frequency Study, Saipan, CNMI* (Environet, 2003). The watershed analysis report and the resulting drainage design are included as Appendix E of the Ecosystem Restoration Report (ERR).

## REFERENCES

Community Planning & Engineering, Inc., 2012. Preliminary Drainage Design for Aquatic Ecosystem Restoration Study, Saipan Lagoon, Saipan, Northern Mariana Islands. January.

Environet, 2003. Rainfall-Frequency Study, Saipan, Commonwealth of Northern Marianas Islands. Report prepared for the U.S Army Corps of Engineers, dated April 2003.

# *C.8*
# *Lagoon Water Quality Investigation*

# APPENDIX C.8

# LAGOON WATER QUALITY INVESTIGATION

In order to obtain general lagoon water quality data, lagoon water samples were collected by the Commonwealth of the Northern Mariana Islands (CNMI) Division of Environmental Quality (DEQ) personnel from February 2002 to February 2003. Samples were collected in nearshore waters adjacent to Drains 4, 6, 11, and 14 (Figure C.8). Samples were analyzed for microbiological and chemical parameters by the DEQ Environmental Surveillance Laboratory.

Table C.21 summarizes the water sample analytical results collected at Drains 4, 6, 11, and 14 from February 2002 to February 2003. The analytical results were compared against the CNMI water quality criteria for Class AA marine waters (DEQ, 2010). Water quality standards for several of the parameters (salinity, temperature, and turbidity) are in terms of deviation from ambient conditions. Ambient conditions have not been specified for the lagoon area; therefore, determining water standard exceedances is difficult for these parameters. In Table C.21, a turbidity of 2.5 was considered as the value for a healthy reef system, thus values exceeding 2.5 were shaded to indicate an exceedance. During the 2002-2003 sampling period, water quality standard exceedances were regularly observed for instantaneous enterococci measurements, dissolved oxygen (DO), turbidity, hydrogen activity (pH), nitrate, and orthophosphate, although strong correlations were not noted. The nutrients nitrate and orthophosphate currently have not been monitored by DEQ for more than six years because of the known problems with the accuracy of the previously used spectrophotometer method and because of unacceptable quality control samples. The accuracy of the nutrient data collected during the 2002-2003 sampling period may be questionable, nonetheless it was included here as a reference.

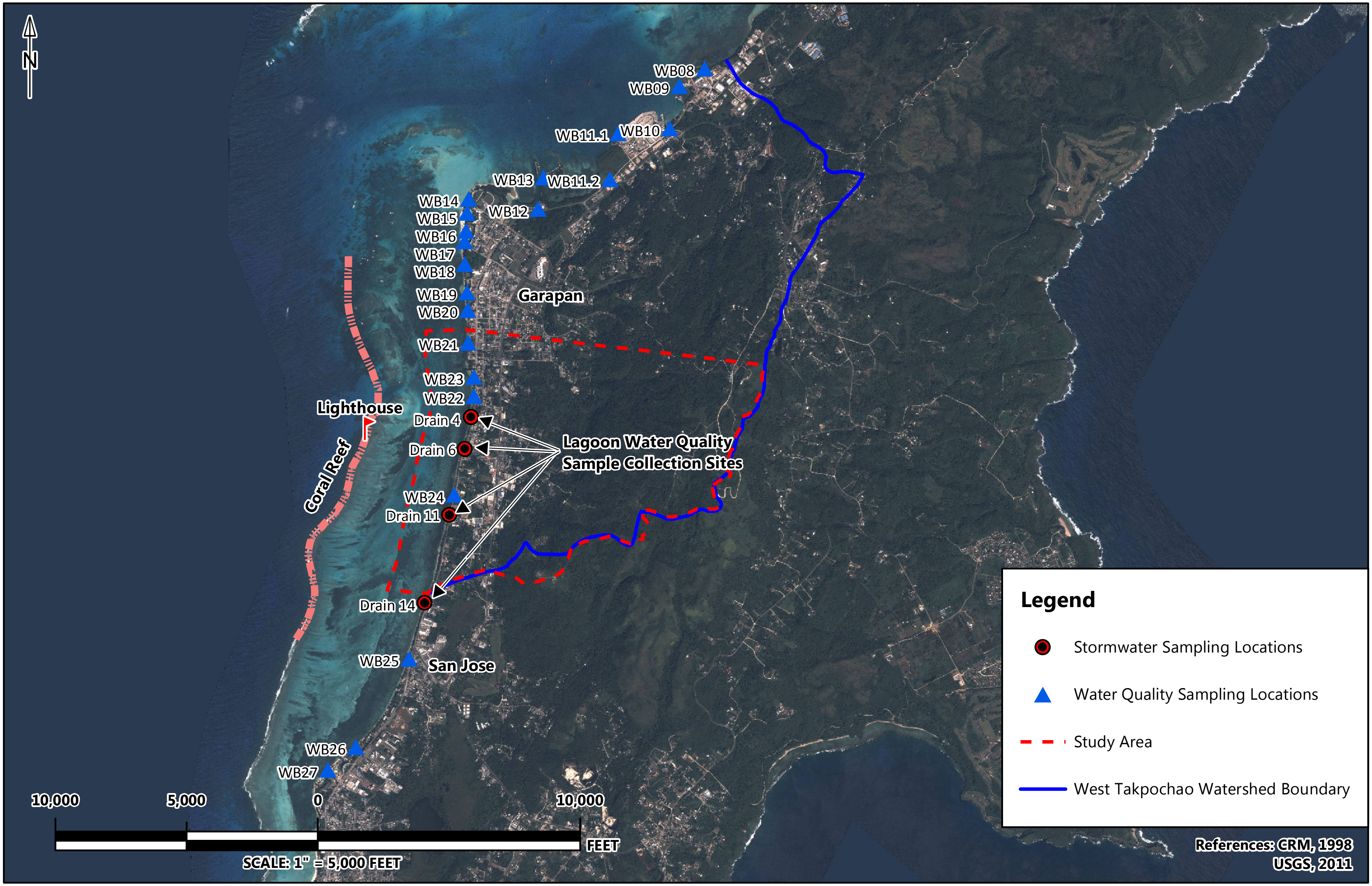
Average values of the water quality sample results for the 2002-2003 sampling period during the wet season (July through November) and dry season (December through June) were calculated for all parameters except fecal coliform and are presented in Table C.22. Enterococci values were consistently higher at all four sample locations during the wet season than during the dry season, as was turbidity at Drains 4, 6, and 11. Salinity was consistently higher during dry season sampling events at all four sample locations, as were DO and chloride. These patterns fit the general presumption that nearshore lagoon waters are affected by an increased volume of stormwater runoff during the rainy season, leading to an increase in turbidity and microbial contamination. During the dry season, less freshwater runoff is experienced, leading to higher salinities and chlorides, and lower turbidity and less microbial contamination.

The DEQ currently monitors 38 fixed stations along Saipan’s most used west coast beaches on a weekly basis for microbiological and chemical parameters. Four of these fixed stations (WB 21, WB 22, WB 23, and WB 24) occur within the study area (Figure C.8). Table C.23 presents the data collected at these four stations from July 2010 to June 2011. During the 2010-2011 monitoring period, water quality standard exceedances were regularly observed for instantaneous and geomean (GM) enterococci measurements, DO, turbidity, and pH, although strong correlations among the measured parameters were not noted. As mentioned earlier, nutrient data during this sampling period is not available.

As a comparison, average values of the 2010-2011 monitoring data for the wet season and dry season were also calculated. Results are presented in Table C.24. A significant correlation was not observed between seasonal discharges and water quality parameters during the 2010-2011 sampling period, suggesting that other factors are also contributing to the observed contaminant loadings entering the lagoon. These factors may include periodic releases of pollutants not associated with rainfall, a better system of contaminant uptake, a natural filtration or buffering of stormwater runoff prior to discharging into the lagoon, or a difference in upgradient land use.

## REFERENCES

DEQ, 2010. Commonwealth of the Northern Mariana Islands Integrated 305(b) and 303 (d) Water Quality Assessment Report. November.



Environet, Inc.

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| PROJECT NO.: 1057 | |
| DATE: SEPTEMBER 20, 2012 | |
| DRAWN BY: CB | |
| REVIEWED BY: MA | |

**ECOSYSTEM RESTORATION REPORT**
**SAIPAN LAGOON AQUATIC ECOSYSTEM RESTORATION STUDY**

**WEEKLY WATER QUALITY SAMPLING LOCATIONS**
**SAIPAN, CNMI**

**FIGURE C.8**

## Table C.21: Lagoon Water Quality Results, 2002-2003

| Date | Time | Site | Fecal Coliform (CFU/100 ml) | Enterococci (CFU/100 ml) | Salinity (‰)$^2$ | Dissolved Oxygen (%) | Temperature (°C)$^2$ | Turbidity (NTU)$^2$ | pH | Nitrate (mg/L) | PO$_4$ (mg/L) | Chloride (mg/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CNMI Water Quality Standards | | | GM$^1$<200, <400 Single Sample$^*$ | GM$^1$<35, <104 Single Sample$^*$ | 10 | >75 | 1.0 | 0.5 | 7.6 - 8.6 | <0.2 | <0.025 | NA |
| 2/13/2002 | 913 | Drain 4 | - | 0 | 33 | **58.1** | 26.8 | 230 | 7.9 | 0 | - | - |
| 2/13/2002 | 918 | Drain 6 | - | 10 | 33 | **57.5** | 27.2 | 82 | 7.9 | 0.1 | - | - |
| 2/13/2002 | 922 | Drain 11 | - | 31 | 33 | **66.7** | 26.9 | - | 8 | 0.15 | - | - |
| 2/13/2002 | 858 | Drain 14 | - | 74 | 29 | 75.2 | 26.1 | 170 | 8 | 0 | - | - |
| 2/28/2002 | 1108 | Drain 4 | - | 0 | 33 | 99.5 | 27.6 | 1.8 | 8.1 | 0 | - | - |
| 2/28/2002 | 1113 | Drain 6 | - | 10 | 33 | 80.7 | 27.5 | 2 | 8.2 | 0.13 | - | - |
| 2/28/2002 | 1118 | Drain 11 | - | 20 | 33 | **69.3** | 27.3 | 5.5 | 8 | 0.16 | - | - |
| 2/28/2002 | 1123 | Drain 14 | - | 10 | 33 | 88.6 | 27.3 | 1.3 | 8.1 | 0.13 | - | - |
| 3/6/2002 | 1110 | Drain 4 | - | 10 | 28 | 126.1 | 29.4 | 4.1 | 8.1 | 0 | **0.04** | 19629 |
| 3/6/2002 | 1116 | Drain 6 | - | 0 | 30 | 132.8 | 29 | 3 | 8.1 | 0.1 | 0.02 | 19883 |
| 3/6/2002 | 1038 | Drain 11 | - | 10 | 31 | 119.7 | 28.6 | 2.9 | 8.1 | 0.13 | **0.03** | 20394 |
| 3/6/2002 | 1024 | Drain 14 | - | 0 | 32 | 152.8 | 27.2 | 0.85 | 8.1 | 0.03 | **0.03** | 19883 |
| 3/13/2002 | 1057 | Drain 4 | - | 0 | 32 | 127.2 | 29.6 | 7 | 8 | 0.04 | **0.24** | 19884 |
| 3/13/2002 | 1053 | Drain 6 | - | 0 | 32 | - | - | 3.8 | - | 0 | **0.03** | 40276 |
| 3/13/2002 | 1038 | Drain 11 | - | 0 | 31 | - | - | 5.3 | - | 0 | **0.03** | 17844 |
| 3/13/2002 | 1037 | Drain 14 | - | 30 | 30 | 86.4 | 28.5 | 1.9 | 8.2 | 0 | **0.04** | 15295 |
| 3/20/2002 | 1038 | Drain 4 | - | 10 | 29 | 94 | 29.1 | 5.2 | 8.1 | 0 | ND | - |
| 3/20/2002 | 1033 | Drain 6 | - | 0 | 33 | 111.5 | 29.4 | 3.2 | 8 | 0.09 | ND | - |
| 3/20/2002 | 1028 | Drain 11 | - | 97 | 32 | 79.5 | 29.1 | 3.3 | 8.1 | 0 | ND | - |
| 3/20/2002 | 1017 | Drain 14 | - | 0 | 32 | 85.3 | 29.9 | 0.75 | 8.1 | 0 | ND | - |
| 3/26/2002 | 1042 | Drain 4 | - | 0 | 30 | 86.8 | 30 | 7.3 | 8.2 | 0.18 | - | - |
| 3/26/2002 | 1037 | Drain 6 | - | 10 | 32 | 102 | 29 | 8.9 | 8.1 | 0 | - | - |
| 3/26/2002 | 1031 | Drain 11 | - | 0 | 32 | 81.9 | 29.5 | 7.6 | 7.9 | 0 | - | - |
| 3/26/2002 | 1017 | Drain 14 | - | 30 | 32 | 94 | 29.1 | 1.5 | 8.1 | 0 | - | - |
| 4/3/2002 | 918 | Drain 4 | - | 31 | 31 | 97.2 | 28.9 | 8.5 | 8 | 0 | **0.03** | - |
| 4/3/2002 | 913 | Drain 6 | - | 0 | 33 | 109.3 | 28.7 | 3.6 | 8.1 | 0 | **0.07** | - |
| 4/3/2002 | 908 | Drain 11 | - | 30 | 32 | 121.4 | 28.8 | 3.44 | 8.1 | 0.11 | ND | - |
| 4/3/2002 | 853 | Drain 14 | - | 0 | 33 | 117.3 | 28.8 | 2.5 | 8.1 | 0 | ND | - |
| 4/10/2002 | 853 | Drain 4 | - | 41 | 32 | 103.7 | 29.1 | 6.8 | 8.1 | 0 | ND | - |
| 4/10/2002 | 847 | Drain 6 | - | 0 | 33 | 101.1 | 29 | 3.4 | 8.2 | 0 | ND | - |
| 4/10/2002 | 842 | Drain 11 | - | 10 | 33 | 121.3 | 28.7 | 1.2 | 8.1 | 0.01 | ND | - |
| 4/10/2002 | 830 | Drain 14 | - | 10 | 33 | 102.8 | 28.5 | 1.6 | 8 | 0 | ND | - |
| 5/1/2002 | 931 | Drain 4 | - | 20 | 32 | - | 29.7 | 4.7 | 8 | - | ND | - |
| 5/1/2002 | 925 | Drain 6 | - | 0 | 31 | - | 29.4 | 3.6 | 8 | - | ND | - |
| 5/1/2002 | 918 | Drain 11 | - | 10 | 33 | - | 30.5 | 2.8 | 7.9 | - | ND | - |
| 5/1/2002 | 904 | Drain 14 | - | 30 | 33 | 123.5 | 29.6 | 1.1 | 8.1 | - | ND | - |
| 5/8/2002 | 1058 | Drain 4 | - | 10 | 27 | - | 30.8 | 7.7 | 8 | - | 0.009 | 18994 |
| 5/8/2002 | 1051 | Drain 6 | - | 0 | 29 | - | 30.3 | 2.5 | 8 | - | 0.013 | 19494 |
| 5/8/2002 | 1037 | Drain 11 | - | 0 | 28 | - | 31.3 | 3.9 | 7.9 | - | **0.02** | 18994 |
| 5/8/2002 | 1025 | Drain 14 | - | 0 | 31 | - | 29.9 | 1.7 | 8.2 | - | 0.019 | 19993 |
| 5/15/2002 | 907 | Drain 4 | - | 0 | - | - | - | 1 | 7.9 | 0.4 | 0.014 | 19994 |
| 05/1502 | 912 | Drain 6 | - | 63 | - | - | - | 1.1 | 7.9 | 0 | **0.326** | 18994 |
| 5/15/2002 | 918 | Drain 11 | - | 20 | - | - | - | 2.6 | 8 | 0.18 | **0.023** | 19994 |
| 5/15/2002 | 927 | Drain 14 | - | 0 | - | - | - | 2.2 | 8.2 | 0 | 0.013 | 19994 |
| 5/22/2002 | 853 | Drain 4 | - | 0 | 31 | - | 29.1 | 1.6 | 7.9 | 0 | - | - |
| 5/22/2002 | 903 | Drain 6 | - | 20 | 30 | - | 29.2 | 0.95 | 8 | 0 | - | - |
| 5/22/2002 | 909 | Drain 11 | - | 20 | 31 | - | 29.2 | 1.5 | 7.9 | 0 | - | - |
| 5/22/2002 | 0923 | Drain 14 | - | 10 | 30 | - | 29.4 | 0.9 | 8 | 0 | - | - |
| 5/29/2002 | 1002 | Drain 4 | - | **727** | 30 | - | 30.4 | 4 | 8 | 0 | - | 19494 |
| 5/29/2002 | 1015 | Drain 6 | - | 84 | 30 | - | 30.3 | 3.6 | 8 | 0 | - | 19994 |
| 5/29/2002 | 1028 | Drain 11 | - | 20 | 30 | - | 31.5 | 4.3 | 8 | 0 | - | 19494 |
| 5/29/2002 | 1053 | Drain 14 | - | 96 | 30 | - | 32 | 1.4 | 8.1 | 0 | - | 19994 |
| 6/5/2002 | 1012 | Drain 4 | - | 73 | 33 | - | 30.6 | 10 | 8.1 | 0 | **0.063** | 18994 |
| 6/5/2002 | 1008 | Drain 6 | - | 73 | 33 | - | 30.5 | 2.5 | 8.1 | 0 | **0.028** | 19994 |
| 6/5/2002 | 1002 | Drain 11 | - | **272** | 32 | - | 31.5 | 2.1 | 8.1 | 0 | 0.024 | 19994 |
| 6/5/2002 | 951 | Drain 14 | - | 10 | 33 | - | 30.9 | 4 | 8.2 | 0 | **0.314** | 18994 |
| 6/12/2002 | 939 | Drain 4 | - | 0 | 30 | - | - | 3.7 | 8.1 | 0 | - | 18494 |
| 6/12/2002 | 1002 | Drain 6 | - | 0 | 30 | - | - | 1.6 | 8 | 0 | - | 19994 |
| 6/12/2002 | 1019 | Drain 11 | - | 0 | 30 | - | - | 2.7 | 8.1 | 0 | - | 18994 |
| 6/12/2002 | 1037 | Drain 14 | - | 0 | 30 | - | - | 0.9 | 8.1 | 0 | - | 18994 |
| 6/19/2002 | 1003 | Drain 4 | - | 30 | 30 | - | - | 5.7 | 8.2 | - | - | - |
| 6/19/2002 | 1040 | Drain 6 | - | 0 | 32 | - | - | 1.2 | 8.2 | - | - | - |
| 6/19/2002 | 1055 | Drain 11 | - | 0 | 30 | - | - | 4.7 | 8.1 | - | - | - |
| 6/19/2002 | 1115 | Drain 14 | - | 0 | 30 | - | - | 0.85 | 8.2 | - | - | - |
| 6/26/2002 | 1000 | Drain 4 | - | 0 | 32 | - | 30.4 | 1.5 | 8 | 0 | - | - |
| 6/26/2002 | 949 | Drain 6 | - | 10 | 31 | - | 31 | 3.5 | 8 | 0 | - | - |
| 6/26/2002 | 942 | Drain 11 | - | 0 | 32 | - | 30.2 | 2.1 | 7.9 | 0 | - | - |
| 6/26/2002 | 936 | Drain 14 | - | 86 | 33 | - | 30.3 | 7.5 | 7.9 | 0 | - | - |
| 7/1/2002 | 115 | Drain 4 | - | **>24192** | 0 | - | 27.1 | 1000 | 8.4 | 0 | **0.354** | - |
| 7/1/2002 | 108 | Drain 6 | - | **198628** | 0 | - | 27.1 | 159 | 8.27 | 0 | **0.886** | - |
| 7/1/2002 | 125 | Drain 11 | - | **>24192** | 0 | - | 27.4 | 337 | 8.56 | 0 | **0.374** | - |
| 7/2/2002 | 1027 | Drain 4 | - | **703** | 30 | - | 29.4 | 69.1 | 7.97 | 0 | **0.18** | 20494 |
| 7/2/2002 | 1023 | Drain 6 | - | **959** | 29 | - | 29.3 | 52 | 8 | 0 | **0.22** | 20494 |
| 7/2/2002 | 1018 | Drain 11 | - | **839** | 29 | - | 29.6 | 24.8 | 8.01 | 0 | **0.201** | 20993 |
| 7/2/2002 | 1007 | Drain 14 | - | **905** | 28 | - | 29.6 | 39.9 | 8.05 | 0 | **0.171** | 21993 |
| 7/10/2002 | 953 | Drain 4 | - | <1 | 33 | - | 28.1 | 5.99 | 8.1 | **0.2** | **0.242** | 21993 |
| 7/10/2002 | 1000 | Drain 6 | - | 41 | 33 | - | 28.5 | 5.16 | 8.2 | **0.39** | **0.119** | 20494 |
| 7/10/2002 | 1008 | Drain 11 | - | <1 | 35 | - | 27.8 | 3.44 | 8.2 | **0.28** | **0.168** | 21493 |
| 7/10/2002 | 1021 | Drain 14 | - | 20 | 35 | - | 28.6 | 7.56 | 8.2 | 0.19 | **0.107** | 20993 |
| 7/17/2002 | 1009 | Drain 4 | - | <1 | 30 | - | 29.9 | 4.61 | 8.1 | 0 | **0.142** | - |
| 7/17/2002 | 1021 | Drain 6 | - | <1 | 32 | - | 30 | 6.02 | 8.1 | 0 | **0.117** | - |

## Table C.21: Lagoon Water Quality Results, 2002-2003

| Date | Time | Site | Fecal Coliform (CFU/100 ml) | Enterococci (CFU/100 ml) | Salinity (‰)$^2$ | Dissolved Oxygen (%) | Temperature (°C)$^2$ | Turbidity (NTU)$^2$ | pH | Nitrate (mg/L) | PO$_4$ (mg/L) | Chloride (mg/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CNMI Water Quality Standards | | | GM[1]<200, <400 Single Sample* | GM[1]<35, <104 Single Sample* | 10 | >75 | 1.0 | 0.5 | 7.6 - 8.6 | <0.2 | <0.025 | NA |
| 7/17/2002 | 1027 | Drain 11 | - | <1 | 32 | - | 29.7 | 3.23 | 8.1 | 0 | **0.116** | - |
| 7/17/2002 | 1032 | Drain 14 | - | <1 | 32 | - | 29.7 | 4.36 | 8 | 0.04 | **0.083** | - |
| 7/24/2002 | 945 | Drain 4 | - | **>24192** | 0 | - | - | 69 | 8.3 | 0 | **0.617** | - |
| 7/24/2002 | 952 | Drain 6 | **24191.7** | - | 28.1 | 82 | 27.1 | 54 | 7.9 | 0 | **0.251** | - |
| 7/24/2002 | 1000 | Drain 11 | - | **>24192** | 0 | - | - | 110 | 8.2 | 0 | **0.296** | - |
| 7/24/2002 | 1150 | Drain 14 | - | **14136** | 0 | - | - | 50 | 8.5 | 0 | **0.324** | - |
| 7/31/2002 | 950 | Drain 4 | - | **3130** | 29 | - | - | 6 | 8 | 0.02 | **0.052** | - |
| 7/31/2002 | 955 | Drain 6 | - | **256** | 30 | - | - | 2.5 | 7.9 | 0.06 | **0.166** | - |
| 7/31/2002 | 1001 | Drain 11 | - | 73 | 30 | - | - | 1.8 | 7.9 | **0.21** | **0.073** | - |
| 7/31/2002 | 1010 | Drain 14 | - | <1 | 30 | - | - | 1.2 | 8.2 | 0.02 | **0.258** | - |
| 8/7/2002 | 1006 | Drain 4 | - | **4106** | 30 | - | 30.5 | 8.64 | 7.9 | 0 | **0.191** | - |
| 8/7/2002 | 1000 | Drain 6 | - | 98 | 31 | - | 30 | 7.15 | 8.2 | 0 | **0.105** | - |
| 8/7/2002 | 953 | Drain 11 | - | 94 | 30 | - | 30.7 | 12.2 | 8 | 0.09 | **0.161** | - |
| 8/7/2002 | 945 | Drain 14 | - | <1 | 31 | - | 30.1 | 1.66 | 8.3 | 0 | **0.144** | - |
| 8/13/2002 | 818 | Drain 4 | - | **>24192** | - | - | - | - | - | 0 | **0.872** | - |
| 8/13/2002 | 835 | Drain 6 | - | **>24192** | - | - | - | - | - | 0 | **0.499** | - |
| 8/13/2002 | 846 | Drain 11 | - | **>24192** | - | - | - | - | - | 0 | **3.446** | - |
| 8/14/2002 | 942 | Drain 4 | - | - | 30 | - | 30.8 | - | 7.9 | - | - | - |
| 8/14/2002 | 955 | Drain 6 | - | 30 | 29 | - | 31.3 | 1.1 | 7.9 | 0 | **0.051** | 18994 |
| 8/14/2002 | 1007 | Drain 11 | - | <1 | 30 | - | 31.6 | 2.3 | 7.9 | 0.02 | **0.065** | 18494 |
| 8/14/2002 | 1025 | Drain 14 | - | <1 | 30 | - | 30.6 | 1.9 | 8 | 0 | **0.078** | 17994 |
| 8/21/2002 | 946 | Drain 4 | - | <1 | - | 79.4 | 30.1 | 2.7 | 8 | 0 | **0.114** | - |
| 8/21/2002 | 952 | Drain 6 | - | <1 | - | 78.4 | 30.1 | 1.8 | 8.1 | 0 | **0.115** | - |
| 8/21/2002 | 958 | Drain 11 | - | <1 | - | **74.6** | 29.8 | 1.2 | 8 | 0 | **0.124** | - |
| 8/21/2002 | 1012 | Drain 14 | - | - | - | 77.5 | 29.6 | 1.3 | 8.1 | 0 | **0.074** | - |
| 8/28/2002 | 955 | Drain 4 | - | **24191.7** | 26 | - | 28.8 | 56 | 7.8 | 0 | **8.364** | - |
| 8/28/2002 | 1002 | Drain 6 | - | **15530.7** | 27 | - | 28.6 | 15 | 7.8 | 0 | **1.582** | - |
| 8/28/2002 | 1012 | Drain 11 | - | **2310** | 28 | - | 28.5 | 17 | 7.8 | 0 | **2.064** | - |
| 8/28/2002 | 1032 | Drain 14 | - | **1455** | 30 | - | 28.4 | 4.2 | 7.8 | 0 | 0.02 | - |
| 9/4/2002 | 943 | Drain 4 | - | 41 | 18 | - | 31.1 | 2.7 | 7.8 | **0.65** | **0.047** | - |
| 9/4/2002 | 955 | Drain 6 | - | 20 | 25 | - | 31.2 | 3.5 | 7.9 | 0 | **0.092** | - |
| 9/4/2002 | 1004 | Drain 11 | - | <1 | 26 | - | 31.2 | 2.1 | 7.9 | 0 | **0.082** | - |
| 9/4/2002 | 1022 | Drain 14 | - | <1 | 23 | - | 30.8 | 1.3 | 8 | 0 | **0.106** | - |
| 9/10/2002 | 1009 | Drain 4 | - | 10 | 29 | - | 30.8 | 8.6 | 8.05 | 0 | - | - |
| 9/10/2002 | 1005 | Drain 6 | - | 10 | 29 | - | 30.6 | 1.76 | **1.76** | 0 | - | - |
| 9/10/2002 | 959 | Drain 11 | - | <1 | 28 | - | 30.3 | 1.8 | **1.8** | 0 | - | - |
| 9/10/2002 | 946 | Drain 14 | - | <1 | 29 | - | 29.9 | 1.87 | **1.87** | 0 | - | - |
| 9/18/2002 | 953 | Drain 4 | - | **>24192** | 8 | - | 28.2 | - | 8.1 | - | - | 7998 |
| 9/18/2002 | 1005 | Drain 6 | - | **24197** | 19 | - | 29.2 | - | 7.8 | - | - | 14995 |
| 9/18/2002 | 1017 | Drain 11 | - | **>24192** | 17 | - | 30 | - | 8 | - | - | 13996 |
| 9/18/2002 | 1035 | Drain 14 | - | <1 | 22 | - | 30.1 | - | 8.1 | - | - | 16995 |
| 9/18/2002 | 953 | Drain 4 | - | **>24192** | 8 | - | 28.2 | - | 8.1 | - | - | 7998 |
| 9/18/2002 | 1005 | Drain 6 | - | **24197** | 19 | - | 29.2 | - | 7.8 | - | - | 14995 |
| 9/18/2002 | 1017 | Drain 11 | - | **>24192** | 17 | - | 30 | - | 8 | - | - | 13996 |
| 9/18/2002 | 1035 | Drain 14 | - | <1 | 22 | - | 30.1 | - | 8.1 | - | - | 16995 |
| 9/25/2002 | - | Drain 4 | - | **368** | - | **26** | 30.5 | 2.48 | 8.03 | 0 | **0.107** | 17994 |
| 9/25/2002 | - | Drain 6 | - | <1 | - | **28** | 30.8 | 1.92 | 8 | 0 | **0.087** | 18994 |
| 9/25/2002 | - | Drain 11 | - | 10 | - | **27** | 30.6 | 1.53 | 7.87 | 0 | **0.064** | 18994 |
| 9/25/2002 | - | Drain 14 | - | <1 | - | **29** | 29.2 | 1.27 | 8.12 | 0 | **0.029** | - |
| 10/2/2002 | 0946 | Drain 4 | - | <1 | 18 | - | 31.2 | 4.78 | 7.6 | **0.61** | **0.414** | 12996 |
| 10/2/2002 | 0941 | Drain 6 | - | <1 | 27 | - | 31.2 | 1.53 | 7.77 | 0 | **0.038** | 18994 |
| 10/2/2002 | 0931 | Drain 11 | - | <1 | 23 | - | 32.2 | 1.36 | **7.54** | 0 | **0.225** | 17495 |
| 10/2/2002 | 0922 | Drain 14 | - | <1 | 32 | - | 30.5 | 1.79 | 8.02 | 0 | **0.056** | 16994 |
| 10/7/2002 | 1032 | Drain 4 | - | - | - | - | - | - | - | 0 | **1.879** | 32 |
| 10/7/2002 | 1044 | Drain 6 | - | - | - | - | - | - | - | 0 | **0.218** | 40 |
| 10/7/2002 | 1052 | Drain 11 | - | - | - | - | - | - | - | 0 | **0.47** | 15 |
| 10/9/2002 | 1017 | Drain 4 | - | **171** | 27 | - | 29.9 | 2.3 | 7.7 | 0 | 0.002 | 18494 |
| 10/9/2002 | 1014 | Drain 6 | - | 52 | 27 | - | 29.8 | 2.88 | 7.8 | 0 | 0.022 | 18494 |
| 10/9/2002 | 1009 | Drain 11 | - | 20 | 28 | - | 30.4 | 4.07 | 7.7 | 0 | **1.24** | 18494 |
| 10/9/2002 | 0957 | Drain 14 | - | <1 | 30 | - | 29.7 | 1.67 | 7.9 | 0 | **0.441** | 18494 |
| 10/15/2002 | 0940 | Drain 4 | - | 30 | 20 | - | 30.9 | 4.93 | 7.6 | - | **0.025** | 14496 |
| 10/15/2002 | 0935 | Drain 6 | - | <1 | 27 | - | 30.6 | 5.55 | 7.8 | - | 0.009 | 18494 |
| 10/15/2002 | 0930 | Drain 11 | - | 10 | 29 | - | 30.9 | 3.81 | 7.6 | - | **0.079** | 16995 |
| 10/15/2002 | 0916 | Drain 14 | - | <1 | 29 | - | 29.2 | 3.19 | 7.8 | - | **0.034** | 16495 |
| 10/23/2002 | 0959 | Drain 4 | - | <1 | 27 | - | 31.1 | 2.69 | 7.8 | 0 | **0.041** | - |
| 10/23/2002 | 0955 | Drain 6 | - | <1 | 28 | - | 31.2 | 2.2 | 7.9 | 0 | **0.562** | - |
| 10/23/2002 | 0949 | Drain 11 | - | <1 | 29 | - | 31.1 | 1.32 | 7.7 | 0 | **0.027** | - |
| 10/23/2002 | 0940 | Drain 14 | - | <1 | 28 | - | 31.3 | 1.01 | 7.9 | 0 | **0.027** | - |
| 10/30/2002 | 0959 | Drain 4 | - | <1 | 30 | - | - | 3 | 8 | 0 | **0.027** | 12496 |
| 10/30/2002 | 1004 | Drain 6 | - | 74 | 30 | - | - | 1.4 | 7.9 | 0 | 0.02 | 16495 |
| 10/30/2002 | 1009 | Drain 11 | - | <1 | 30 | - | - | 2.5 | 7.8 | 0 | **0.031** | 16994 |
| 10/30/2002 | 1020 | Drain 14 | - | <1 | 31 | - | - | 1.3 | 8.2 | 0 | 0.005 | 17495 |
| 11/6/2002 | 1048 | Drain 4 | - | 20 | 30 | - | - | 2.9 | 8.1 | 0 | **2.72** | 18494 |
| 11/6/2002 | 1052 | Drain 6 | - | **121** | 31 | - | - | 2.5 | 8.1 | 0 | **0.092** | 19494 |
| 11/6/2002 | 1056 | Drain 11 | - | <1 | 29 | - | - | 1.6 | 8 | **0.29** | **0.519** | 19494 |
| 11/6/2002 | 1059 | Drain 14 | - | <1 | 30 | - | - | 2 | 8.1 | **0.25** | **1.019** | 19494 |
| 11/13/2002 | 1002 | Drain 4 | - | <1 | 22 | - | - | 3.21 | 7.8 | 0 | 0.009 | 13996 |
| 11/13/2002 | 0958 | Drain 6 | - | <1 | 27 | - | - | 3.52 | 8 | 0 | 0.002 | 18494 |
| 11/13/2002 | 0953 | Drain 11 | - | <1 | 27 | - | - | 1.41 | 7.8 | 0 | 0.022 | 18494 |
| 11/13/2002 | 0942 | Drain 14 | - | <1 | 28 | - | - | 2.16 | 8 | 0 | 0.013 | 17495 |
| 11/20/2002 | 1056 | Drain 4 | - | **>2419.2** | 29 | - | - | - | 8.2 | 0 | **0.147** | - |

### Table C.21: Lagoon Water Quality Results, 2002-2003

| Date | Time | Site | Fecal Coliform (CFU/100 ml) | Enterococci (CFU/100 ml) | Salinity (‰)[2] | Dissolved Oxygen (%) | Temperature (°C)[2] | Turbidity (NTU)[2] | pH | Nitrate (mg/L) | $PO_4$ (mg/L) | Chloride (mg/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CNMI Water Quality Standards | | | GM[1]<200, <400 Single Sample[*] | GM[1]<35, <104 Single Sample[*] | 10 | >75 | 1.0 | 0.5 | 7.6 - 8.6 | <0.2 | <0.025 | NA |
| 11/20/2002 | 1110 | Drain 6 | - | **>2419.2** | 25 | - | - | - | 7.9 | 0 | **0.107** | - |
| 11/20/2002 | 1116 | Drain 11 | - | **>2419.2** | 23 | - | - | - | 7.9 | 0 | **0.125** | - |
| 11/20/2002 | 0848 | Drain 14 | - | **2046** | 31 | - | - | 3.47 | 8.1 | 0 | **0.275** | - |
| 11/26/2002 | 1057 | Drain 4 | - | 20 | - | - | - | 1.8 | 8.1 | 0 | **0.129** | 18994 |
| 11/26/2002 | 1103 | Drain 6 | - | 10 | - | - | - | 1.5 | 8.1 | 0 | **0.332** | 18994 |
| 11/26/2002 | 1108 | Drain 11 | - | 30 | - | - | - | 0.94 | 8.1 | 0 | **0.117** | 18994 |
| 11/26/2002 | 0910 | Drain 14 | - | <1 | - | - | - | - | 8.1 | 0 | **0.089** | 19994 |
| 12/4/2002 | 1053 | Drain 4 | - | 10 | 31 | - | - | - | - | 0 | **0.042** | 18994 |
| 12/4/2002 | 1058 | Drain 6 | - | <1 | 31 | - | - | - | - | 0 | **0.067** | 18494 |
| 12/4/2002 | 1104 | Drain 11 | - | <1 | 30 | - | - | - | - | 0 | **0.095** | 18994 |
| 12/4/2002 | 0837 | Drain 14 | - | 10 | 32 | - | - | 1.05 | 8 | 0 | **0.074** | 23493 |
| 12/4/2002 | - | Drain 4 | - | **>2419.2** | - | - | - | - | - | 0 | **0.497** | - |
| 12/4/2002 | - | Drain 6 | - | **19862.8** | - | - | - | - | - | 0 | **0.073** | - |
| 12/10/2002 | 1102 | Drain 4 | - | 63 | - | - | - | 2 | 8 | 0 | 0.018 | 17994 |
| 12/10/2002 | 1109 | Drain 6 | - | 54 | - | - | - | 2.1 | 8 | 0 | 0.02 | 18994 |
| 12/10/2002 | 1114 | Drain 11 | - | 86 | - | - | - | 1.8 | 8.1 | 0 | 0.008 | 19494 |
| 12/10/2002 | 1034 | Drain 14 | - | 41 | 35 | - | 27.6 | 2.44 | 8.2 | 0 | **0.025** | 18494 |
| 12/18/2002 | 1057 | Drain 4 | - | **160** | 30 | - | - | - | 8 | 0 | **0.057** | 18494 |
| 12/18/2002 | 1104 | Drain 6 | - | 20 | 30 | - | - | - | 8 | 0 | **0.035** | 18494 |
| 12/18/2002 | 1110 | Drain 11 | - | <1 | 30 | - | - | - | 7.8 | 0 | 0.01 | 18494 |
| 12/18/2002 | 1035 | Drain 14 | - | <1 | 30 | - | - | 1.56 | 8.2 | 0 | 0.017 | 19994 |
| 12/23/2002 | 0927 | Drain 4 | - | 20 | 30 | - | - | 1.62 | 7.7 | 0 | **0.058** | 16495 |
| 12/23/2002 | 0915 | Drain 6 | - | 10 | 29 | - | - | 1.57 | 7.8 | 0 | **0.067** | 18994 |
| 12/23/2002 | 0910 | Drain 11 | - | <1 | 30 | - | - | 1.1 | 7.7 | 0 | **0.064** | 19994 |
| 12/23/2002 | 1112 | Drain 14 | - | 20 | 31 | - | 29.1 | 1.94 | 8.1 | 0 | **0.051** | 18994 |
| 12/30/2002 | 0912 | Drain 4 | - | 31 | 29 | - | - | 1.88 | 7.9 | 0 | **0.031** | 19494 |
| 12/30/2002 | 0906 | Drain 6 | - | <1 | 33 | - | - | 1.41 | 7.9 | 0 | **0.025** | 19994 |
| 12/30/2002 | 0900 | Drain 11 | - | **110** | 29 | - | - | 8.14 | 8 | 0 | **0.039** | 17994 |
| 12/30/2002 | 0840 | Drain 14 | - | 41 | 30 | - | 26.3 | 1.95 | 8.1 | 0 | **0.03** | 16495 |
| 1/7/2003 | 1133 | Drain 4 | - | **226** | 30 | - | - | 3.72 | 8.1 | 0 | **0.015** | 18994 |
| 1/7/2003 | 1137 | Drain 6 | - | **226** | 30 | - | - | 5.76 | 8.2 | 0 | 0.009 | 15495 |
| 1/7/2003 | 1143 | Drain 11 | - | **985** | 30 | - | - | 2.98 | 8.3 | 0 | 0.009 | 15995 |
| 1/7/2003 | 1152 | Drain 14 | - | <1 | 30 | - | - | 3.46 | 8.3 | 0 | 0.011 | 18494 |
| 1/15/2003 | 1025 | Drain 4 | - | 97 | 30 | - | 28.5 | 1.1 | 7.9 | 0 | **0.082** | 18494 |
| 1/15/2003 | 1031 | Drain 6 | - | <1 | 30 | - | 28 | 2.3 | 8.1 | 0 | **0.129** | 19994 |
| 1/15/2003 | 1037 | Drain 11 | - | 10 | 30 | - | 28.8 | 1.2 | 8 | 0 | **0.114** | 19994 |
| 1/15/2003 | 1043 | Drain 14 | - | <1 | 30 | - | 28.6 | 1.6 | 8.2 | 0 | **0.037** | 18994 |
| 1/22/2003 | 1024 | Drain 4 | - | <1 | 30 | - | 28.5 | 1.9 | **7** | 0 | **0.033** | - |
| 1/22/2003 | 1030 | Drain 6 | - | 41 | 30 | - | 27.3 | 2.5 | 7.9 | 0 | **0.035** | - |
| 1/22/2003 | 1037 | Drain 11 | - | 10 | 30 | - | 28.1 | 1.9 | 7.8 | 0 | **0.029** | - |
| 1/22/2003 | 1043 | Drain 14 | - | 10 | 30 | - | 27.1 | 6.2 | 8.1 | 0 | **0.053** | - |
| 1/29/2003 | 1027 | Drain 4 | - | 41 | 30 | - | 28 | 2.2 | 8 | 0 | 0.017 | 17994 |
| 1/29/2003 | 1033 | Drain 6 | - | 20 | 30 | - | 28.1 | 2.8 | 8 | 0 | 0.013 | 17994 |
| 1/29/2003 | 1038 | Drain 11 | - | 20 | 30 | - | 27.6 | 3.2 | 8 | 0 | **0.027** | 18994 |
| 1/29/2003 | 1050 | Drain 14 | - | 20 | 30 | - | 27 | 2.9 | 8 | 0 | 0.01 | 18994 |
| 2/5/2003 | 0855 | Drain 4 | - | **4352** | 30 | - | 29.3 | 12 | 7.7 | 0 | - | - |
| 2/5/2003 | 0900 | Drain 6 | - | **798** | 30 | - | 27.4 | 9.4 | 7.9 | 0 | - | - |
| 2/5/2003 | 0905 | Drain 11 | - | **335** | 30 | - | 28.8 | 1.6 | 7.8 | 0 | - | - |
| 2/5/2003 | 0909 | Drain 14 | - | **231** | 30 | - | 27.3 | 1.2 | 8.1 | 0 | - | - |

[1] GM in not less than four samples over a 30-day period.

[2] Shall not exceed ambient by more than the stated value.

[*] For the purpose of this study, analytical results were compared against the single sample standard.

- = data not available
% = percent
‰ = per mil (parts per thousand)
°C = degrees Celsius
GM = geometric mean
CFU = colony forming units
mg/L = milligrams per liter
ml = milliliter
NA = not applicable
ND = not detected
NTU = nephelometric turbidity units
$PO_4$ = orthophosphate
**Bold** values exceed CNMI water quality standards.
Grey-shaded values exceed 2.5, a non-regulatory assigned value for coastal waters to approximate ambient conditions in a healthy reef system.

## Table C.22: Average Values of Lagoon Water Quality Results, Wet versus Dry Season, 2002-2003

| Location | Enterococci (CFU/100 ml) | Salinity (‰) | Dissolved Oxygen (%) | Temperature (°C) | Turbidity (NTU) | pH | Nitrate (mg/L) | $PO_4$ (mg/L) | Chloride (mg/L) |
|---|---|---|---|---|---|---|---|---|---|
| Drain 4 Wet | 9186.5 | 22.6 | 52.7 | 29.8 | 63.1 | 7.98 | 0.07 | 0.76 | 14344.2 |
| Drain 4 Dry | 310 | 30.5 | 99.1 | 29.2 | 13.5 | 7.96 | 0.02 | 0.08 | 18829.1 |
| Drain 6 Wet | 17614.9 | 26.3 | 62.8 | 29.8 | 15.8 | 7.7 | 0.02 | 0.25 | 17033.2 |
| Drain 6 Dry | 852.5 | 31.1 | 99.3 | 28.9 | 8.6 | 8.02 | 0 | 0.07 | 20472.1 |
| Drain 11 Wet | 423.3 | 24.8 | 50.8 | 30.1 | 25.5 | 7.68 | 0.04 | 0.44 | 16781.5 |
| Drain 11 Dry | 87.3 | 30.9 | 94.3 | 29.2 | 3.2 | 7.99 | 0 | 0.04 | 19044.1 |
| Drain 14 Wet | 3712.4 | 27.6 | 53.3 | 29.8 | 6.7 | 7.8 | 0.03 | 0.17 | 18452.6 |
| Drain 14 Dry | 31.6 | 31.2 | 102.9 | 28.6 | 8.3 | 8.11 | 0 | 0.05 | 19139.9 |

% = percent
‰ = per mil (part per thousand)
°C = degrees Celsius
CFU = colony forming units
mg/L = milligrams per liter
ml = milliliter
NTU = nephelometric turbidity units
$PO_4$ = orthophosphate

# Table C.23: Lagoon Water Quality Results, 2010-2011

| Date | Time | Site | Fecal Coliform (CFU/100 ml) | Enterococci (CFU/100 ml) | Enterococci (CFU/100 ml) /GM$^1$ | Salinity (‰)$^2$ | Dissolved Oxygen (%) | Temperature (°C)$^2$ | Turbidity (NTU)$^2$ | pH |
|---|---|---|---|---|---|---|---|---|---|---|
| CNMI Water Quality Standards | | | GM$^1$<200, <400 Single Sample$^*$ | <104 | <35 | 10 | >75 | 1.0 | 0.5 | 7.6 - 8.6 |
| 7/8/2010 | 0906 | 21.0 | - | 73 | **73** | 33.0 | 118.9 | 28.5 | 7.4 | 8.1 |
| 7/8/2010 | 0917 | 22.0 | - | **201** | 21 | 34.1 | 96.8 | 29.3 | 3.6 | 8.1 |
| 7/8/2010 | 0913 | 23.0 | - | 10 | 10 | 33.8 | 103.1 | 29.1 | 2.9 | 8.1 |
| 7/8/2010 | 0928 | 24.0 | - | 20 | 14 | 34.2 | 90.8 | 29.4 | 1.3 | 8 |
| 7/14/2010 | 0848 | 21.0 | - | 86 | **86** | 35.6 | **74.0** | 29.9 | 5.8 | 8 |
| 7/14/2010 | 0855 | 22.0 | - | 20 | 25 | 35.6 | 83.3 | - | 1.7 | 8.1 |
| 7/14/2010 | 0852 | 23.0 | - | 10 | 10 | 34.8 | 84.2 | 30.2 | 2.2 | 8.1 |
| 7/14/2010 | 0943 | 24.0 | - | 10 | 14 | 35.2 | 79.8 | 31.2 | 4 | 8.1 |
| 7/22/2010 | 1142 | 21.0 | - | **906** | **131** | 35.3 | **68.2** | 31.4 | 7.6 | 8.1 |
| 7/22/2010 | 1132 | 22.0 | - | 41 | **36** | 31.8 | 110.0 | 33.0 | 2.1 | 8.1 |
| 7/22/2010 | 1134 | 23.0 | - | 10 | 12 | 35.2 | 150.6 | 33.4 | 2.4 | 8.4 |
| 7/22/2010 | 1127 | 24.0 | - | 30 | 19 | 34.3 | 98.9 | 35.9 | 3.3 | 8.1 |
| 7/27/2010 | 0850 | 21.0 | - | 41 | **124** | 33.4 | 86.9 | 28.6 | 2 | 8.1 |
| 7/27/2010 | 0905 | 22.0 | - | 20 | **43** | 33.8 | 88.9 | 28.8 | 1 | 8 |
| 7/27/2010 | 0855 | 23.0 | - | 75 | 17 | 33.8 | 90.4 | 28.1 | 2.5 | 8.1 |
| 7/27/2010 | 0915 | 24.0 | - | 10 | 16 | 33.9 | 89.4 | 28.4 | 1 | 8.1 |
| 8/3/2010 | 0850 | 21.0 | - | **209** | **161** | 35.6 | **71.7** | 30.0 | 4.8 | 7.9 |
| 8/3/2010 | 0902 | 22.0 | - | 10 | 20 | 35.9 | **69.3** | 30.8 | 2.3 | 7.8 |
| 8/3/2010 | 0855 | 23.0 | - | 10 | 17 | 33.5 | 81.4 | 30.4 | 1.6 | 7.8 |
| 8/3/2010 | 0912 | 24.0 | - | 10 | 13 | 34.9 | **52.9** | 32.2 | 1.4 | 7.8 |
| 8/11/2010 | 0903 | 21.0 | - | 31 | **125** | 32.3 | 110.6 | 28.9 | 5.5 | 7.8 |
| 8/11/2010 | 0924 | 22.0 | - | 31 | 22 | 34.9 | 94.3 | 30.4 | 2.6 | 8 |
| 8/11/2010 | 0919 | 23.0 | - | 52 | 25 | 33.9 | 99.8 | 30.6 | 3.4 | 8 |
| 8/11/2010 | 0936 | 24.0 | - | 10 | 13 | 34.5 | 94.7 | 30.3 | 2.1 | 8 |
| 8/18/2010 | 0824 | 21.0 | - | **74** | **67** | 32.6 | **60.1** | 30.2 | 7.1 | 8 |
| 8/18/2010 | 0837 | 22.0 | - | 10 | 16 | 32.0 | 80.2 | 31.0 | 2 | 8 |
| 8/18/2010 | 0831 | 23.0 | - | 31 | 33 | 29.6 | **45.5** | 30.6 | 1.9 | 7.7 |
| 8/18/2010 | 0844 | 24.0 | - | 10 | 10 | 30.1 | **43.7** | 33.1 | 2 | 7.7 |
| 8/25/2010 | 1126 | 21.0 | - | **226** | **102** | 32.6 | 86.1 | 30.8 | 6.3 | 7.8 |
| 8/25/2010 | 1114 | 22.0 | - | **199** | 28 | 33.6 | 94.4 | 30.6 | 2 | 8 |
| 8/25/2010 | 1119 | 23.0 | - | **135** | **38** | 34.0 | 88.9 | 30.9 | 1.9 | 8.1 |
| 8/25/2010 | 1106 | 24.0 | - | 41 | 14 | 34.1 | 91.3 | 30.7 | 1.1 | 8.1 |
| 9/1/2010 | 1012 | 21.0 | - | 10 | **48** | 33.0 | 79.3 | 30.4 | 7.5 | 7.8 |
| 9/1/2010 | 0959 | 22.0 | - | 61 | **44** | 33.6 | 87.8 | 30.1 | 2.6 | 8 |
| 9/1/2010 | 1004 | 23.0 | - | 84 | **65** | 32.8 | 91.3 | 30.2 | 3.9 | 8 |
| 9/1/2010 | 0954 | 24.0 | - | 10 | 14 | 34.4 | 93.1 | 30.2 | 1.3 | 8 |
| 9/8/2010 | 0856 | 21.0 | - | 85 | **61** | 29.9 | 104.6 | 29.7 | 4.9 | 7.8 |
| 9/8/2010 | 0911 | 22.0 | - | **160** | **66** | 33.8 | 96.3 | 29.9 | 2.4 | 8 |
| 9/8/2010 | 0904 | 23.0 | - | **393** | **108** | 31.6 | 99.8 | 29.7 | 3.3 | 8 |
| 9/8/2010 | 0917 | 24.0 | - | 20 | 17 | 34.0 | 100.6 | 29.6 | 1.6 | 8.1 |
| 9/15/2010 | 0837 | 21.0 | - | 52 | **56** | 33.3 | **63.8** | 30.7 | 2.6 | 8 |
| 9/15/2010 | 0857 | 22.0 | - | 10 | **66** | 30.3 | 75.6 | 30.9 | 1.2 | 7.9 |
| 9/15/2010 | 0845 | 23.0 | - | 10 | **82** | 12.8 | **61.3** | 29.4 | 2.2 | 7.9 |
| 9/15/2010 | 0902 | 24.0 | - | 10 | 17 | 30.8 | **57.2** | 33.2 | 2.2 | 7.7 |
| 9/22/2010 | 1043 | 21.0 | - | **6131** | **128** | 33.4 | 79.4 | 28.8 | 7.4 | 8.1 |
| 9/22/2010 | 1024 | 22.0 | - | **41** | **45** | 33.6 | 86.1 | 28.8 | 3.6 | 8.2 |
| 9/22/2010 | 1033 | 23.0 | - | **2382** | **167** | 33.9 | 85.3 | 28.7 | 6.9 | 8.2 |
| 9/22/2010 | 1017 | 24.0 | - | 62 | 19 | 33.4 | 84.4 | 28.7 | 2.3 | 8 |
| 9/29/2010 | 0855 | 21.0 | - | **295** | **299** | 33.4 | 89.9 | 28.7 | 3.6 | 8.1 |
| 9/29/2010 | 0910 | 22.0 | - | **52** | **43** | 33.6 | 94.6 | 28.6 | 2.6 | 8 |
| 9/29/2010 | 0900 | 23.0 | - | **160** | **197** | 33.4 | 89.9 | 28.4 | 3 | 8.1 |
| 9/29/2010 | 0920 | 24.0 | - | 10 | 19 | 33.8 | 91.9 | 28.6 | 2.5 | 8 |
| 10/6/2010 | 0948 | 21.0 | - | 10 | **175** | 33.5 | **72.8** | 30.5 | 6.1 | 7.9 |
| 10/6/2010 | 1012 | 22.0 | - | 10 | 21 | 31.2 | 85.5 | 30.6 | 2.8 | 7.8 |
| 10/6/2010 | 1009 | 23.0 | - | **109** | **143** | 26.2 | 104.2 | 30.6 | 1.8 | 7.8 |
| 10/6/2010 | 1016 | 24.0 | - | 10 | 16 | 26.2 | **67.2** | 33.3 | 1.9 | 7.9 |
| 10/13/2010 | 0818 | 21.0 | - | **9804** | **649** | 32.4 | 76.2 | 30.4 | 6.2 | 7.9 |
| 10/13/2010 | 0828 | 22.0 | - | 22 | 26 | 34.0 | 81.0 | 30.5 | 2.4 | 7.9 |
| 10/13/2010 | 0824 | 23.0 | - | 10 | **143** | 33.6 | 80.5 | 30.2 | 3 | 7.9 |
| 10/13/2010 | 0835 | 24.0 | - | 10 | 16 | 32.0 | 75.6 | 31.3 | 4.7 | 7.9 |
| 10/20/2010 | 0906 | 21.0 | - | **2046** | **493** | 31.3 | 104.9 | 28.5 | 6.3 | 8.2 |
| 10/20/2010 | 0919 | 22.0 | - | 10 | 18 | 33.8 | 99.3 | 28.8 | 2.9 | 8.1 |
| 10/20/2010 | 0913 | 23.0 | - | 97 | **64** | 32.4 | 89.4 | 28.7 | 4.8 | 8.1 |
| 10/20/2010 | 0926 | 24.0 | - | 10 | 10 | 33.9 | 103.9 | 28.8 | 1.9 | 8 |
| 10/27/2010 | 0936 | 21.0 | - | **275** | **485** | 33.1 | 94.9 | 29.6 | 2.1 | 7.9 |
| 10/27/2010 | 0948 | 22.0 | - | 31 | 16 | 31.8 | 118.3 | 29.7 | 1 | 7.9 |
| 10/27/2010 | 0940 | 23.0 | - | 10 | 32 | 33.4 | 104.6 | 29.6 | 1.9 | 7.9 |
| 10/27/2010 | 1005 | 24.0 | - | 10 | 10 | 32.7 | 103.9 | 29.8 | 0.75 | 7.9 |
| 11/2/2010 | 1042 | 21.0 | - | 10 | **485** | 34.3 | 86.9 | 29.8 | 3.6 | 8 |
| 11/2/2010 | 1032 | 22.0 | - | 10 | 16 | 34.4 | 85.4 | 29.8 | 3.2 | 7.9 |
| 11/2/2010 | 1034 | 23.0 | - | 10 | 18 | 34.4 | 92.9 | 28.7 | 1.9 | 8 |
| 11/2/2010 | 1030 | 24.0 | - | 10 | 10 | 34.6 | 96.3 | 29.8 | 1.4 | 8 |
| 11/9/2010 | 0925 | 21.0 | - | **193** | **182** | 34.0 | **34.5** | 29.7 | 3 | 8.1 |
| 11/9/2010 | 0940 | 22.0 | - | 10 | 13 | 33.0 | **33.8** | 29.6 | 2 | 8 |
| 11/9/2010 | 1932 | 23.0 | - | 20 | 21 | 33.0 | **33.9** | 29.8 | 3.5 | 8.1 |
| 11/9/2010 | 0958 | 24.0 | - | 10 | 10 | 34.0 | **34.1** | 29.8 | 2 | 8 |
| 11/17/2010 | 0850 | 21.0 | - | 10 | **48** | 34.0 | 99.6 | 28.6 | 3 | 8.1 |
| 11/17/2010 | 0905 | 22.0 | - | 10 | 13 | 34.0 | 89.4 | 28.4 | 2.6 | 8.1 |
| 11/17/2010 | 0856 | 23.0 | - | 10 | 12 | 34.0 | 94.6 | 28.9 | 4 | 8.1 |
| 11/17/2010 | 0920 | 24.0 | - | 10 | 10 | 34.0 | 89.6 | 28.7 | 2 | 8 |
| 11/23/2010 | 0850 | 21.0 | - | **213** | **45** | 34.0 | 88.9 | 29.6 | 6.6 | 8.1 |
| 11/23/2010 | 0858 | 22.0 | - | 97 | 18 | 34.0 | 90.4 | 29.6 | 2.6 | 8 |
| 11/23/2010 | 0855 | 23.0 | - | **327** | 28 | 34.0 | 94.6 | 29.8 | 3 | 8.1 |

## Table C.23: Lagoon Water Quality Results, 2010-2011

| Date | Time | Site | Fecal Coliform (CFU/100 ml) | Enterococci (CFU/100 ml) | Enterococci (CFU/100 ml) /GM[1] | Salinity (‰)[2] | Dissolved Oxygen (%) | Temperature (°C)[2] | Turbidity (NTU)[2] | pH |
|---|---|---|---|---|---|---|---|---|---|---|
| CNMI Water Quality Standards | | | GM[1]<200, <400 Single Sample[*] | <104 | <35 | 10 | >75 | 1.0 | 0.5 | 7.6 - 8.6 |
| 11/23/2010 | 0905 | 24.0 | - | 10 | 10 | 34.0 | 86.7 | 28.6 | 2.5 | 8 |
| 12/1/2010 | 0827 | 21.0 | - | **41** | **64** | 32.0 | **71.0** | 28.8 | 6.8 | 7.9 |
| 12/1/2010 | 0840 | 22.0 | - | 10 | 18 | 34.0 | **74.6** | 29.2 | 1.5 | 7.9 |
| 12/1/2010 | 0832 | 23.0 | - | 10 | 28 | 32.0 | 97.3 | 29.3 | 1.1 | 7.9 |
| 12/1/2010 | 0846 | 24.0 | - | 10 | 10 | 32.0 | **65.7** | 30.0 | 2.1 | 7.9 |
| 12/6/2010 | 0855 | 21.0 | - | **85** | **52** | 34.0 | 89.9 | 28.3 | 5 | 7.9 |
| 12/6/2010 | 0910 | 22.0 | - | 61 | 28 | 34.0 | 88.4 | 28.8 | 4 | 8 |
| 12/6/2010 | 0900 | 23.0 | - | **862** | **73** | 34.0 | 90.9 | 28.6 | 4.5 | 8.1 |
| 12/6/2010 | 0915 | 24.0 | - | 20 | 12 | 33.0 | 89.4 | 28.8 | 2.5 | 8 |
| 12/15/2010 | 0842 | 21.0 | - | 20 | **62** | 26.0 | **63.9** | 28.7 | 4.1 | 7.9 |
| 12/15/2010 | 0846 | 22.0 | - | 10 | 28 | 29.0 | 97.9 | 29.3 | 2.4 | 7.8 |
| 12/15/2010 | 0851 | 23.0 | - | 10 | **73** | 29.0 | **42.0** | 29.1 | 1.4 | 7.7 |
| 12/15/2010 | 0859 | 24.0 | - | 10 | 12 | 31.0 | **45.5** | 29.8 | 2.1 | 7.7 |
| 12/22/2010 | 0856 | 21.0 | - | **31** | **38** | 33.0 | 84.2 | 28.0 | 1.1 | 8.1 |
| 12/22/2010 | 0911 | 22.0 | - | **259** | **35** | 35.0 | 81.0 | 28.8 | 1.2 | 8.1 |
| 12/22/2010 | 0905 | 23.0 | - | **613** | **85** | 33.0 | 76.1 | 28.6 | 2.2 | 8.1 |
| 12/22/2010 | 0919 | 24.0 | - | 10 | 12 | 34.0 | 86.4 | 28.9 | 0.96 | 8.1 |
| 12/29/2010 | 0915 | 21.0 | - | **417** | **68** | 32.0 | 106.5 | 28.3 | 3.5 | 7.6 |
| 12/29/2010 | 0925 | 22.0 | - | 10 | **35** | 35.0 | 88.6 | 28.4 | 2.6 | 8.1 |
| 12/29/2010 | 0920 | 23.0 | - | 20 | **101** | 33.0 | 98.6 | 28.7 | 3.6 | 8.1 |
| 12/29/2010 | 0934 | 24.0 | - | 20 | 14 | 34.0 | 99.7 | 28.6 | 2.6 | 8 |
| 1/5/2011 | 1121 | 21.0 | - | **292** | **93** | - | - | - | - | - |
| 1/5/2011 | 1125 | 22.0 | - | **428** | **58** | - | - | - | - | - |
| 1/5/2011 | 1127 | 23.0 | - | **231** | **73** | - | - | - | - | - |
| 1/5/2011 | 1131 | 24.0 | - | 52 | 18 | - | - | - | - | - |
| 1/12/2011 | 0908 | 21.0 | - | 97 | **138** | 32.1 | **67.5** | 28.7 | 3.4 | 8 |
| 1/12/2011 | 0913 | 22.0 | - | 74 | **95** | 31.3 | 77.8 | 29.0 | 2 | 7.6 |
| 1/12/2011 | 0919 | 23.0 | - | 10 | **73** | 32.0 | **74.9** | 29.0 | 3 | 7.9 |
| 1/12/2011 | 0925 | 24.0 | - | 10 | 18 | 33.4 | **54.6** | 29.6 | 3.9 | 7.9 |
| 1/19/2011 | 0850 | 21.0 | - | **309** | **162** | 33.8 | 89.9 | 28.4 | 4 | 8.1 |
| 1/19/2011 | 0900 | 22.0 | - | 86 | **93** | 33.8 | 94.8 | 29.8 | 2.6 | 8.1 |
| 1/19/2011 | 0855 | 23.0 | - | **295** | **96** | 33.8 | 96.9 | 28.9 | 4 | 8.1 |
| 1/19/2011 | 0910 | 24.0 | - | 75 | 24 | 33.4 | 84.9 | 29.8 | 2.5 | 8 |
| 1/26/2011 | 0841 | 21.0 | - | **122** | **214** | 33.5 | 89.7 | 28.8 | 3 | 8.1 |
| 1/26/2011 | 0855 | 22.0 | - | 41 | **65** | 34.6 | 91.6 | 28.8 | 2 | 8.1 |
| 1/26/2011 | 0850 | 23.0 | - | 30 | **53** | 34.7 | 96.6 | 28.8 | 3.5 | 8.1 |
| 1/26/2011 | 0905 | 24.0 | - | 20 | 27 | 34.6 | 89.9 | 28.4 | 2 | 8 |
| 2/2/2011 | 0828 | 21.0 | - | **148** | **174** | 33.9 | **72.9** | 27.7 | 7.9 | 7.9 |
| 2/2/2011 | 0838 | 22.0 | - | 98 | **102** | 33.6 | 80.9 | 27.4 | 3 | 8 |
| 2/2/2011 | 0833 | 23.0 | - | **243** | **87** | 34.5 | 79.9 | 27.8 | 3.3 | 8 |
| 2/2/2011 | 0843 | 24.0 | - | 52 | 33 | 34.1 | **74.2** | 28.4 | 1.2 | 8 |
| 2/9/2011 | 0858 | 21.0 | - | 52 | **123** | 32.5 | 81.5 | 28.4 | 3.3 | 8 |
| 2/9/2011 | 0907 | 22.0 | - | **228** | **90** | 32.6 | 81.1 | 28.6 | 1.2 | 8 |
| 2/9/2011 | 0903 | 23.0 | - | **231** | **87** | 32.5 | 81.5 | 28.4 | 1.2 | 8 |
| 2/9/2011 | 0914 | 24.0 | - | 10 | 24 | 32.5 | 79.3 | 29.7 | 1.7 | 7.9 |
| 2/16/2011 | 0859 | 21.0 | - | 10 | **43** | 34.0 | 103.7 | 27.4 | 7.8 | 8 |
| 2/16/2011 | 0915 | 22.0 | - | 20 | **69** | 34.1 | 99.8 | 27.6 | 3.6 | 8.1 |
| 2/16/2011 | 0907 | 23.0 | - | 10 | **87** | 32.6 | 88.3 | 27.8 | 4.3 | 8 |
| 2/16/2011 | 0927 | 24.0 | - | 10 | 24 | 34.3 | 98.1 | 27.6 | 1.6 | 8.1 |
| 2/23/2011 | 0843 | 21.0 | - | 20 | 22 | 34.4 | 96.9 | 28.4 | 5 | 8.1 |
| 2/23/2011 | 0855 | 22.0 | - | 10 | **45** | 34.6 | 94.6 | 28.6 | 2 | 8.1 |
| 2/23/2011 | 0848 | 23.0 | - | **934** | **109** | 34.7 | 89.6 | 28.7 | 3 | 8.1 |
| 2/23/2011 | 0905 | 24.0 | - | 10 | 16 | 33.9 | 88.6 | 28.4 | 2 | 8.1 |
| 3/2/2011 | 0856 | 21.0 | - | **931** | **68** | 31.8 | 79.4 | 27.5 | 6.1 | 7.8 |
| 3/2/2011 | 0911 | 22.0 | - | 86 | **52** | 34.0 | 82.9 | 27.4 | 2.6 | 8 |
| 3/2/2011 | 0905 | 23.0 | - | 86 | **135** | 33.4 | 91.6 | 27.3 | 4.9 | 7.9 |
| 3/2/2011 | 0919 | 24.0 | - | **857** | **34** | 34.1 | 84.9 | 27.4 | 1.4 | 8 |
| 3/9/2011 | 1027 | 21.0 | - | 31 | **50** | 33.2 | 97.5 | 27.2 | 2.3 | 8.1 |
| 3/9/2011 | 1025 | 22.0 | - | 10 | 33 | 34.8 | 94.3 | 27.8 | 1 | 8.1 |
| 3/9/2011 | 1023 | 23.0 | - | 41 | **95** | 34.6 | 94.1 | 27.5 | 1.5 | 8 |
| 3/9/2011 | 1018 | 24.0 | - | 10 | 24 | 32.1 | 94.7 | 27.1 | 1.4 | 8.1 |
| 3/16/2011 | 0906 | 21.0 | - | 10 | **36** | 33.4 | 82.7 | 27.4 | 1.8 | 8 |
| 3/16/2011 | 0912 | 22.0 | - | 20 | 20 | 34.4 | 87.7 | 26.8 | 2.3 | 8 |
| 3/16/2011 | 0918 | 23.0 | - | 52 | **70** | 33.6 | 80.2 | 26.9 | 2.2 | 8 |
| 3/16/2011 | 0923 | 24.0 | - | 10 | 24 | 34.7 | 76.8 | 27.4 | 1.6 | 8 |
| 3/22/2011 | 0856 | 21.0 | - | **146** | **61** | 34.8 | 99.6 | 26.5 | 1.5 | 8 |
| 3/22/2011 | 0903 | 22.0 | - | 10 | 18 | 35.5 | 98.7 | 27.6 | 2.2 | 8.1 |
| 3/22/2011 | 0905 | 23.0 | - | 97 | **111** | 35.3 | 97.2 | 26.4 | 1 | 8.1 |
| 3/22/2011 | 0909 | 24.0 | - | 10 | 24 | 34.2 | 96.1 | 25.7 | 0.98 | 8.2 |
| 3/30/2011 | 0855 | 21.0 | - | 52 | **74** | 33.6 | 79.9 | 27.6 | 2.2 | 8 |
| 3/30/2011 | 0901 | 22.0 | - | 20 | 20 | 34.0 | 89.0 | 27.3 | 2.6 | 8 |
| 3/30/2011 | 0906 | 23.0 | - | 41 | **59** | 34.2 | 92.0 | 27.0 | 1.8 | 8 |
| 3/30/2011 | 0912 | 24.0 | - | 10 | 24 | 34.8 | 79.8 | 27.7 | 1.1 | 8 |
| 4/6/2011 | 0850 | 21.0 | - | **238** | **56** | 33.1 | 88.6 | 28.6 | 6 | 7.8 |
| 4/6/2011 | 0855 | 22.0 | - | **109** | **21** | 33.6 | 91.4 | 28.7 | 7.5 | 8 |
| 4/6/2011 | 0905 | 23.0 | - | **24196** | **183** | 33.4 | 89.9 | 28.8 | 3.8 | 8.1 |
| 4/6/2011 | 0915 | 24.0 | - | 84 | 15 | 33.5 | 88.4 | 28.7 | 2.6 | 8.1 |
| 4/13/2011 | 0858 | 21.0 | - | **263** | **86** | 34.4 | **74.2** | 27.0 | 2 | 8 |
| 4/13/2011 | 0905 | 22.0 | - | 10 | 21 | 33.6 | 77.0 | 26.9 | 2.1 | 8 |
| 4/13/2011 | 0912 | 23.0 | - | **143** | **235** | 34.1 | 82.1 | 27.2 | 1.3 | 8.1 |
| 4/13/2011 | 0918 | 24.0 | - | 10 | 15 | 33.8 | 79.5 | 27.0 | 1.7 | 8 |
| 4/20/2011 | 0828 | 21.0 | - | **450** | **185** | 32.5 | **72.7** | 28.8 | 6.6 | 7.9 |
| 4/20/2011 | 0833 | 22.0 | - | 10 | 19 | 32.5 | 78.3 | 28.9 | 1.4 | 7.9 |

# Table C.23: Lagoon Water Quality Results, 2010-2011

| **Date** | **Time** | **Site** | **Fecal Coliform (CFU/100 ml)** | **Enterococci (CFU/100 ml)** | **Enterococci (CFU/100 ml) /GM[1]** | **Salinity (‰)[2]** | **Dissolved Oxygen (%)** | **Temperature (°C)[2]** | **Turbidity (NTU)[2]** | **pH** |
|---|---|---|---|---|---|---|---|---|---|---|
| CNMI Water Quality Standards | | | GM[1]<200, <400 Single Sample[*] | <104 | <35 | 10 | >75 | 1.0 | 0.5 | 7.6 - 8.6 |
| 4/20/2011 | 0838 | 23.0 | - | **31** | **212** | 34.2 | **60.1** | 29.3 | 1.7 | 7.9 |
| 4/20/2011 | 0844 | 24.0 | - | 10 | 15 | 34.0 | **37.3** | 30.5 | 0.59 | 7.7 |
| 4/27/2011 | 0832 | 21.0 | - | 20 | **124** | 33.6 | 76.5 | 29.4 | 10.2 | 7.9 |
| 4/27/2011 | 0836 | 22.0 | - | 10 | 19 | 12.7 | 142.8 | 29.3 | 1.4 | 7.6 |
| 4/27/2011 | 0840 | 23.0 | - | 10 | **134** | 32.7 | **61.0** | 29.9 | 3.4 | 7.7 |
| 4/27/2011 | 0844 | 24.0 | - | 10 | 15 | 33.5 | **65.7** | 30.9 | 1.2 | 7.7 |
| 5/4/2011 | 0858 | 21.0 | - | 10 | **89** | 34.7 | **34.7** | 26.2 | 1.4 | 8 |
| 5/4/2011 | 0901 | 22.0 | - | 10 | 16 | 34.3 | **34.3** | 26.4 | 0.97 | 8.1 |
| 5/4/2011 | 0905 | 23.0 | - | 10 | **101** | 35.2 | **35.2** | 26.5 | 1.7 | 8.1 |
| 5/4/2011 | 0912 | 24.0 | - | 10 | 15 | 35.6 | **35.6** | 26.9 | 1.1 | 8 |
| 5/11/2011 | 0853 | 21.0 | - | **85** | **73** | 34.9 | 86.9 | 29.4 | 2.5 | 7.9 |
| 5/11/2011 | 0855 | 22.0 | - | 10 | 10 | 34.8 | 90.6 | 28.9 | 4.5 | 8.1 |
| 5/11/2011 | 0900 | 23.0 | - | 10 | 21 | 34.8 | 88.6 | 28.8 | 2 | 8 |
| 5/11/2011 | 0910 | 24.0 | - | 10 | 10 | 34.8 | 90.4 | 29.8 | 2.5 | 8.1 |
| 5/18/2011 | 0844 | 21.0 | - | **75** | **56** | 34.6 | 76.1 | 29.7 | 3.9 | 8.1 |
| 5/18/2011 | 0850 | 22.0 | - | 10 | 10 | 33.2 | 84.7 | 29.7 | 1.5 | 8 |
| 5/18/2011 | 0857 | 23.0 | - | 20 | 14 | 34.7 | **40.9** | 29.7 | 1.2 | 7.9 |
| 5/18/2011 | 0904 | 24.0 | - | 10 | 10 | 35 | **47.9** | 31.2 | 2.2 | 7.9 |
| 5/25/2011 | 0811 | 21.0 | - | **177** | **47** | 32.8 | **66.2** | 29.8 | - | **5.7** |
| 5/25/2011 | 0816 | 22.0 | - | 20 | 11 | 13.2 | 102.5 | 28.2 | - | **2.5** |
| 5/25/2011 | 0819 | 23.0 | - | **981** | **29** | 31.3 | **64.3** | 29.7 | - | **2.2** |
| 5/25/2011 | 0825 | 24.0 | - | 10 | 10 | 33.2 | **55.1** | 31.7 | - | **4.5** |
| 6/1/2011 | 1036 | 21.0 | - | 20 | **47** | 33.6 | 89.1 | 31 | 7.5 | 7.8 |
| 6/1/2011 | 1041 | 22.0 | - | 10 | 11 | 33.8 | 91.1 | 29.8 | 4 | 7.9 |
| 6/1/2011 | 1045 | 23.0 | - | 30 | **36** | 33.6 | 86.8 | 29.7 | 2.5 | 7.8 |
| 6/1/2011 | 1052 | 24.0 | - | 10 | 10 | 33.8 | 89.4 | 29.6 | 1.5 | 8 |
| 6/8/2011 | 0915 | 21.0 | - | **52** | **65** | 35.3 | **72.3** | 30.3 | 17 | 8 |
| 6/8/2011 | 0920 | 22.0 | - | 10 | 11 | 31.1 | **74.5** | 30.5 | 1.4 | 7.8 |
| 6/8/2011 | 0926 | 23.0 | - | **110** | **58** | 33.8 | **50.7** | 30.7 | 2.5 | 7.9 |
| 6/8/2011 | 0935 | 24.0 | - | 10 | 10 | 33.9 | 79.8 | 30.4 | 1.9 | 8 |
| 6/13/2011 | 0859 | 21.0 | - | **63** | **61** | 32.8 | 76.1 | 30.4 | 3.9 | 8 |
| 6/13/2011 | 0906 | 22.0 | - | 30 | 14 | 33.6 | 90.8 | 30.3 | 2.8 | 8.1 |
| 6/13/2011 | 0913 | 23.0 | - | 10 | **58** | 34.1 | 86.9 | 30.2 | 2.1 | 8.1 |
| 6/13/2011 | 0921 | 24.0 | - | 20 | 11 | 34.3 | 92.9 | 30.3 | 1.3 | 8.1 |
| 6/22/2011 | 0909 | 21.0 | - | **74** | **61** | 33.8 | **70.7** | 29.8 | 4.3 | 8 |
| 6/22/2011 | 0914 | 22.0 | - | 84 | 22 | 33.1 | 76.3 | 30.2 | 2.7 | 7.9 |
| 6/22/2011 | 0921 | 23.0 | - | **187** | **90** | 34 | 94.8 | 30 | 1.6 | 8 |
| 6/22/2011 | 0929 | 24.0 | - | 10 | 11 | 34.3 | 87.9 | 30.2 | 0.94 | 8 |
| 6/29/2011 | 0828 | 21.0 | - | **122** | **57** | 33.4 | **63.2** | 29.9 | 5 | 7.9 |
| 6/29/2011 | 0834 | 22.0 | - | 10 | 19 | 25.4 | **61.4** | 29.9 | 4 | 7.6 |
| 6/29/2011 | 0839 | 23.0 | - | **52** | **50** | 31.1 | **35.5** | 30.3 | 2.6 | 7.6 |
| 6/29/2011 | 0946 | 24.0 | - | 52 | 16 | 33.5 | **51.4** | 31.8 | 6 | 7.7 |

[1] GM in not less than four samples over a 30-day period.

[2] Shall not exceed ambient by more than the stated value.

- = data not available

% = percent

‰ = per mil (parts per thousand)

°C = degrees Celsius

GM = geometric mean

CFU = colony forming units

ml = milliliter

NTU = nephelometric turbidity units

$PO_4$ = orthophosphate

**Bold** values exceed CNMI water quality standards.

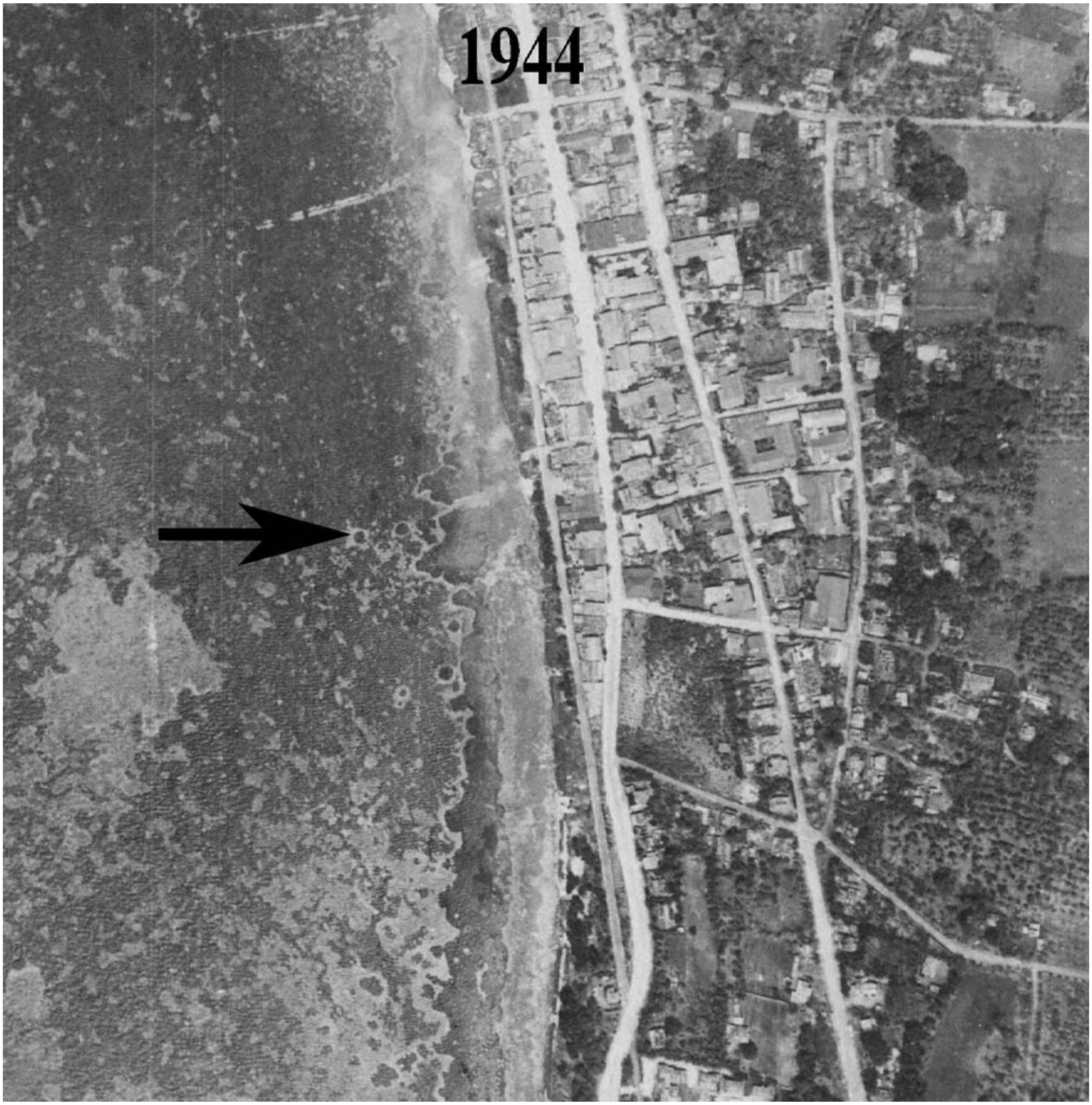
Grey-shaded values exceed 2.5, a non-regulatory assigned value for coastal waters to approximate ambient conditions in a healthy reef system.

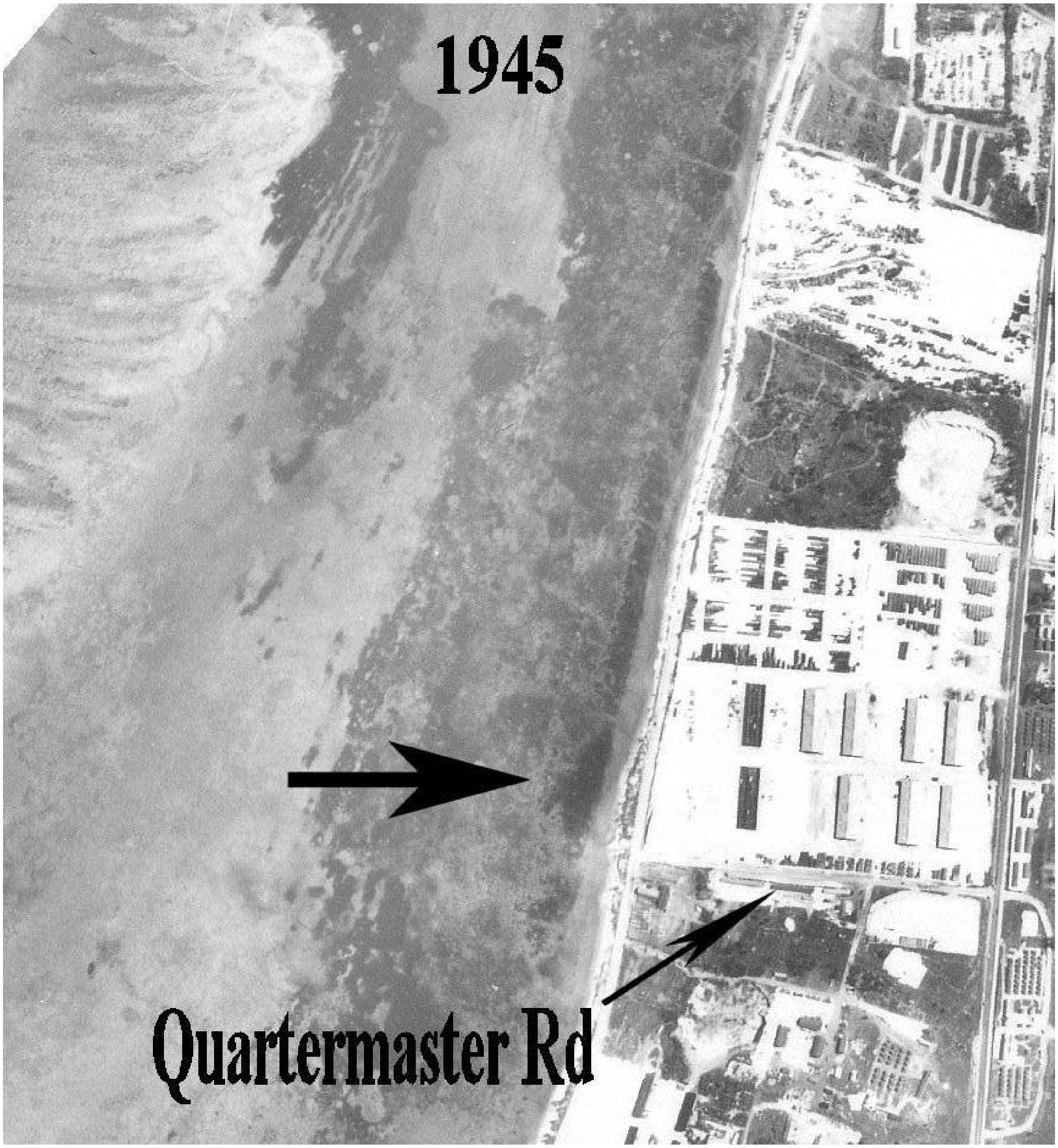
## Table C.24: Average Values of Lagoon Water Quality Results, Wet versus Dry Season, 2010-2011

| Location | Enterococci (CFU/100 ml) | Enterococci (CFU/100 ml) /GM | Salinity (‰) | Dissolved Oxygen (%) | Temperature (°C) | Turbidity (NTU) | pH |
|---|---|---|---|---|---|---|---|
| WB 21 Wet | 989.5 | 191.5 | 33.3 | 83.4 | 29.7 | 5.21 | 7.99 |
| WB 21 Dry | 144.0 | 82.2 | 33.3 | 80.1 | 28.5 | 4.80 | 7.88 |
| WB 22 Wet | 50.3 | 29.4 | 33.5 | 87.7 | 30.0 | 2.34 | 8.00 |
| WB 22 Dry | 58.5 | 32.0 | 32.0 | 86.6 | 28.6 | 2.52 | 7.79 |
| WB 23 Wet | 188.3 | 59.1 | 32.1 | 88.9 | 29.8 | 2.95 | 8.02 |
| WB 23 Dry | 955.0 | 87.7 | 33.5 | 78.2 | 28.7 | 2.51 | 7.78 |
| WB 24 Wet | 15.9 | 13.8 | 33.3 | 82.2 | 30.6 | 2.06 | 7.97 |
| WB 24 Dry | 47.2 | 17.4 | 33.8 | 76.3 | 29.1 | 1.90 | 7.86 |

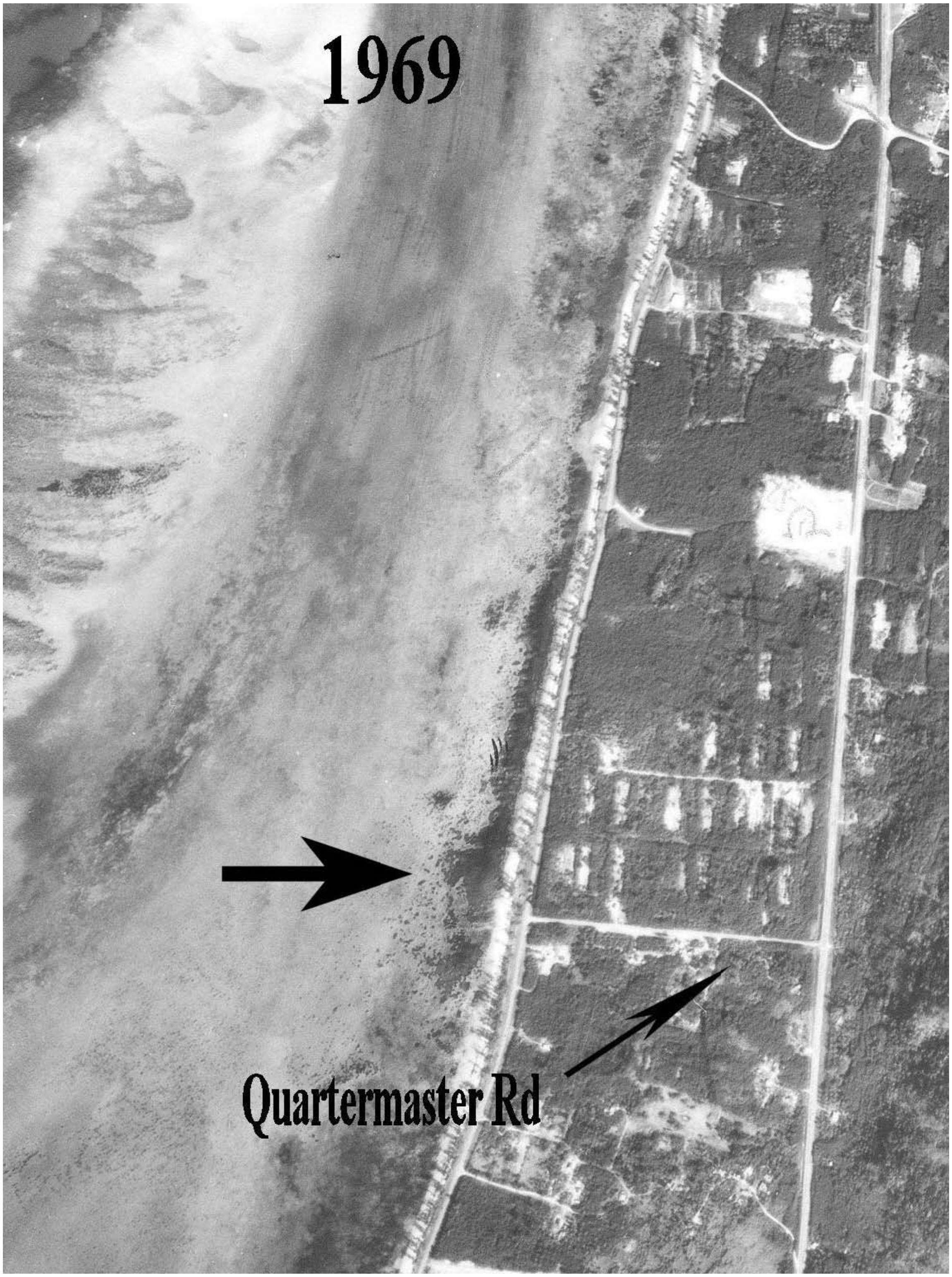
% = percent
‰ = per mil (part per thousand)
°C = degrees Celsius
CFU = colony forming units
GM = geometric mean
ml = milliliter
NTU = nephelometric turbidity units
$PO_4$ = orthophosphate

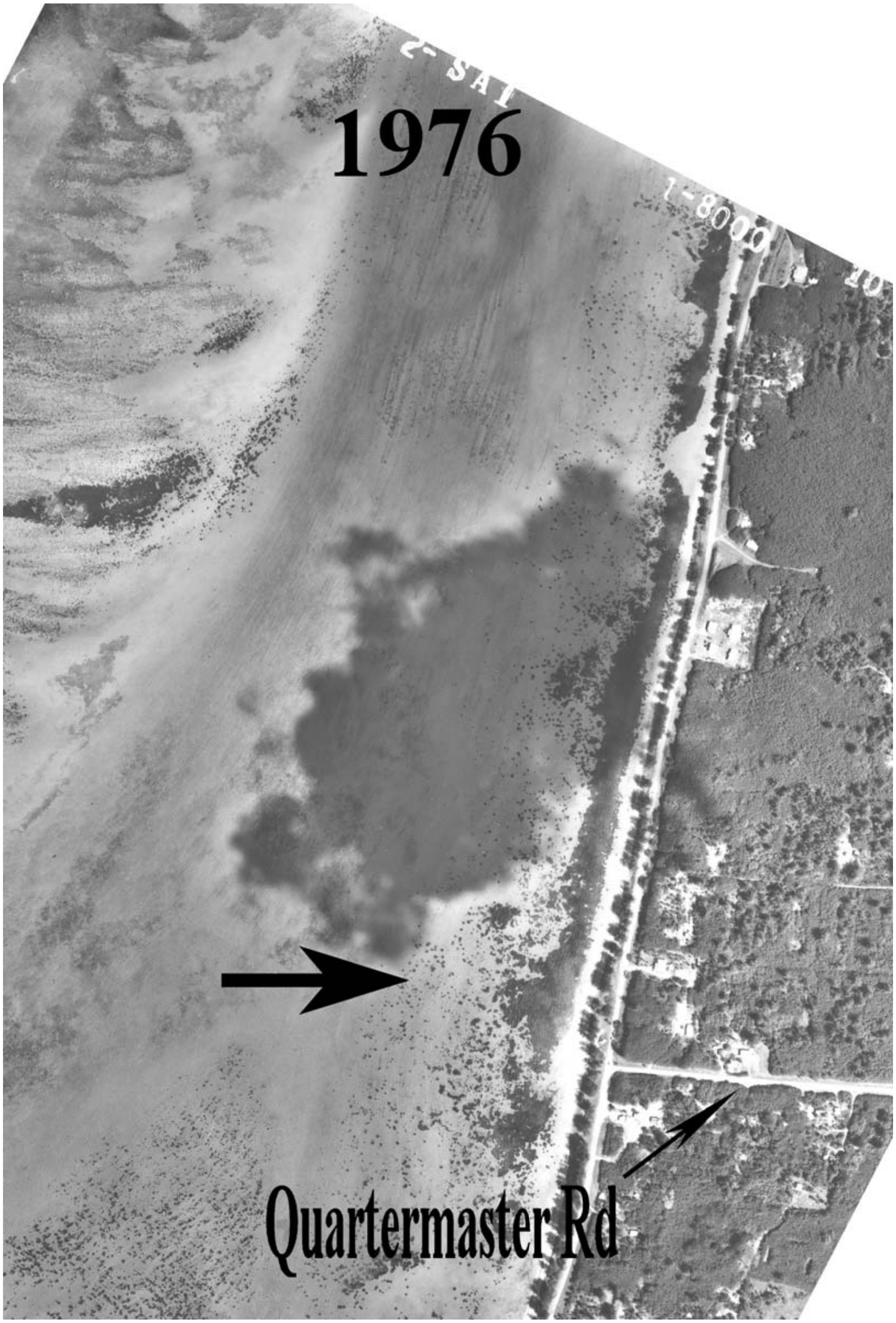
# *Appendix D*
# *Historical Aerial Photographs*

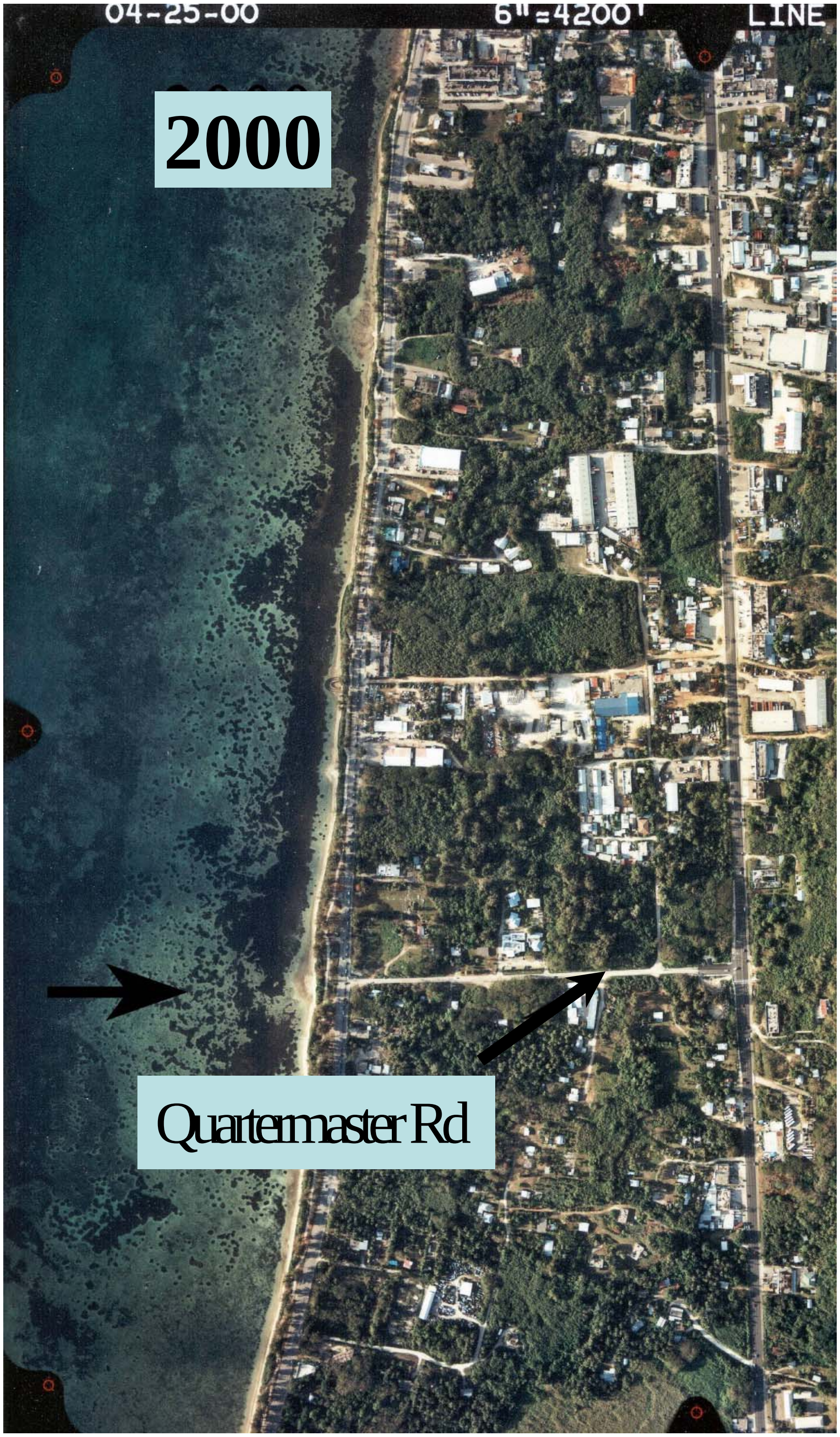

1944


1945
Quartermaster Rd


1956
Quartermaster Rd


1969
Quartermaster Rd


1976
Quartermaster Rd


04-25-00
6" =4200'
LINE
2000
Quartermaster Rd


May 24, 2009
2009
Quartermaster Rd
Image © 2011 GeoEye
©2009 Google

# *Appendix E*
# *Study Area Photographs*

# Appendix E:  Study Area Photographs

Sediment plume at runoff discharge point.

Stormwater runoff during Typhoon Tingting.

Unpaved roads in West Takpochao watershed.

Nuisance algae growth near Dai Ichi Canal.

Land-clearing activities within the West Takpochao watershed.

Agricultural land use in close proximity to the coast.

Stormwater runoff during the May 8, 2002 rain event, Drain 6.

Sediment plume adjacent to Drain 6 during May 8, 2002 rain event.

Sediment delta October 2001.

Nearshore seagrass beds.

Stormwater runoff outfall point.

Surface flooding during a rainfall event.

Surface flooding and runoff during a rain event.

Nuisance algae growth along shoreline.

Overview of the Cock Fight Arena site facing northeast.

Existing cock fight arena.

Cock Fight Arena site behind the existing arena.

Overview of China House site from golf course located on Middle Road.

View of Quartermaster site to the right.

Overview of Quartermaster site.

# *Appendix F*
# *Preliminary Drainage Design Report*

# PRELIMINARY DRAINAGE DESIGN
# FOR
# AQUATIC ECOSYSTEM RESTORATION STUDY
# SAIPAN LAGOON
# SAIPAN, NOTHERN MARIANA ISLANDS

Prepared for:
U.S Army Corps of Engineers
Honolulu District
&
Environet Inc.

Prepared by:
Community Planning & Engineering, Inc.
1100 Alakea, Sixth Floor
Honolulu, HI 96813

January 2012

# Table of Contents

# List of Figures

# *Appendix A*

# Section 1 Hydrology

Three low-lying areas in the West Takapochao watershed were selected for evaluation as possible drainage detention basins. These sites include vacant land adjacent to Quartermaster Road, the China House, and the Cockfight Arena; see Figure 1. These three areas currently flood during heavy rains.

During heavy rains the initial rainfall will produce the most sediment, nutrients and pollutants, known as the “first flush.” In order to represent this “first flush” a one-hour intensity storm over a one hour duration has been applied to the analyses. Three storm events were evaluated in this report; 2-year, 5-year, and 10-year recurrence storms. Storm event data were utilized from the “Rainfall – Frequency Study, Saipan Commonwealth of Northern Marianas Islands, Contract No. DACA83-01-D-0014”, prepared by Environet, Incorporated, dated April 2003.

Table 1: Saipan International Airport Rainfall Data – 60 minute Duration Storm Events

| Return Frequency | Cumulative Rainfall (inches) | Rainfall Intensity (inches/ hour)[1] |
|---|---|---|
| $X_{10}$ | 3.06 | 3.06 |
| $X_5$ | 2.61 | 2.61 |
| $X_2$ | 1.93 | 1.93 |

1 From Table 4-6 and Table 4-7 in the “Rainfall – Frequency Study”

The watershed analysis for each storm and site was performed using the computer software program Hydrologic Modeling System HEC-HMS, version 3.5 and can be found in Appendix A. The Soil Conservation Service (now the Natural Resource Conservation Service) curve number was applied to the analyses along with the SCS unit hydrograph to symbolize the direct runoff over the watersheds. The lag time for the unit hydrograph was assumed to equal the time of concentration. No baseflow is assumed in the analyses. The simulations were ran over a 24-hour time period.

# Section 2 Hydraulics

HEC-HMS version 3.5 was also used to perform the analysis on the proposed detention basins. Elevation-area functions were used to specify the storage relationships. The outlet structure routing method was used to perform the reservoir routing. The simulations were routed through reinforced concrete outlet pipes (RCP) that were sized according to the analysis and existing site conditions. The RCP outlet pipes are to be wrapped in filter cloth and gravel, and are to be located 1’-2’ above the bottom of the detention basin. This will allow sediment to settle out in the basin and will require periodic removal of sediment from the basins. The simulations were ran over a 24-hour time period.

Each watershed was analyzed separately for the three storm events. A preliminary design of the required improvements was completed for each event and each site. The preliminary designs are further explained in detail in the following sections. Each design is based upon 100% of the design storm runoff passing through the detention basin. The analysis assumes that the topographic conditions and existing drainage facilities adequately convey storm flows to the proposed detention basins. Detailed as-built information and condition surveys about existing storm drain systems were not available; nor were detailed surveys of the proposed sites. This information will be necessary for implementation of the final design of the proposed detention basins. For the purposes of preliminary design and comparison, assumptions were made regarding the sites and existing drain systems. These assumptions are identified in the following sections and/or on the figures. It should also be noted that the Quartermaster Site and the Cock Fight Arena are currently on private property. This report does not address acquiring such properties and that it is assumed that all lands used for the proposed detention basins can or will be acquired by the CNMI Government.

# *Section 3 Quartermaster Site*

## *3.1 Existing Conditions*

The Quartermaster Site is located at the northwest corner of the intersection of Quartermaster Road and Middle Road. The site is currently vacant and overgrown with vegetation. The site generally slopes to the southwest corner at approximately 4-5%.

The watershed which is tributary to the site is approximately 109 acres. The wtershed is mostly undeveloped, mountainous terrain. The bottom of the watershed, adjacent to Middle Road is more moderately sloped and developed with residential and commercial buildings, roads, and associated improvements. The watershed has an average slope of approximately 23%.

The storm runoff concentrates along the east side of Middle Road at a low point on the northern side of the Quartermaster Road intersection. There is an existing catch basin at this location which will continue to be utilized.

Condition of existing drainage facilities is unknown and may require repair or replacement. Existing facilities were assumed as shown on figures 2.1, 2.2 and 2.3.

## *3.2 2-Year Storm Event*

The 2-year storm event will produce a peak runoff of approximately 20.8 cfs. The runoff will be routed through a proposed detention basin providing approximately 1.52 ac-ft of storage from elevations 23 feet - 32 feet. Discharge from the detention basin will enter an existing swale via an 18 inch RCP outlet and flow along the north side of Quartermaster Road running westward toward Beach Road and the Lagoon. Figure 2.1 depicts the required improvements to the Quartermaster site to detain the 2-year storm event. With the proposed improvements, the detention basin will pond approximately to elevation 26.8 feet, and the peak discharge from the detention basin will be approximately 7.7 cfs.

## *3.3 5-Year Storm Event*

The 5-year storm event will produce a peak runoff of approximately 75.0 cfs. The runoff will be routed through a proposed detention basin providing approximately 4.89 ac-ft of storage from elevations 23 feet – 32 feet. Discharge from the detention basin will enter an existing swale via an 18 inch RCP outlet and flow along the north side of Quartermaster Road running westward toward Beach Road and the Lagoon. Figure 2.2 depicts the required improvements to the Quartermaster site to detain the 5-year storm event. With the proposed improvements, the detention basin will pond approximately to elevation 27.9 feet, and the peak discharge from the detention basin will be approximately 12.4 cfs.

## *3.4 10-Year Storm Event*

The 10-year storm event will produce a peak runoff of approximately 118.5 cfs. The runoff will be routed through a proposed detention basin providing approximately 6.92 ac-ft of storage from elevations 23 feet – 32 feet. Discharge from the detention basin will enter an existing swale via an 18 inch RCP outlet and flow along the north side of Quartermaster Road running westward toward Beach Road and the Lagoon. Figure 2.3 depicts the required improvements to the Quartermaster site to detain the 10-year storm event. With the proposed improvements, the detention basin will pond approximately to elevation 28.9 feet, and the peak discharge from the detention basin will be approximately 14.5 cfs.

# *Section 4 China House Site*

## *4.1 Existing Conditions*

The China House Site is located near the China House Restaurant and the driving range, about halfway between Middle Road and Beach Road. The site is currently undeveloped and overgrown with vegetation. However there are abandoned structures on the property which will need to be demolished. The site generally slopes to the west at approximately 3.5%.

The watershed which is tributary to the site is approximately 344 acres. The watershed is mixed between undeveloped, mountainous terrain and areas developed with residential and commercial buildings, roads, and associated improvements. The watershed has an average slope of approximately 16%.

The storm runoff concentrates along the east side of Middle Road at a low point in the road. There is an existing catch basin at this location which will continue to be utilized. Each storm event requires improvements starting at this existing catch basin, which are further detailed in the following sections.

Condition of existing drainage facilities is unknown and may require repair or replacement. Existing facilities were assumed as shown on figures 3.1, 3.2 and 3.3.

## *4.2 2-Year Storm Event*

The 2-year storm event will produce a peak runoff of approximately 51.9 cfs. The runoff will be routed through a proposed detention basin providing approximately 4.77 ac-ft of storage from elevations 20 feet – 29 feet. An 18 inch RCP outlet will discharge from the detention basin to an existing double 30 inch culvert under Beach Road, discharging to the Lagoon. Figure 3.1 depicts the required improvements to the China House site to detain the 2-year storm event. With the proposed improvements, the detention basin will pond approximately to elevation 24.4 feet, and the peak discharge from the detention basin will be approximately 15.0 cfs.

## *4.3 5-Year Storm Event*

The 5-year storm event will produce a peak runoff of approximately 178.6 cfs. The runoff will be routed through a proposed detention basin providing approximately 13.54 ac-ft of storage from elevations 19 feet – 29 feet. An 18 inch outlet pipe will discharge from the detention basin to an existing double 30 inch culvert under Beach Road, discharging to the Lagoon. Figure 3.2 depicts the required improvements to the China House site to detain the 5-year storm event. With the proposed improvements, the detention basin will pond approximately to elevation 26.8 feet, and the peak discharge from the detention basin will be approximately 15.6 cfs.

## *4.4 10-Year Storm Event*

The 10-year storm event will produce a peak runoff of approximately 284.0 cfs. The runoff will be routed through a proposed detention basin providing approximately 15.84 ac-ft of storage from elevations 18 feet – 30 feet. A 36 inch outlet pipe will discharge from the detention basin to an existing double 30 inch culvert under Beach Road, then discharging to the Lagoon. Figure 3.3 depicts the required improvements to the China House site to detain the 10-year storm event. With the proposed improvements, the detention basin will pond approximately to elevation 27.9 feet, and the peak discharge from the detention basin will be approximately 91.1 cfs.

# *Section 5 Cock Fight Arena Site*

## *5.1 Existing Conditions*

The Cock Fight Arena Site is located on the east side of Middle Road, surrounding the existing Cock Fight Arena. The site is currently developed as a Cock Fight Arena, and portions were utilized as a quarry. The site generally slopes to the quarry pit.

The watershed which is tributary to the site is approximately 413 acres. The watershed is mainly undeveloped, mountainous terrain with some minor areas developed with residential and commercial buildings, roads, and associated improvements. The watershed has an average slope of approximately 12%.

Condition of existing drainage facilities is unknown and may require repair or replacement. Existing facilities were assumed as shown on figures 4.1, 4.2 and 4.3.

## *5.2 2-Year Storm Event.*

The 2-year storm event will produce a peak runoff of approximately 20.9 cfs. The runoff will be routed through a proposed detention basin providing approximately 11.85 ac-ft of storage from elevations 37 feet – 45 feet. An 18 inch outlet pipe will discharge from the detention basin to the Lagoon following existing paved roadways. Figure 4.1 depicts the required improvements to the Cock Fight Arena site to retain the 2-year storm event. The pit is currently sufficiently sized to accommodate the 2-year storm event; however, inlet improvements are required and outlet improvements are recommended. With the proposed improvements, the detention basin will pond approximately to elevation 40.3 feet, and the peak discharge from the detention basin will be approximately 4.4 cfs.

Based upon the minimal topographic information provided, it appears that the Cock Fight Arena's finish floor is approximately 43 feet in elevation. Additional investigation of the Arena and the pit should be performed to verify that ponding will not flood the Arena.

## *5.3 5-Year Storm Event*

The 5-year storm event will produce a peak runoff of approximately 95.9 cfs. The runoff will be routed through a proposed detention basin providing approximately 11.85 ac-ft of storage from elevations 37 feet – 45 feet. An 18 inch outlet pipe will discharge from the detention basin to the Lagoon following existing paved roadways. Figure 4.2 depicts the required improvements to the Cock Fight Arena site to detain the 5-year storm event. The pit is currently sufficiently sized to accommodate the 5-year storm event; however, inlet and outlet improvements are required. With the proposed improvements, the detention basin will pond approximately to elevation 43.4 feet, and the peak discharge from the detention basin will be approximately 14.0 cfs.

Based upon the minimal topographic information provided, it appears that the Cock Fight Arena's finish floor is approximately 43 feet in elevation. Additional investigation of the Arena and the pit should be performed to verify that ponding will not flood the Arena. If flooding will occur, modifications can be made to the pit, or outlet structures. Alternatively, the Arena may be demolished.

## *5.4 10-Year Storm Event.*

The 10-year storm event will produce a peak runoff of approximately 164.7 cfs. The runoff will be routed through a proposed detention basin providing approximately 14.23 ac-ft of storage from elevations 37 feet – 45 feet. A 24 inch outlet pipe will discharge from the detention basin to the Lagoon following existing paved roadways. Figure 4.3 depicts the required improvements to the Cock Fight Arena site to detain the 10-year storm event. Improvements to the pit will include some grading at the base of the existing pit, the walls of the pit and limits of the pit will not require expansion. In addition, inlet and outlet improvements are required. With the proposed improvements, the detention basin will pond approximately to elevation 44.6 feet, and the peak discharge from the detention basin will be approximately 30.3 cfs.

Based upon the minimal topographic information provided, it appears that the Cock Fight Arena's finish floor is approximately 43 feet in elevation. Additional investigation of the Arena and the pit should be performed to verify whether ponding will flood the Arena. It appears likely that the Arena will need to be demolished, or additional modifications will need to be made to the pit, or outlet structures.

# *Section 6 Conclusion*

For each of the alternatives the detention basins were designed to provide adequate storage, detention times and outlet design to reduce outflow and improve water quality.

In addition to the detention basins, each site will include a perimeter fence and a paved access driveway to the bottom of each basin for safety and maintenance.

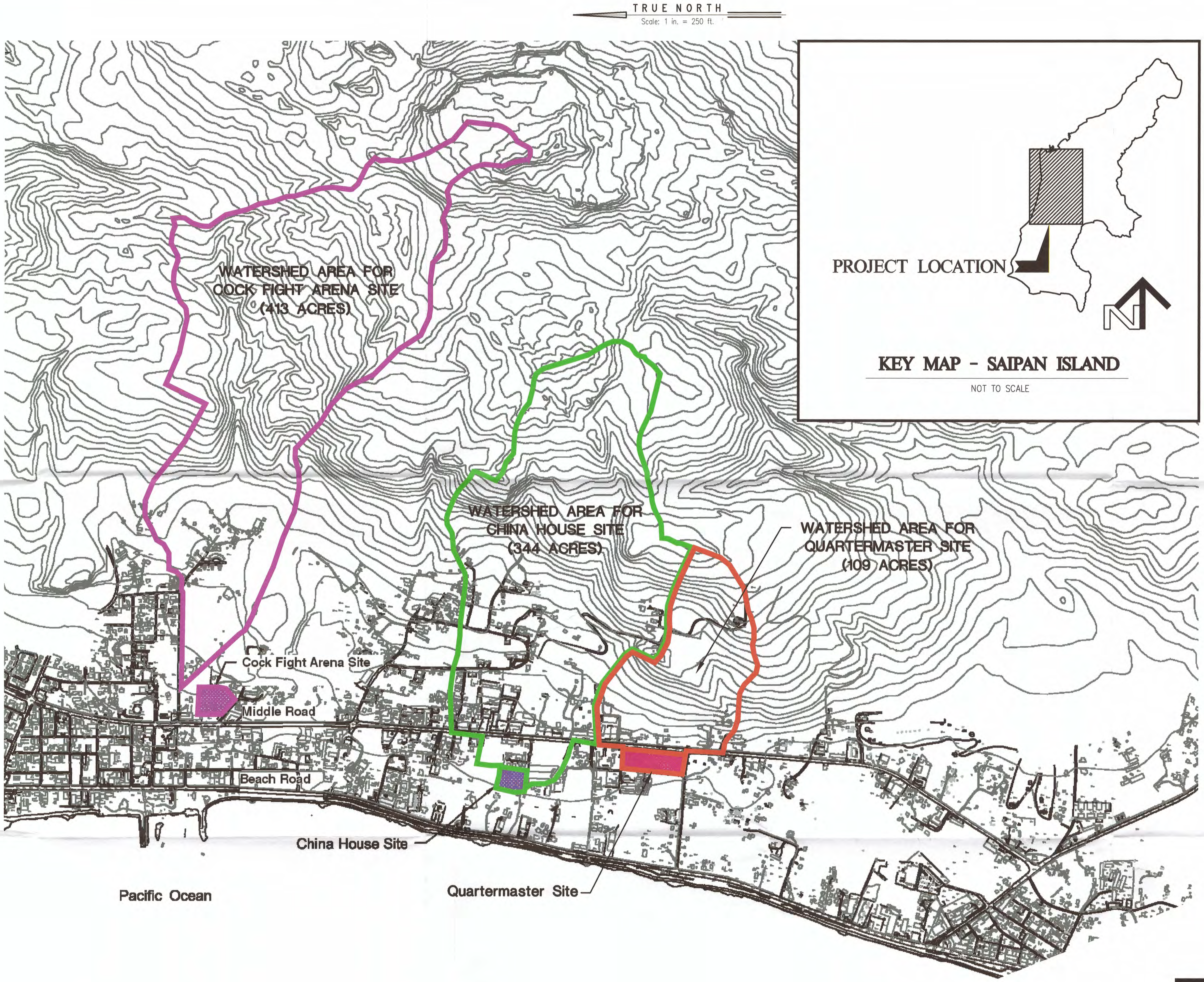
Additional topographic information will be required to finalize actual designs for any selected sites. Condition assessments of existing drainage facilities should also be performed.

The analysis provided herein along with the preliminary designs proposed, provide the U.S. Army Corps of Engineers (USACOE) with information to prepare cost-benefit analysis of the proposed sites and each of the storm event situations.

# Section 7 References

EI, 2003. Rainfall-Frequency Study, Saipan, Commonwealth of Northern Marianas Islands. Report prepared for U.S. Army Corps of Engineers, dated April 2003.

# Figures



KEY MAP - SAIPAN ISLAND

NOT TO SCALE

## OVERALL PLAN

SCALE: 1" = 250'

250 125 0 250 500

SCALE: 1" = 250'

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## PRELIMINARY DRAINAGE DESIGN FOR AQUATIC ECOSYSTEM RESTORATION STUDY, SAIPAN LAGOON

SAIPAN, NORTHERN MARIANA ISLANDS

FIGURE 1 - OVERALL PLAN AND KEY MAP

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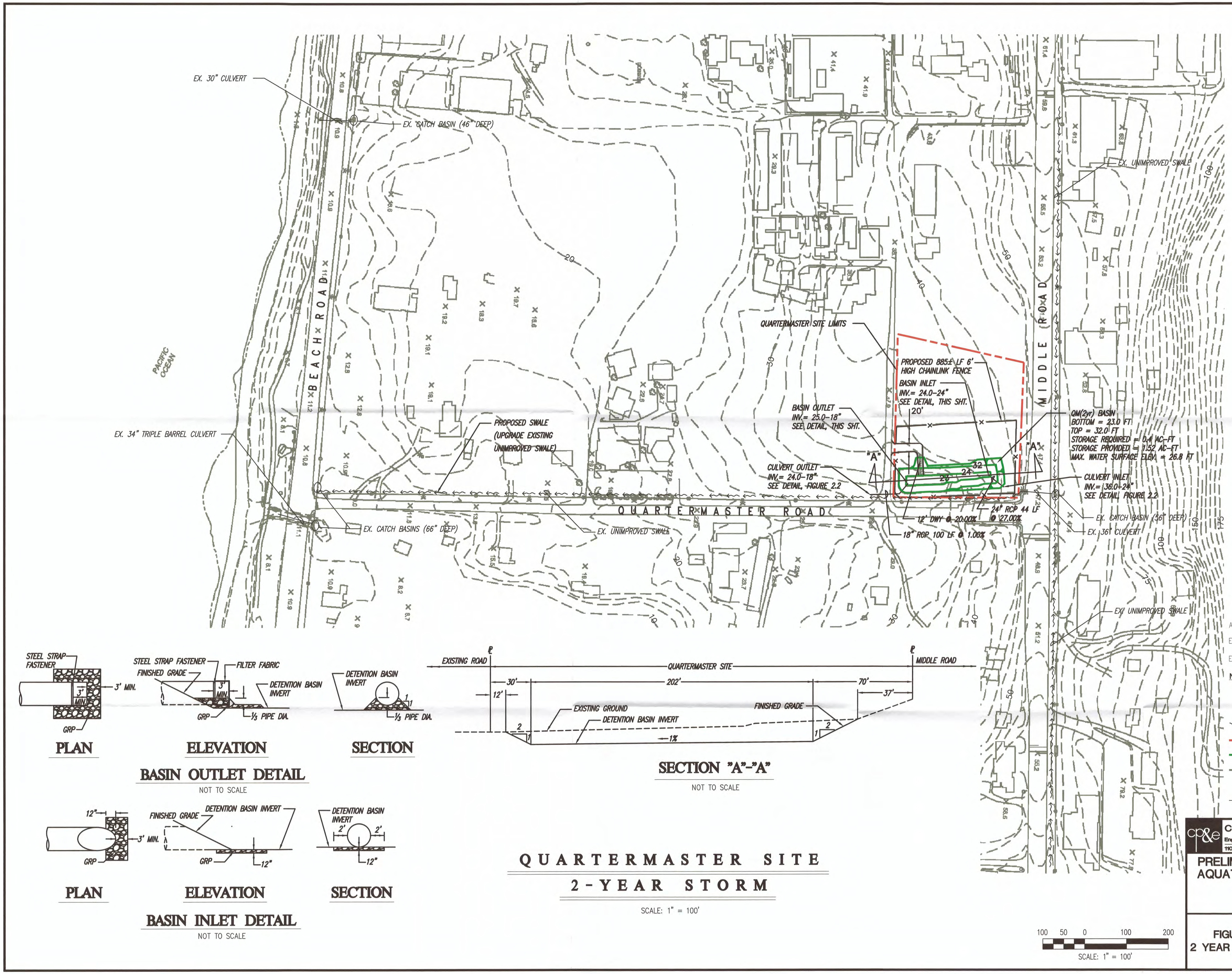

BASIN OUTLET DETAIL

NOT TO SCALE

SECTION "A"-"A"

NOT TO SCALE

BASIN INLET DETAIL

NOT TO SCALE

## QUARTERMASTER SITE
## 2-YEAR STORM

SCALE: 1" = 100'

TRUE NORTH
Scale: 1 in. = 100 ft.

**EARTHWORK QUANTITIES**
**(FOR ESTIMATION PURPOSES ONLY)**

| | |
|---|---|
| AREA TO BE MASS GRADED | 0.38 ACS |
| EXCAVATION | 3,157 C.Y |
| EMBANKMENT | 0 C.Y |

**NOTE:** QUANTITIES ARE BASED ON TOPOGRAPHY PROVIDED

**LEGEND**

| | |
|---|---|
| ⤳ ⤳ ⤳ | EXISTING UNIMPROVED SWALE |
| — - — | SITE LIMITS |
| —23— | FINISHED CONTOUR |
| —60— | EXISTING CONTOUR |
| ℓ | PROPERTY LINE |
| —x—x— | CHAINLINK FENCE |

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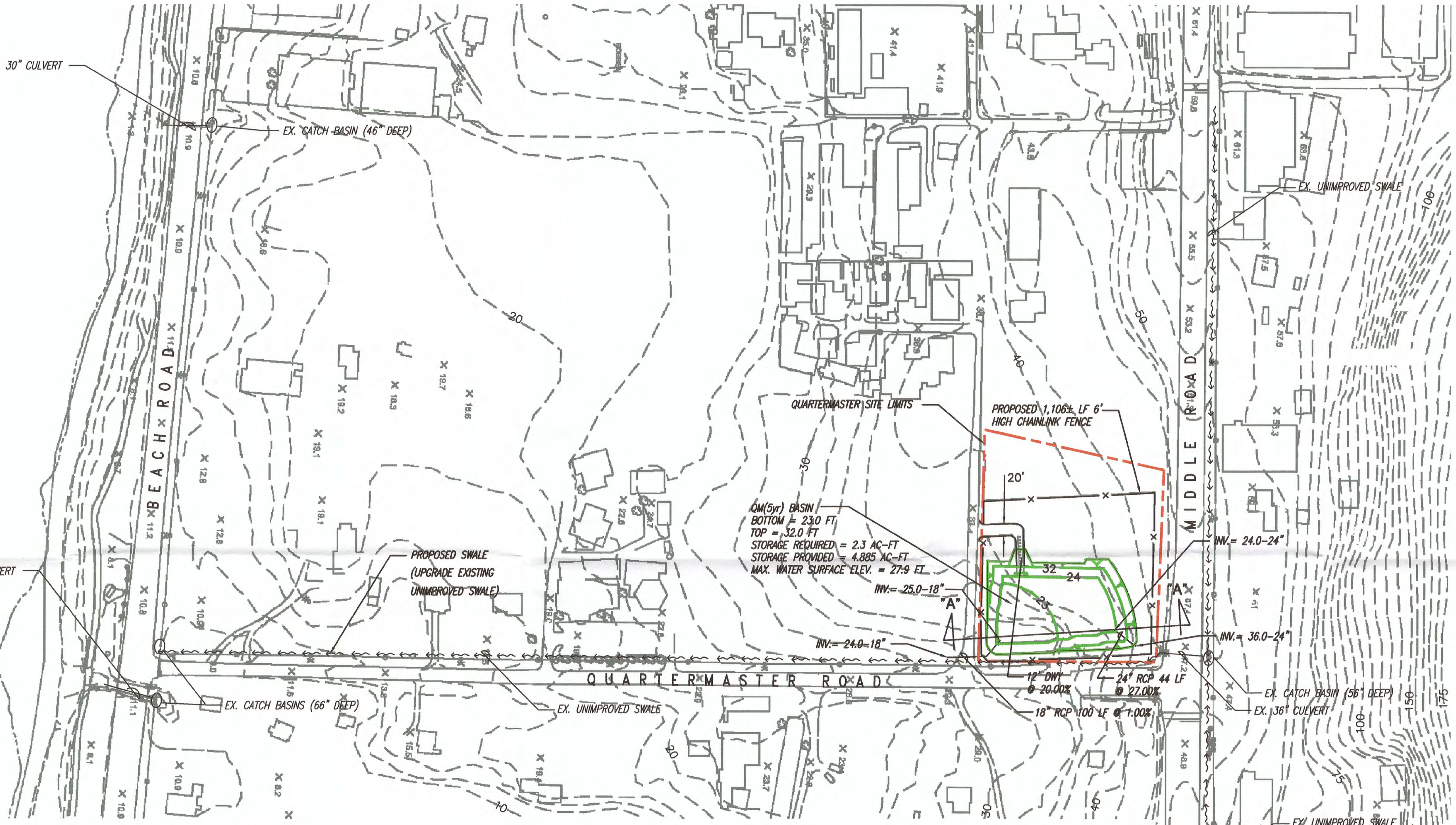
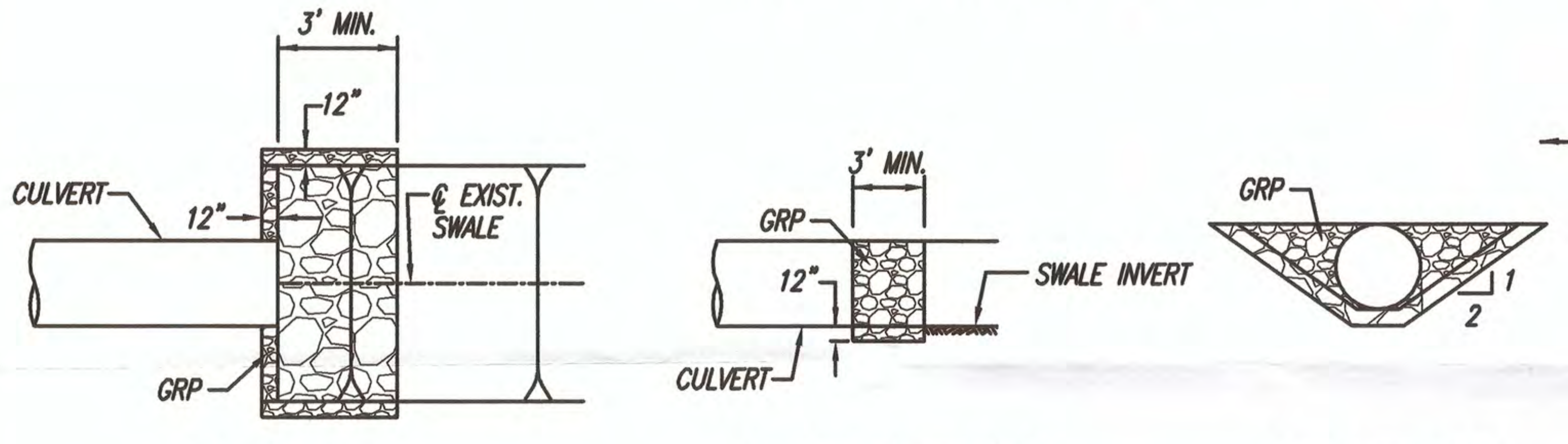
## PRELIMINARY DRAINAGE DESIGN FOR AQUATIC ECOSYSTEM RESTORATION STUDY, SAIPAN LAGOON

SAIPAN, NORTHERN MARIANA ISLANDS

FIGURE 2.1 - QUARTERMASTER SITE
2 YEAR STORM EVENT PRELIMINARY DESIGN

TRUE NORTH
Scale: 1 in. = 100 ft.

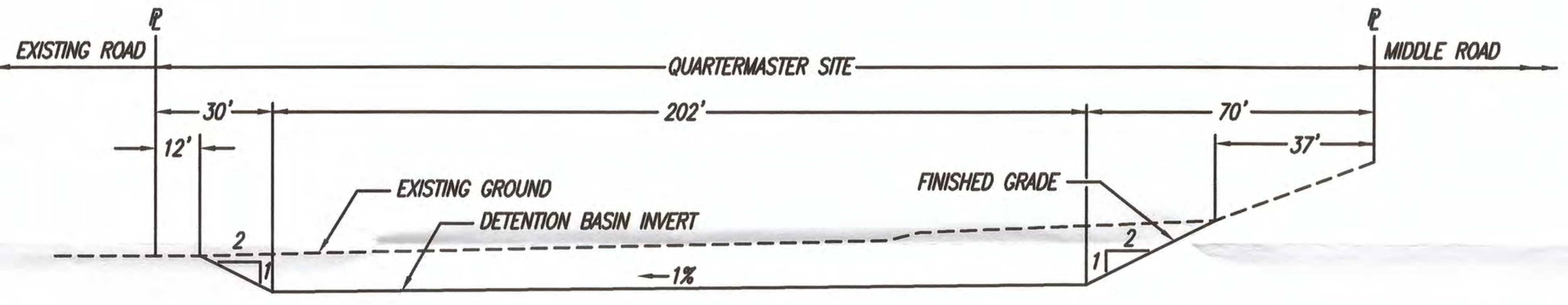




PLAN ELEVATION SECTION

## CULVERT INLET/OUTLET DETAIL

NOT TO SCALE



## SECTION "A"-"A"

NOT TO SCALE

## QUARTERMASTER SITE

## 5-YEAR STORM

SCALE: 1" = 100'

### EARTHWORK QUANTITIES
(FOR ESTIMATION PURPOSES ONLY)

| | |
|---|---|
| AREA TO BE MASS GRADED | 0.83 ACS |
| EXCAVATION | 11,452 C.Y |
| EMBANKMENT | 0 C.Y |

**NOTE:** *QUANTITIES ARE BASED ON TOPOGRAPHY PROVIDED*

### LEGEND

| | |
|---|---|
| ⤳ ⤳ ⤳ ⤳ | EXISTING UNIMPROVED SWALE |
| — - — - — | SITE LIMITS |
| ——23—— | FINISHED CONTOUR |
| — —50— — | EXISTING CONTOUR |
| ℄ | PROPERTY LINE |
| —×——×——×— | FENCE |

100 50 0 100 200
SCALE: 1" = 100'

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## PRELIMINARY DRAINAGE DESIGN FOR AQUATIC ECOSYSTEM RESTORATION STUDY, SAIPAN LAGOON

SAIPAN, NORTHERN MARIANA ISLANDS

FIGURE 2.2 - QUARTERMASTER SITE
5 YEAR STORM EVENT PRELIMINARY DESIGN

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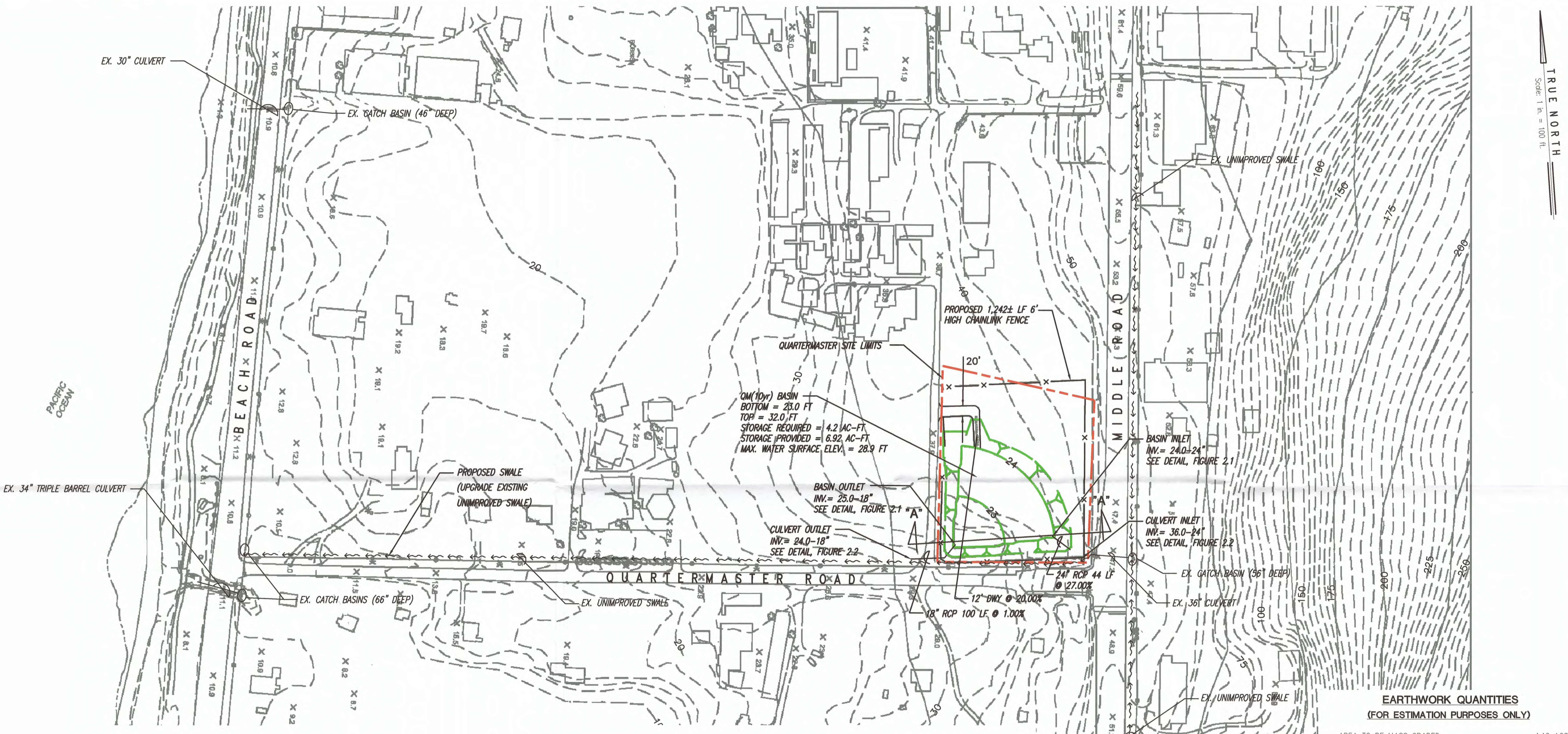

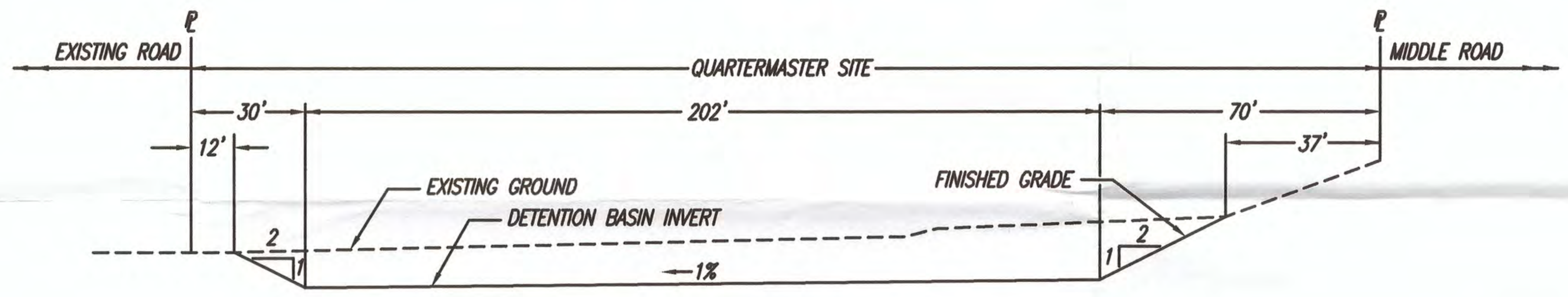

## SECTION "A"-"A"

NOT TO SCALE

## QUARTERMASTER SITE

## 10-YEAR STORM

SCALE: 1" = 100'

### EARTHWORK QUANTITIES

**(FOR ESTIMATION PURPOSES ONLY)**

| | |
|---|---|
| AREA TO BE MASS GRADED | 1.16 ACS |
| EXCAVATION | 18,732 C.Y |
| EMBANKMENT | 0 C.Y |

**NOTE:** *QUANTITIES ARE BASED ON TOPOGRAPHY PROVIDED*

### LEGEND

| | |
|---|---|
| ⤳ ⤳ ⤳ ⤳ | *EXISTING UNIMPROVED SWALE* |
| — — — — | *SITE LIMITS* |
| ——23—— | *FINISHED CONTOUR* |
| — —50— — | *EXISTING CONTOUR* |
| ℄ | *PROPERTY LINE* |
| —×——×——×— | *FENCE* |

100 50 0 100 200

SCALE: 1" = 100'

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## PRELIMINARY DRAINAGE DESIGN FOR AQUATIC ECOSYSTEM RESTORATION STUDY, SAIPAN LAGOON

SAIPAN, NORTHERN MARIANA ISLANDS

## FIGURE 2.3 - QUARTERMASTER SITE 10 YEAR STORM EVENT PRELIMINARY DESIGN

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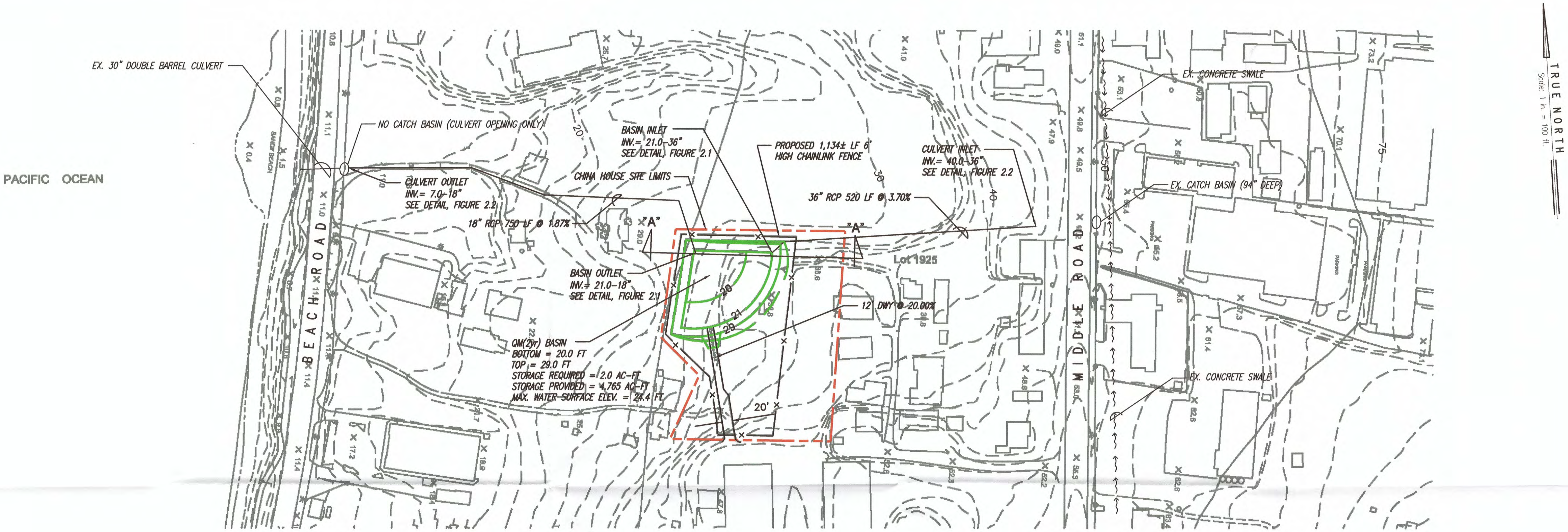
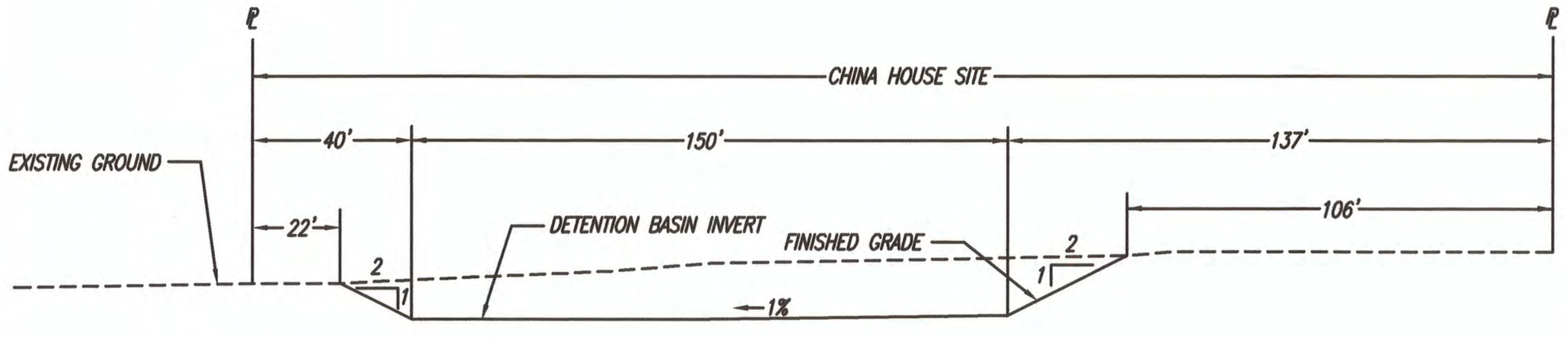




## SECTION "A"-"A"

NOT TO SCALE

**EARTHWORK QUANTITIES**
**(FOR ESTIMATION PURPOSES ONLY)**

| | |
|---|---|
| AREA TO BE MASS GRADED | 0.79 ACS |
| EXCAVATION | 7,939 C.Y |
| EMBANKMENT | 0 C.Y |

**NOTE:** *QUANTITIES ARE BASED ON TOPOGRAPHY PROVIDED*

**NOTE**

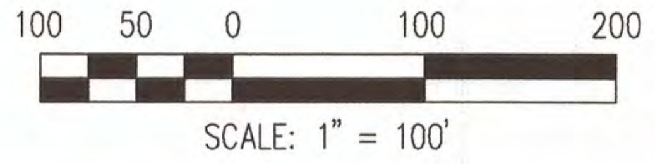
*DRAIN LENGTH MAY BE SHORTENED IF DITCH ON ADJACENT PROPERTY IS NEAR SITE.*

**LEGEND**

| | |
|---|---|
| ⤳ ⤳ ⤳ ⤳ | *EXISTING UNIMPROVED SWALE* |
| — — — | *SITE LIMITS* |
| —23— | *FINISHED CONTOUR* |
| — —50— — | *EXISTING CONTOUR* |
| ℄ | *PROPERTY LINE* |
| —×—×—×— | *FENCE* |

# CHINA HOUSE SITE
## 2-YEAR STORM

SCALE: 1" = 100'



SCALE: 1" = 100'

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**PRELIMINARY DRAINAGE DESIGN FOR AQUATIC ECOSYSTEM RESTORATION STUDY, SAIPAN LAGOON**
SAIPAN, NORTHERN MARIANA ISLANDS

**FIGURE 3.1 - CHINA HOUSE SITE**
**2 YEAR STORM EVENT PRELIMINARY DESIGN**

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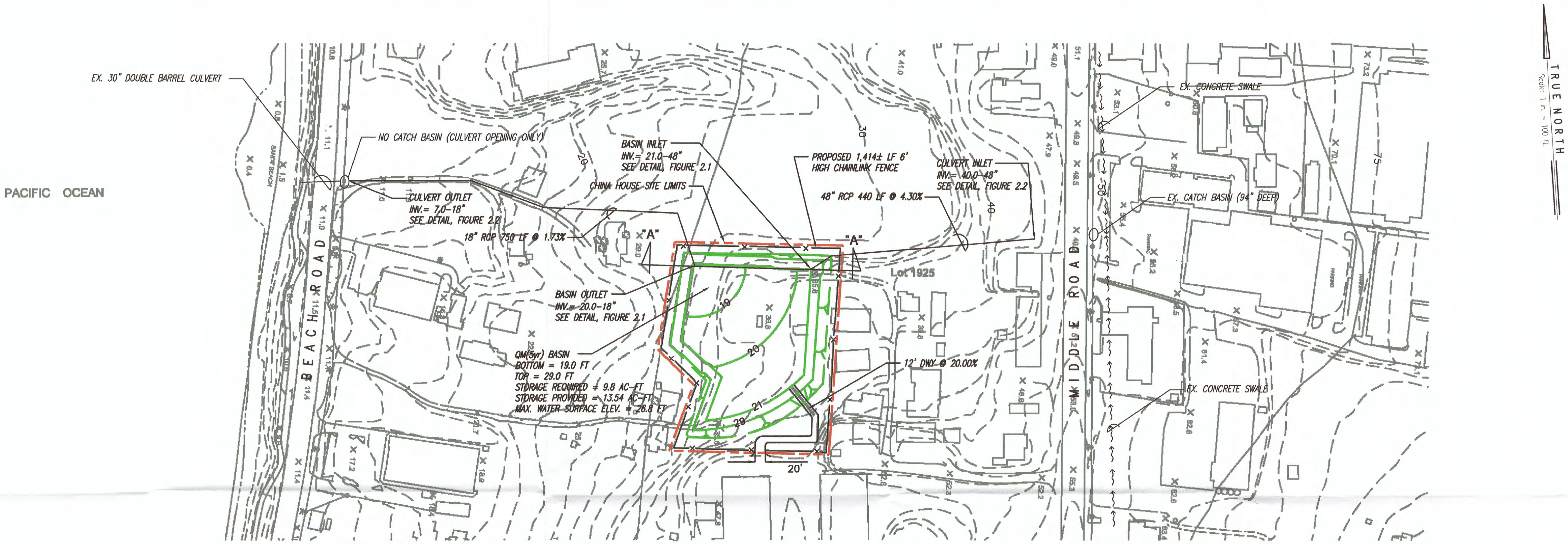

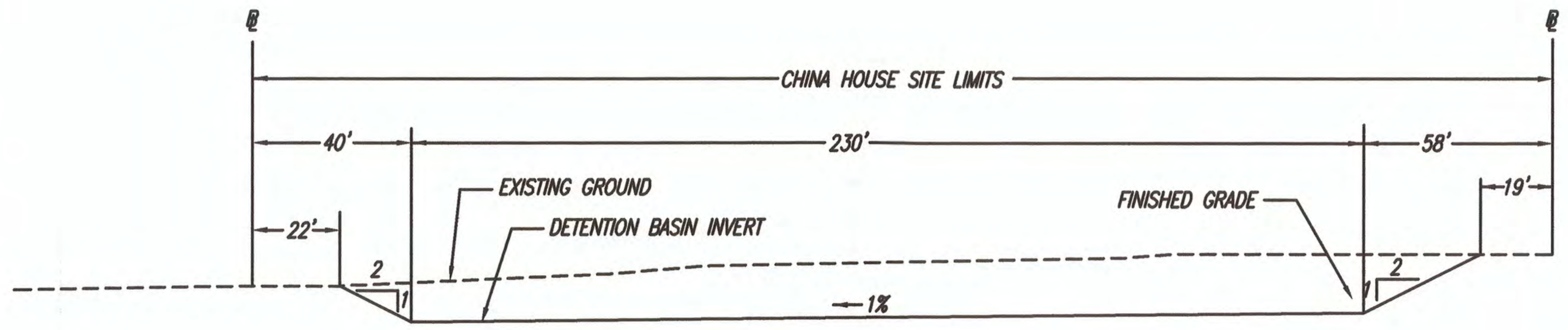

## SECTION "A"-"A"

NOT TO SCALE

**EARTHWORK QUANTITIES**
**(FOR ESTIMATION PURPOSES ONLY)**

AREA TO BE MASS GRADED ______ 2.06 ACS
EXCAVATION ______ 29,129 C.Y
EMBANKMENT ______ 0 C.Y

**NOTE:** *QUANTITIES ARE BASED ON TOPOGRAPHY PROVIDED*

**NOTE**

*DRAIN LENGTH MAY BE SHORTENED IF DITCH ON ADJACENT PROPERTY IS NEAR SITE.*

**LEGEND**

| | |
|---|---|
| ⟿ ⟿ ⟿ ⟿ | EXISTING UNIMPROVED SWALE |
| — — - — — | SITE LIMITS |
| ——23—— | FINISHED CONTOUR |
| — —50— — | EXISTING CONTOUR |
| ℄ | PROPERTY LINE |
| —×——×——×— | FENCE |

## CHINA HOUSE SITE
## 5-YEAR STORM

SCALE: 1" = 100'

100 50 0 100 200

SCALE: 1" = 100'

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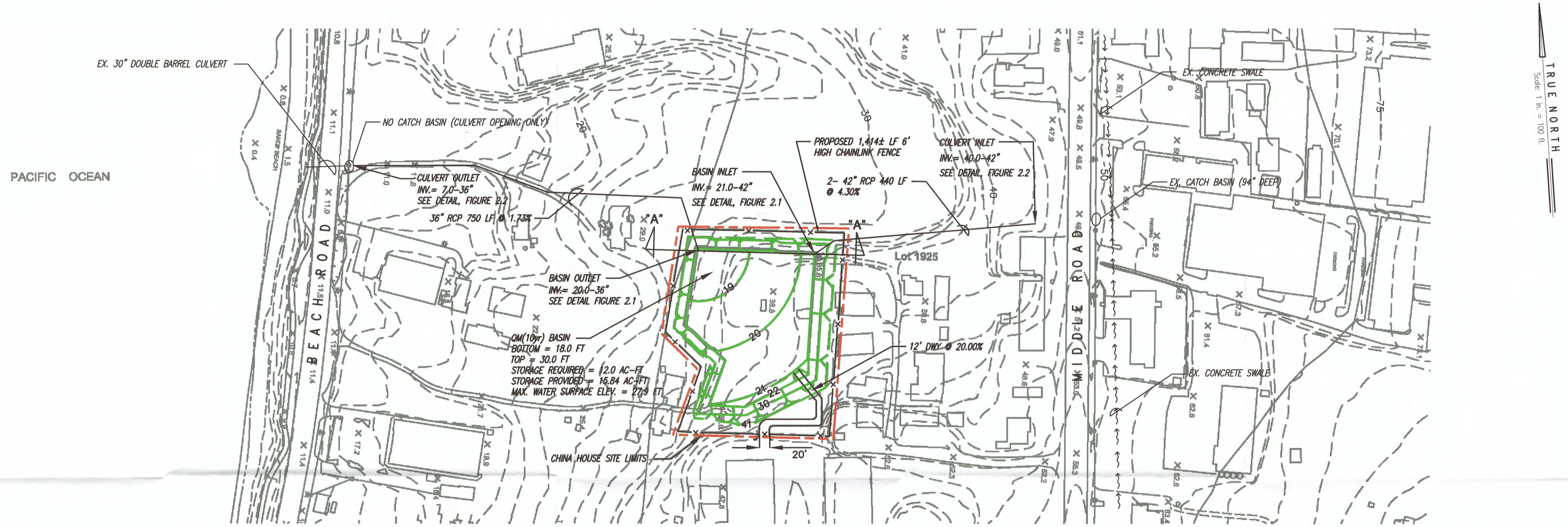
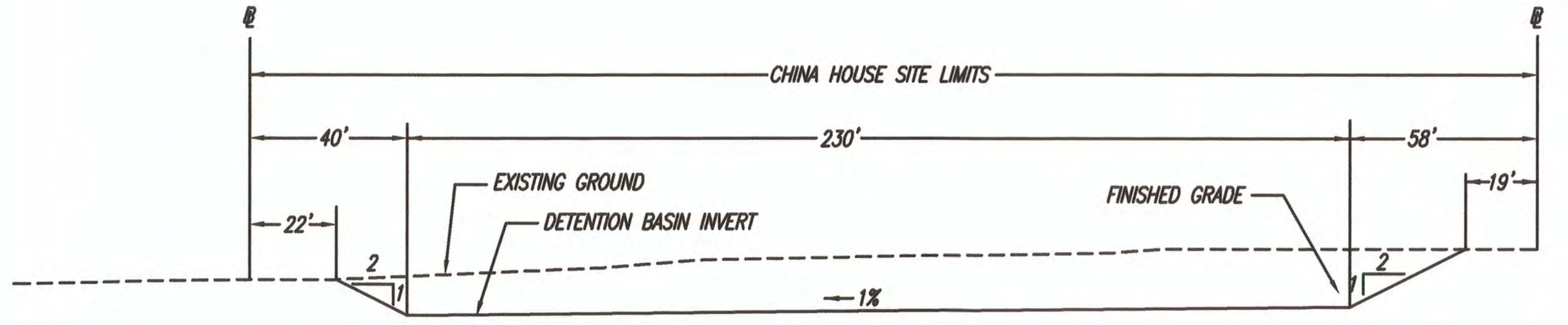
**PRELIMINARY DRAINAGE DESIGN FOR AQUATIC ECOSYSTEM RESTORATION STUDY, SAIPAN LAGOON**
SAIPAN, NORTHERN MARIANA ISLANDS

**FIGURE 3.2 - CHINA HOUSE SITE**
**5 YEAR STORM EVENT PRELIMINARY DESIGN**





## SECTION "A"-"A"

NOT TO SCALE

### EARTHWORK QUANTITIES

(FOR ESTIMATION PURPOSES ONLY)

| | |
|---|---|
| AREA TO BE MASS GRADED | 2.12 ACS |
| EXCAVATION | 29,392 C.Y |
| EMBANKMENT | 0 C.Y |

**NOTE:** *QUANTITIES ARE BASED ON TOPOGRAPHY PROVIDED*

**NOTE**

*DRAIN LENGTH MAY BE SHORTENED IF DITCH ON ADJACENT PROPERTY IS NEAR SITE.*

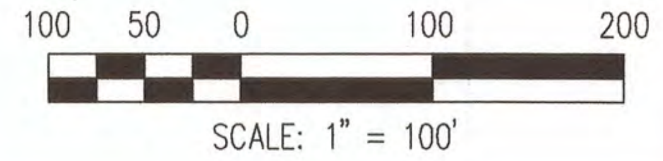
### LEGEND

| | |
|---|---|
| ⤳ ⤳ ⤳ ⤳ | *EXISTING UNIMPROVED SWALE* |
| — — — | *SITE LIMITS* |
| —23— | *FINISHED CONTOUR* |
| — —50— — | *EXISTING CONTOUR* |
| ℓ | *PROPERTY LINE* |
| —x—x—x— | *FENCE* |

# CHINA HOUSE SITE

## 10-YEAR STORM

SCALE: 1" = 100'



SCALE: 1" = 100'

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FIGURE 3.3 - CHINA HOUSE SITE
10 YEAR STORM EVENT PRELIMINARY DESIGN

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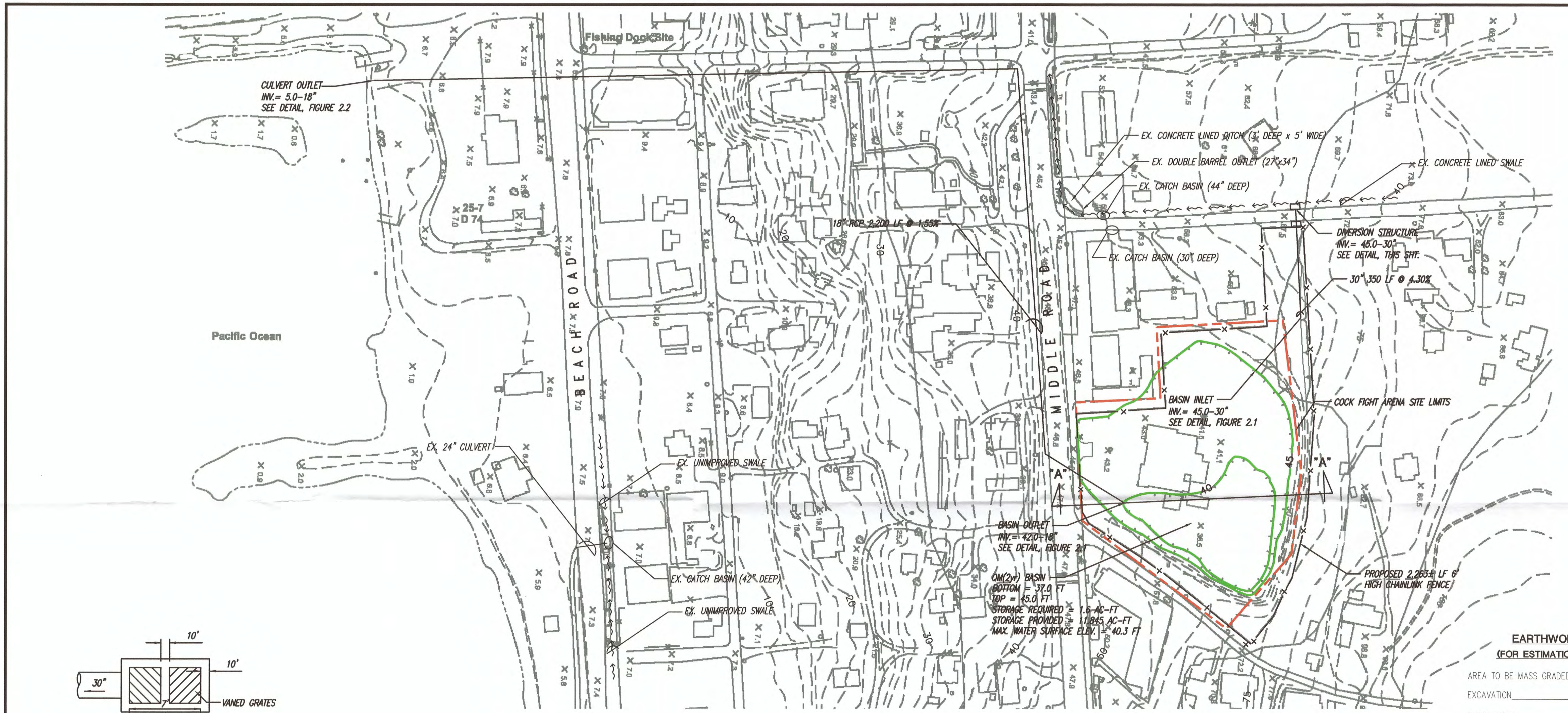


**EARTHWORK QUANTITIES**
**(FOR ESTIMATION PURPOSES ONLY)**

| | |
|---|---|
| AREA TO BE MASS GRADED | 3.17 ACS |
| EXCAVATION | 0 C.Y |
| EMBANKMENT | 0 C.Y |

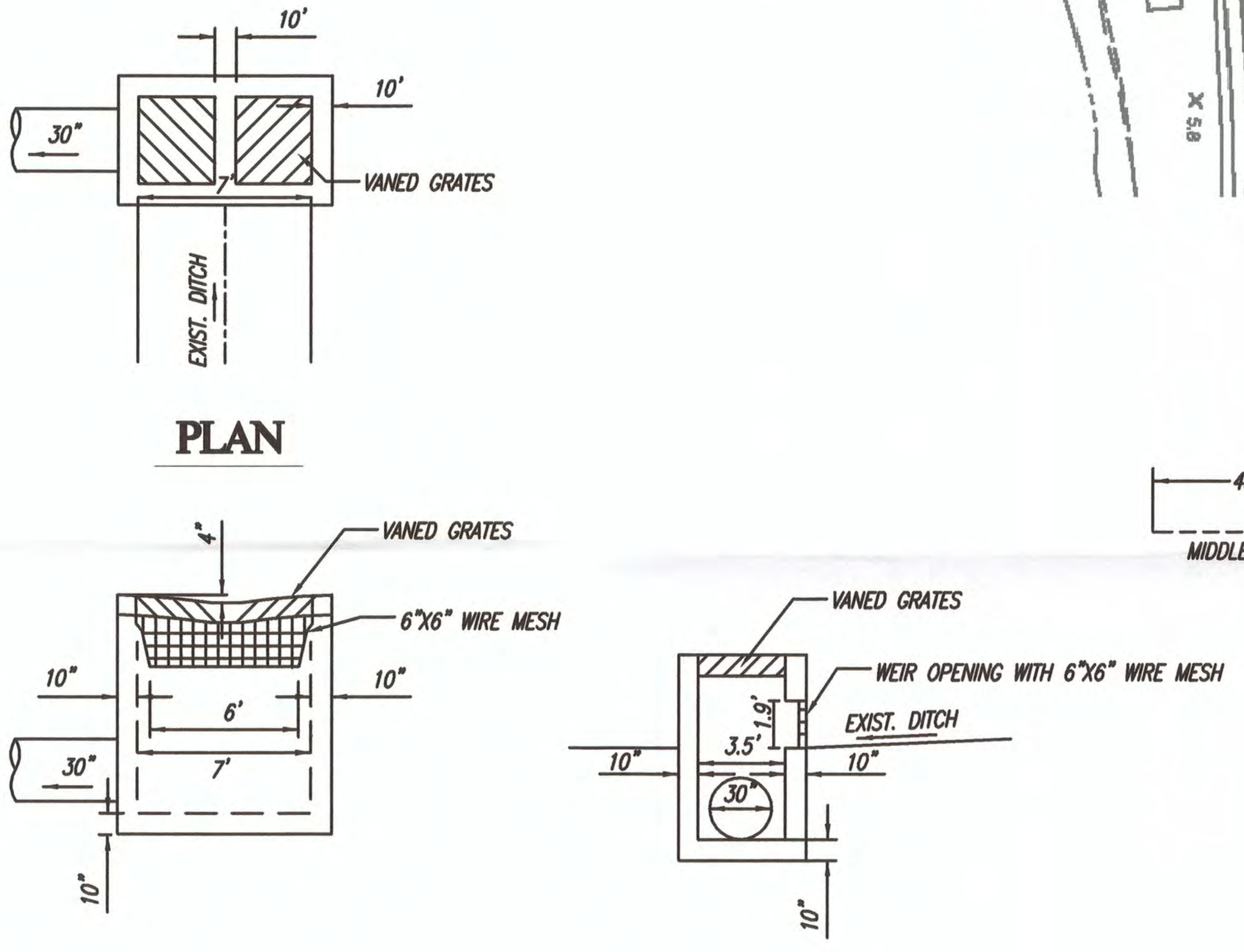
**NOTE:** *QUANTITIES ARE BASED ON TOPOGRAPHY PROVIDED*

**NOTES**

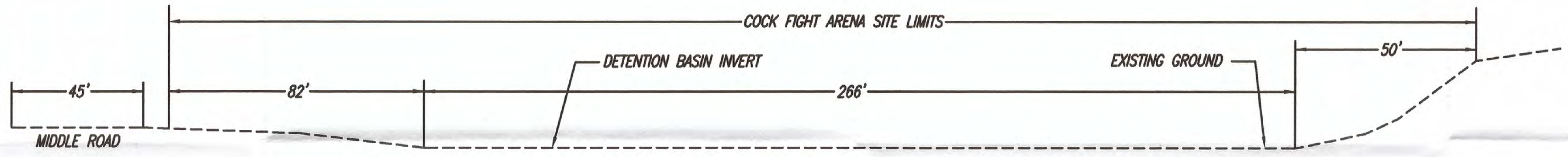
1. OUTLET PIPE NOT REQUIRED FOR BASIN CAPACITY, BUT SHOULD BE PROVIDED FOR EMERGENCY OVERFLOW PURPOSES.
2. NO ADDITIONAL EXCAVATION REQUIRED IN EXISTING PIT.

**LEGEND**

| | |
|---|---|
| ⤳ ⤳ ⤳ ⤳ | EXISTING UNIMPROVED SWALE |
| — - — - | SITE LIMITS |
| —23— | FINISHED CONTOUR |
| — —50— — | EXISTING CONTOUR |
| ℓ | PROPERTY LINE |
| —×—×—×— | FENCE |



**DIVERSION STRUCTURE DETAIL**
NOT TO SCALE



**SECTION "A"-"A"**
NOT TO SCALE

# COCK FIGHT ARENA SITE
## 2-YEAR STORM

SCALE: 1" = 100'

100 50 0 100 200
SCALE: 1" = 100'

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**PRELIMINARY DRAINAGE DESIGN FOR AQUATIC ECOSYSTEM RESTORATION STUDY, SAIPAN LAGOON**
SAIPAN, NORTHERN MARIANA ISLANDS

**FIGURE 4.1 - COCK FIGHT ARENA SITE 2 YEAR STORM EVENT PRELIMINARY DESIGN**

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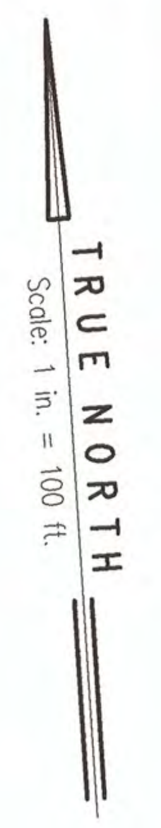
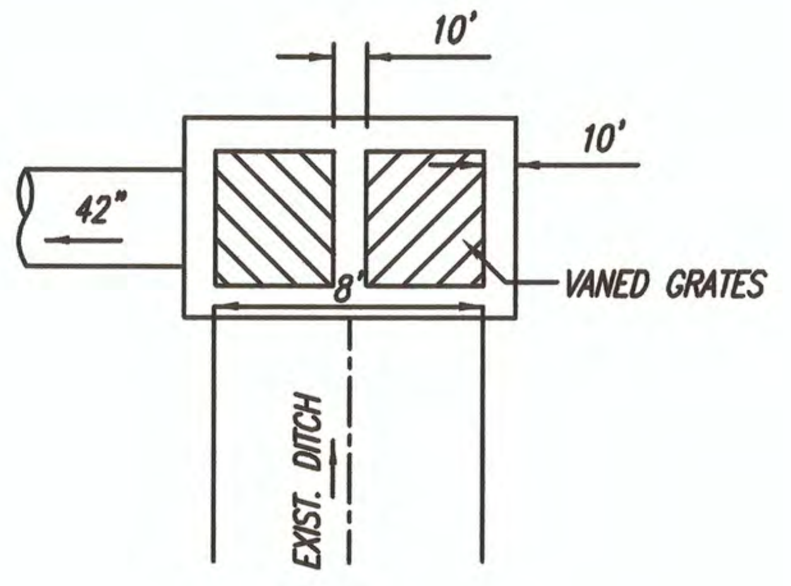
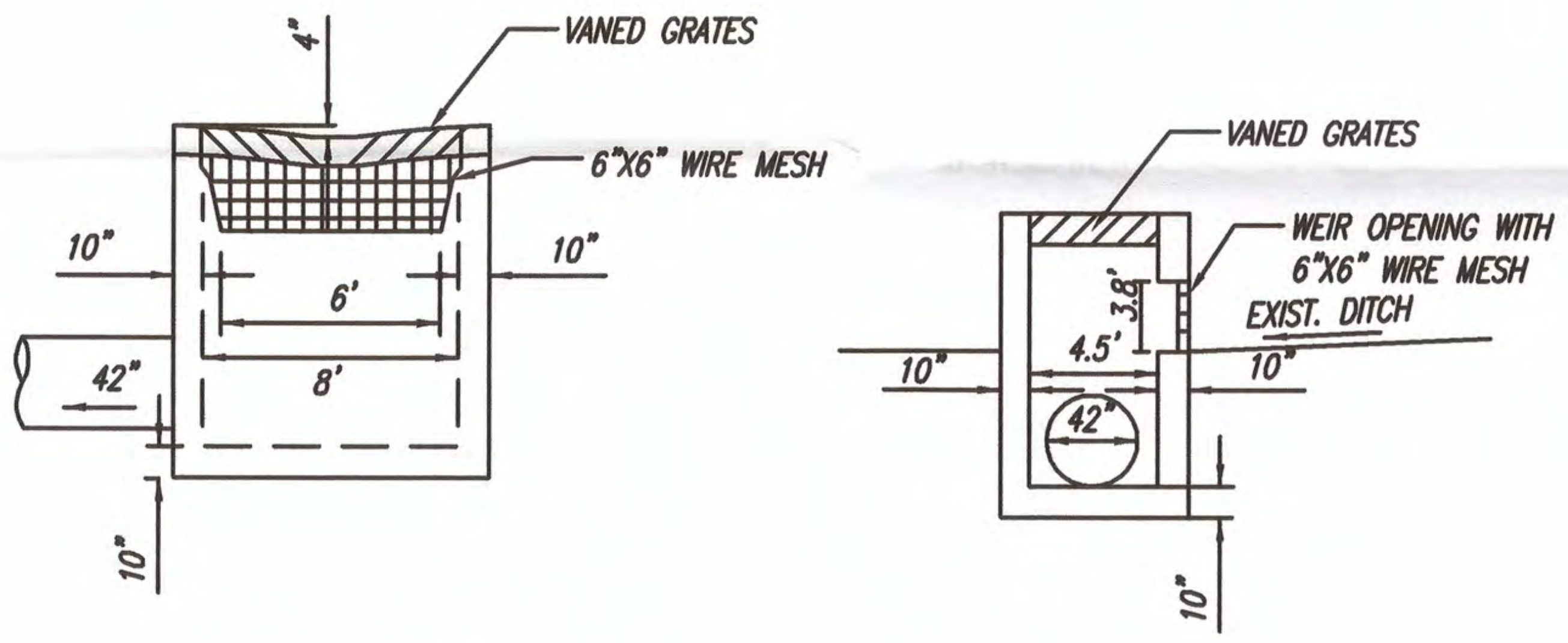




PLAN

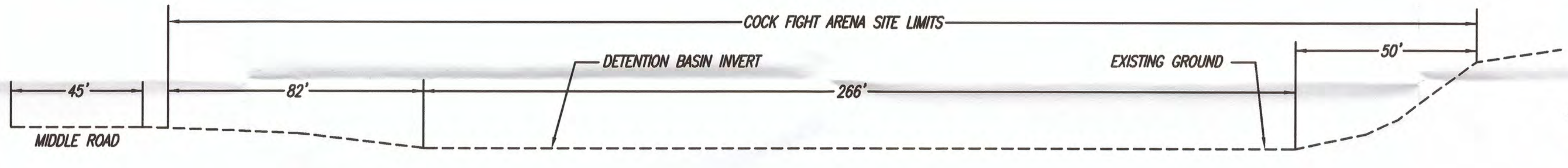


ELEVATION

SECTION

## BASIN OUTLET DETAIL

NOT TO SCALE



## SECTION "A"-"A"

NOT TO SCALE

## COCK FIGHT ARENA SITE

## 5-YEAR STORM

SCALE: 1" = 100'

**EARTHWORK QUANTITIES**
**(FOR ESTIMATION PURPOSES ONLY)**

| | |
|---|---|
| AREA TO BE MASS GRADED | 3.17 ACS |
| EXCAVATION | 0 C.Y |
| EMBANKMENT | 0 C.Y |

**NOTE:** QUANTITIES ARE BASED ON TOPOGRAPHY PROVIDED

**NOTE**
NO ADDITIONAL EXCAVATION REQUIRED IN EXISTING PIT.

**LEGEND**

| | |
|---|---|
| ⤳ ⤳⤳ ⤳ | EXISTING UNIMPROVED SWALE |
| — — — | SITE LIMITS |
| —23— | FINISHED CONTOUR |
| — —50— — | EXISTING CONTOUR |
| ℓ | PROPERTY LINE |
| —x—x—x— | FENCE |

100 50 0 100 200
SCALE: 1" = 100'

**Community Planning and Engineering, Inc.**
Engineering Design | Construction Management | Infrastructure Planning
1100 Alakea Street, Sixth Floor Honolulu, Hawaii

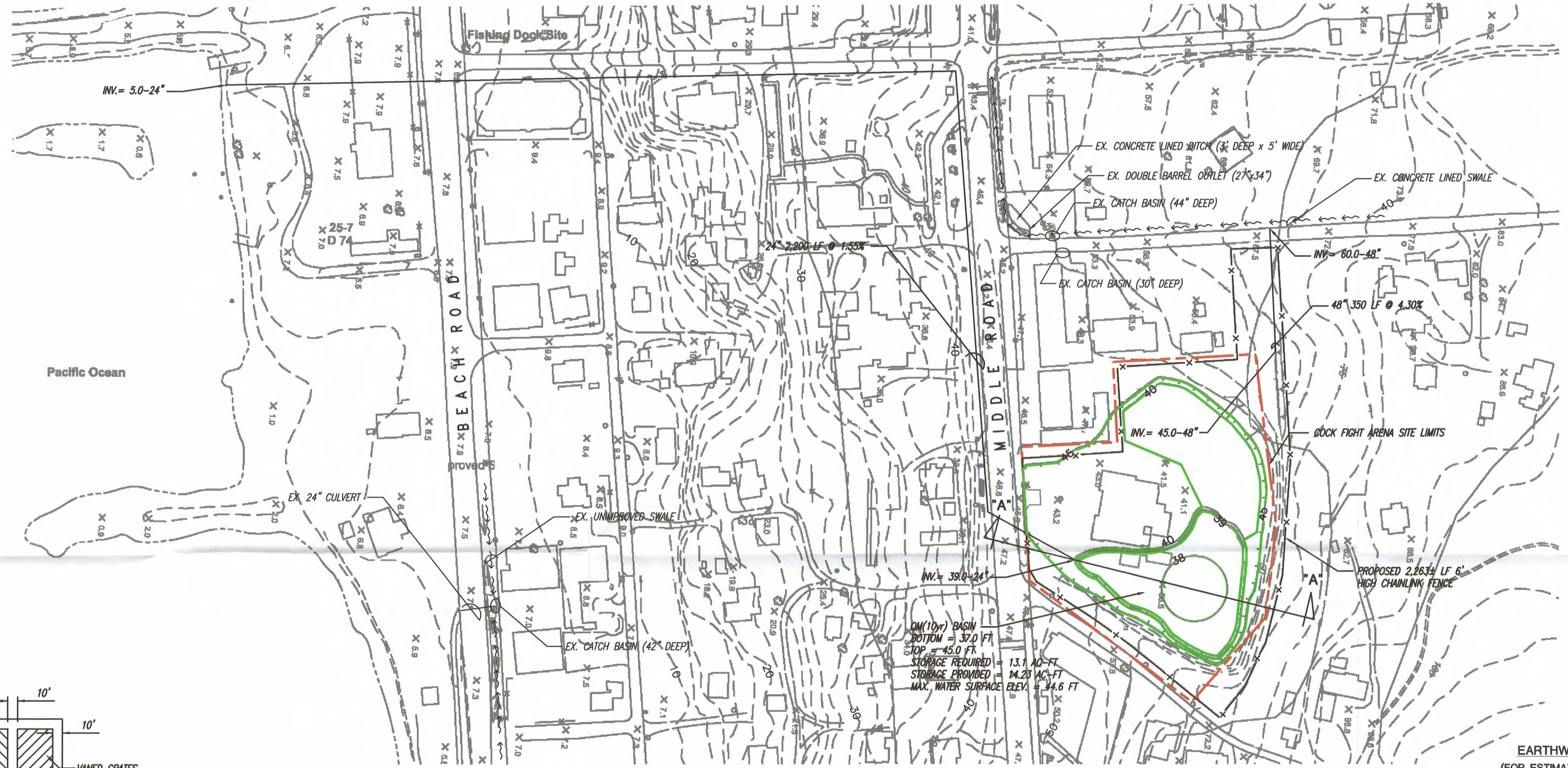
PRELIMINARY DRAINAGE DESIGN FOR AQUATIC ECOSYSTEM RESTORATION STUDY, SAIPAN LAGOON
SAIPAN, NORTHERN MARIANA ISLANDS

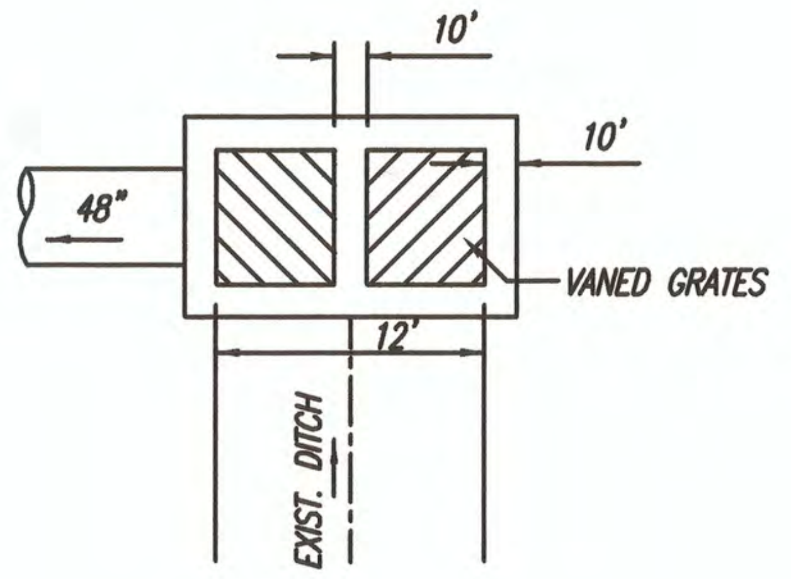
FIGURE 4.2 - COCK FIGHT ARENA SITE
5 YEAR STORM EVENT PRELIMINARY DESIGN

P:\Land Projects\Saipan Lagoon\PDF-TIFF\Figures.dwg, 1/14/2012 6:17:45 PM, HP DesignJet 1050C by HP (temporary).pc3

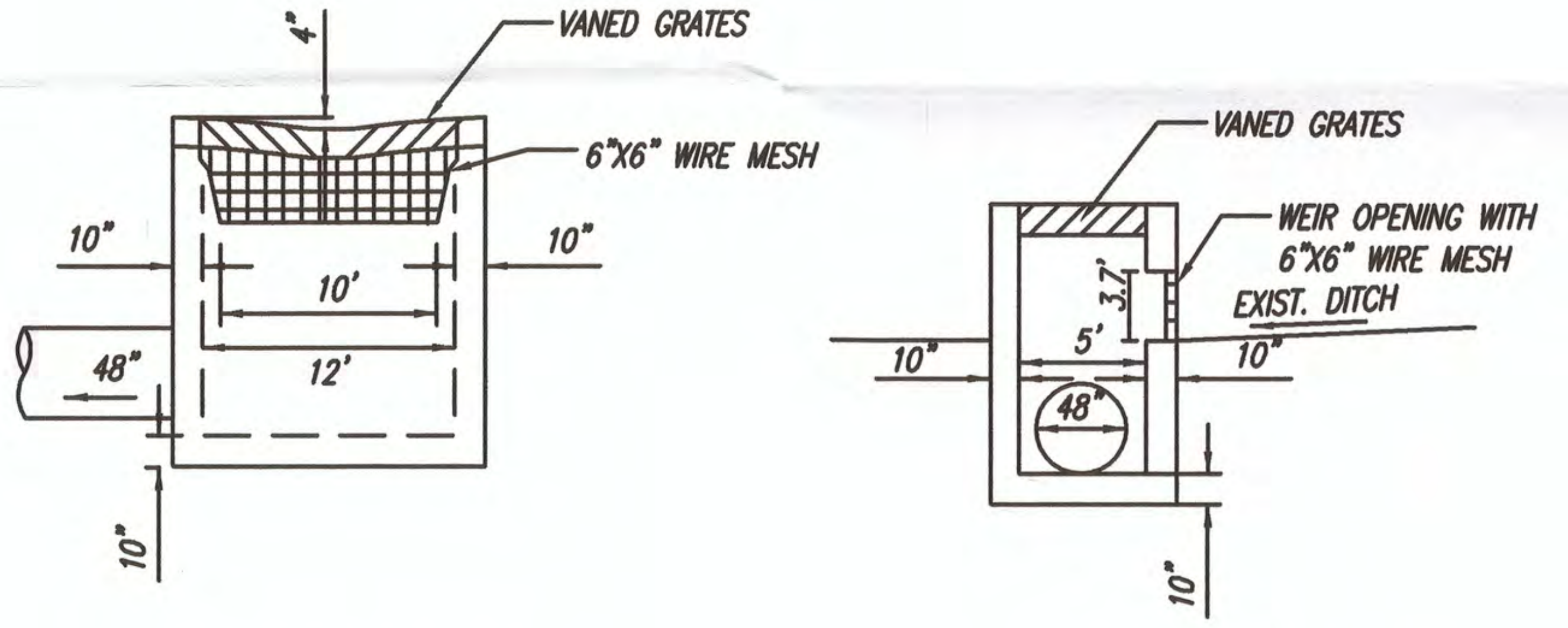
P:\Land Projects\Saipan Lagoon\PDF-TIFF\Figures.dwg, 1/14/2012 6:18:13 PM, HP DesignJet 1050C by HP (temporary).pc3

TRUE NORTH
Scale: 1 in. = 100 ft.





## PLAN

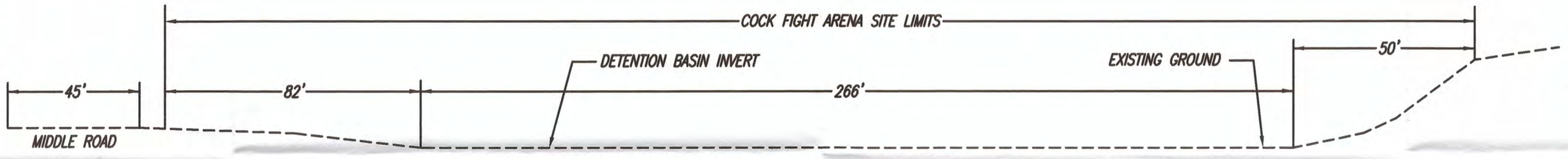


## ELEVATION

## SECTION

## BASIN OUTLET DETAIL

NOT TO SCALE



## SECTION "A"-"A"

NOT TO SCALE

## COCK FIGHT ARENA SITE

## 10-YEAR STORM

SCALE: 1" = 100'

### EARTHWORK QUANTITIES
(FOR ESTIMATION PURPOSES ONLY)

| | |
|---|---|
| AREA TO BE MASS GRADED | 3.17 ACS |
| EXCAVATION | 2,328 C.Y |
| EMBANKMENT | 0 C.Y |

**NOTE:** QUANTITIES ARE BASED ON TOPOGRAPHY PROVIDED

### NOTE
NO ADDITIONAL EXCAVATION REQUIRED IN EXISTING PIT.

### LEGEND

| | |
|---|---|
| ⤳ ⤳ ⤳ ⤳ | EXISTING UNIMPROVED SWALE |
| 🟥 | SITE LIMITS |
| —23— | FINISHED CONTOUR |
| — —50— — | EXISTING CONTOUR |
| ℄ | PROPERTY LINE |
| —×—×—×— | FENCE |

100 50 0 100 200
SCALE: 1" = 100'

**Community Planning and Engineering, Inc.**
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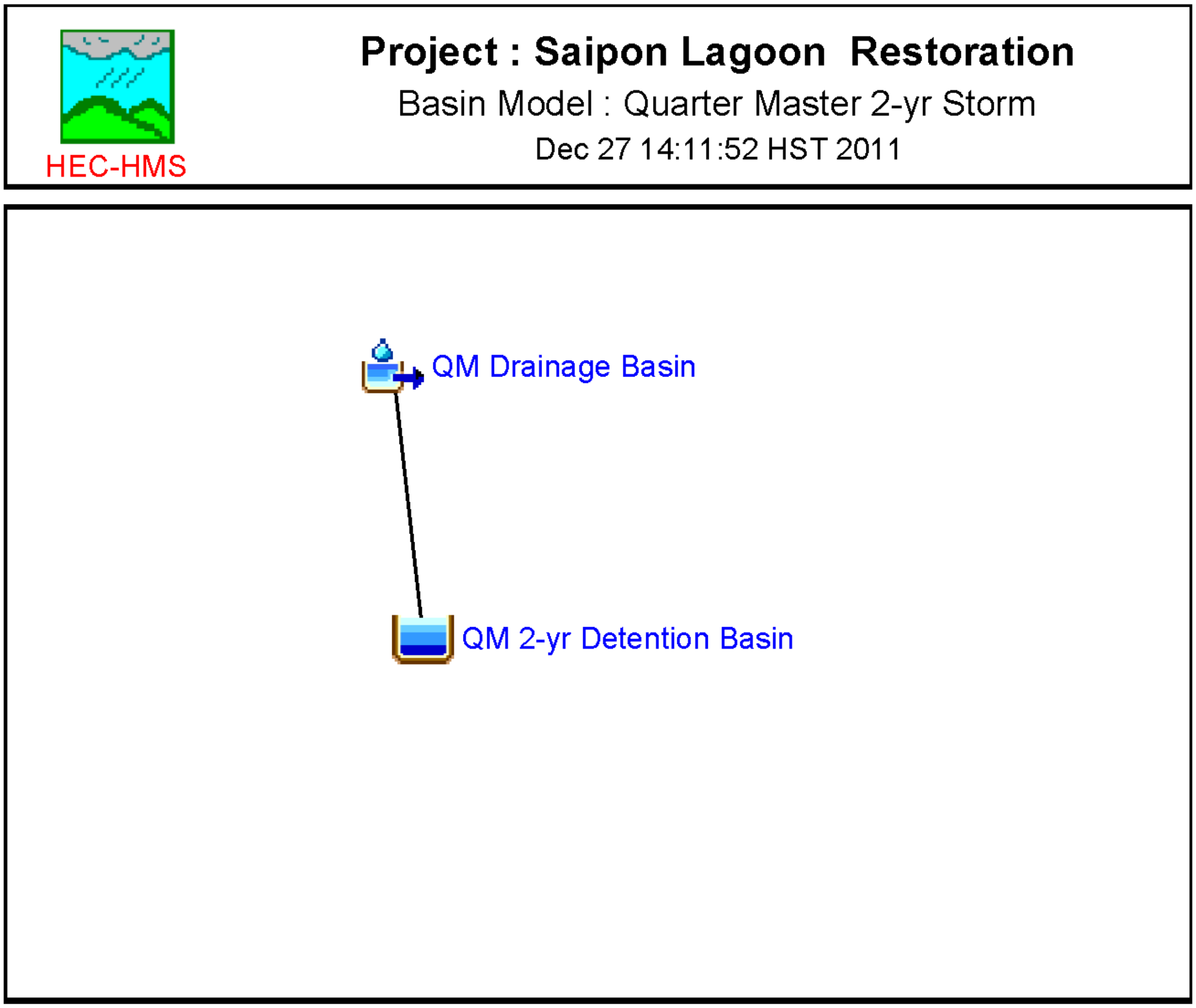
Honolulu, Hawaii

PRELIMINARY DRAINAGE DESIGN FOR AQUATIC ECOSYSTEM RESTORATION STUDY, SAIPAN LAGOON
SAIPAN, NORTHERN MARIANA ISLANDS

FIGURE 4.3 - COCK FIGHT ARENA SITE
10 YEAR STORM EVENT PRELIMINARY DESIGN

# Appendix A

# 1. *Quartermaster Site: 2-Year Storm Event*



**Project : Saipon Lagoon Restoration**
Basin Model : Quarter Master 2-yr Storm
Dec 27 14:11:52 HST 2011

# A.Quartermaster Drainage Basin:

## A.1 Basin Model:

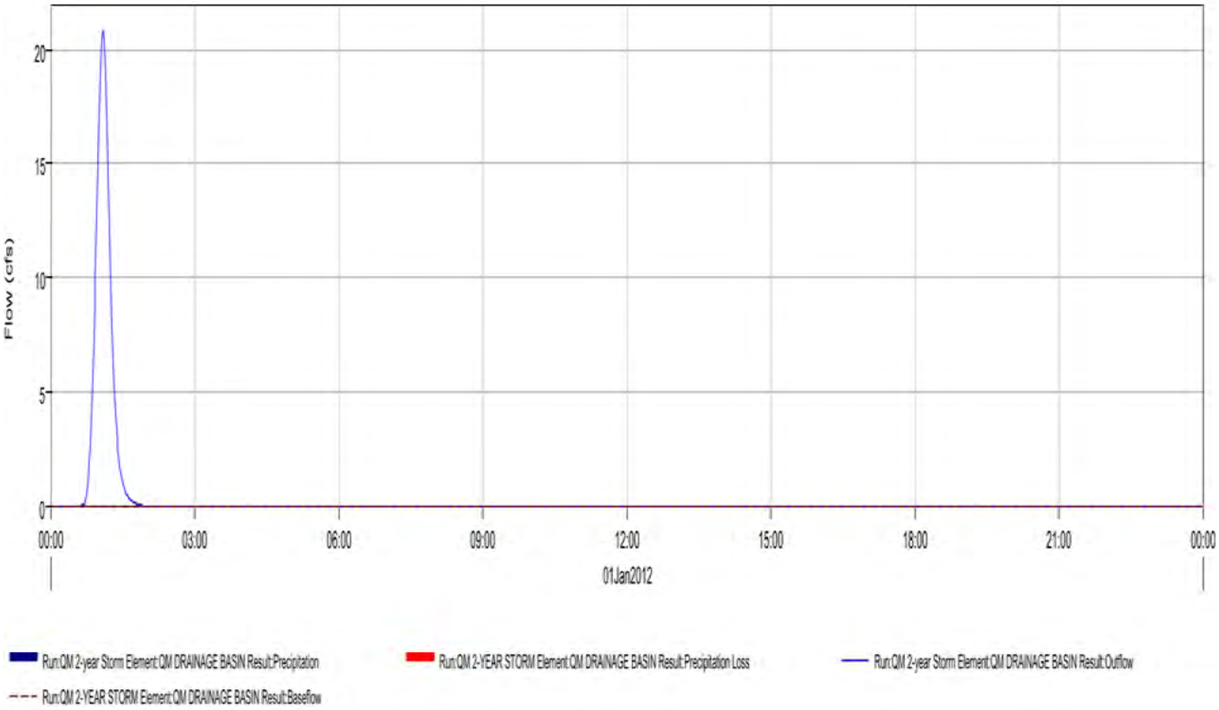
| | |
|---|---|
| Area: | 109 ac (0.1703 mi$^2$) |
| CN: | 65 |
| Tc: | 10.7 min |
| Rainfall 2-year/1 hour: | 1.93 in |
| Loss Method: | SCS Curve Number |
| Transform Method: | SCS Unit Hydrograph |

## A.2 HEC-HMS Simulation Results:

| | |
|---|---|
| Simulation Run: | QM 2-year Storm |
| Subbasin: | QM Drainage Basin |
| Meteorologic Model: | 2-year / 1 hour Storm |
| Control Specification: | Control -24-hour |

| Computed Results | | | |
|---|---|---|---|
| **Peak Discharge:** | **20.8 (cfs)** | **Time of Peak Discharge:** | **01:06** |
| **Total Precipitation:** | **15.4 (ac-ft)** | **Total Direct Runoff:** | **0.6 (ac-ft)** |
| **Total Loss:** | **14.8 (ac-ft)** | **Total Baseflow:** | **0.0 (ac-ft)** |
| **Total Excess:** | **0.6 (ac-ft)** | **Discharge:** | **0.6 (ac-ft)** |

## A3. Hydrograph



# B. Quartermaster 2-Year Detention Basin:

## B.1 Detention Basin Design:

| Elevation (ft) | Surf. Area (ac) | Increment Storage (ac-ft) | Cumulative Storage (ac-ft) |
|---|---|---|---|
| 23.00 | 0.050 | 0.000 | 0.000 |
| 24.00 | 0.090 | 0.070 | 0.070 |
| 25.00 | 0.110 | 0.100 | 0.170 |
| 26.00 | 0.130 | 0.120 | 0.290 |
| 28.00 | 0.180 | 0.310 | 0.600 |
| 30.00 | 0.230 | 0.410 | 1.010 |
| 32.00 | 0.280 | 0.510 | 1.520 |

## B.2 Outlet Design:

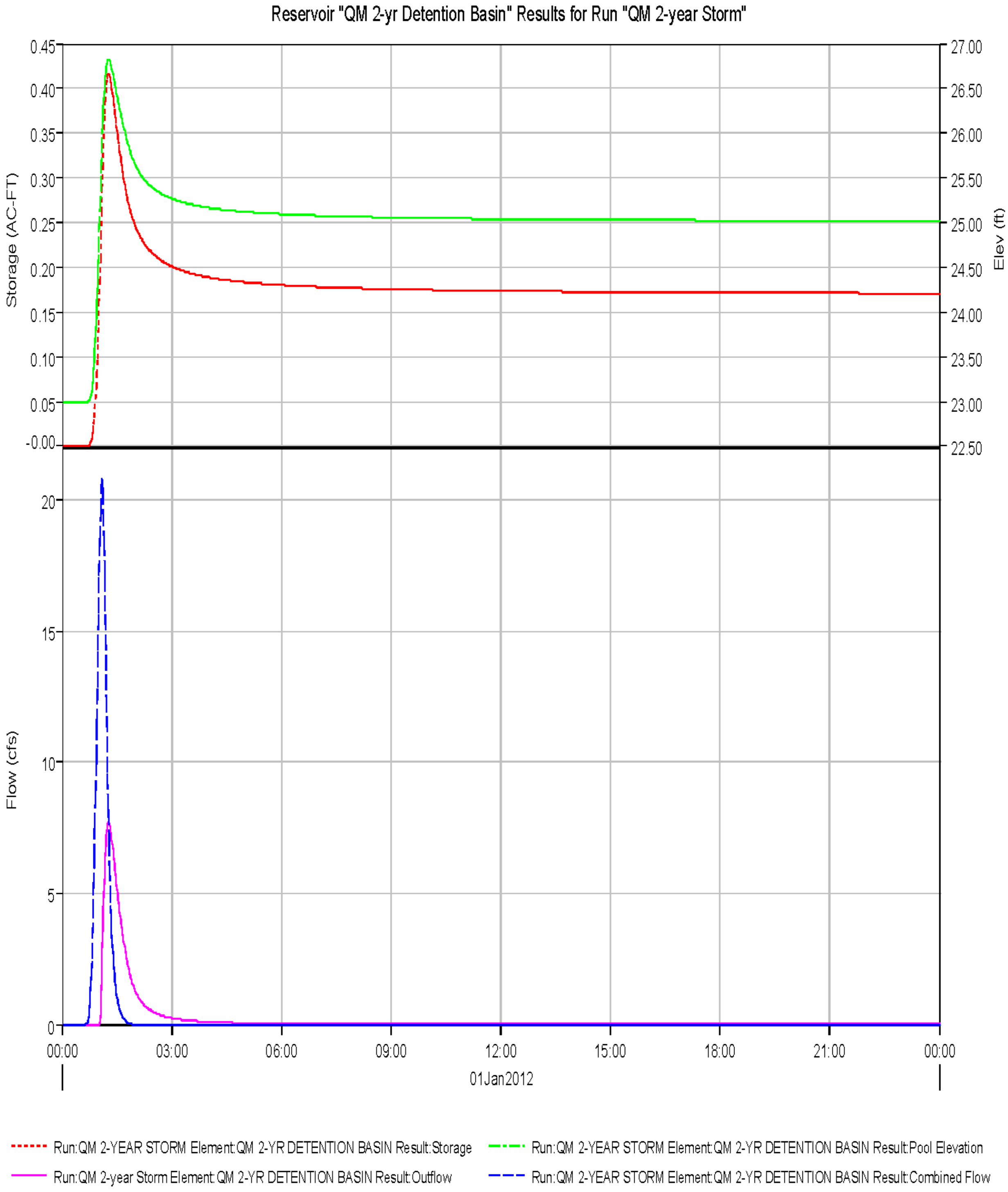
| | |
|---|---|
| Pipe: | RCP culvert (end-section conforming to fill) |
| Diameter: | 18 in |
| Length: | 100 ft |
| Inlet Elevation: | 25.00 ft |
| Outlet Elevation: | 24.00 ft |
| Entrance Coefficient: | 0.500 |
| Slope: | 0.010 |
| Outlet Coefficient: | 0.900 |
| Mannings n: | 0.013 |

## B.3 HEC-HMS Simulation:

Simulation Run: QM 2-year Storm
Subbasin: QM Drainage Basin
Meteorologic Model: 2-year / 1 hour Storm
Control Specification: Control -24-hour

| Computed Results | | | |
|---|---|---|---|
| **Peak Inflow:** | **20.8 (cfs)** | **Time of Peak Inflow:** | **01:06** |
| **Peak Outflow:** | **7.7 (cfs)** | **Time of Peak Outflow:** | **01:16** |
| **Total Inflow:** | **0.6 (ac-ft)** | **Peak Storage:** | **0.4 (ac-ft)** |
| **Total Outflow:** | **0.4 (ac-ft)** | **Peak Elevation:** | **26.8 (ft)** |

## B.4 Hydrograph



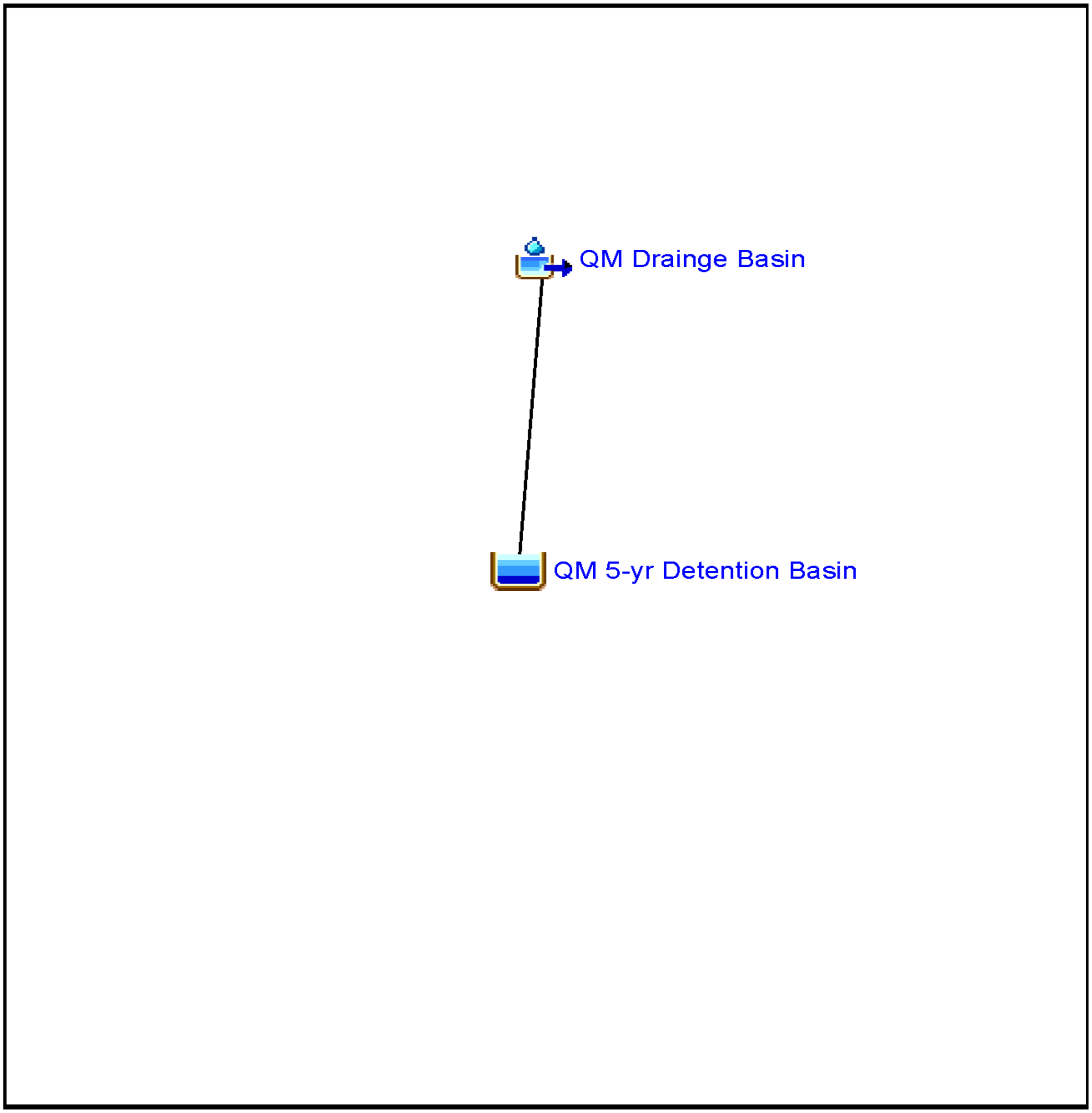
# *2. Quartermaster Site: 5-Year Storm Event*

HEC-HMS

**Project : Saipon Lagoon  Restoration**

Basin Model : Quarter Master 5-yr Storm

Jan 12 07:57:36 HST 2012



# C.Quartermaster Drainage Basin:

## A.1 Basin Model:

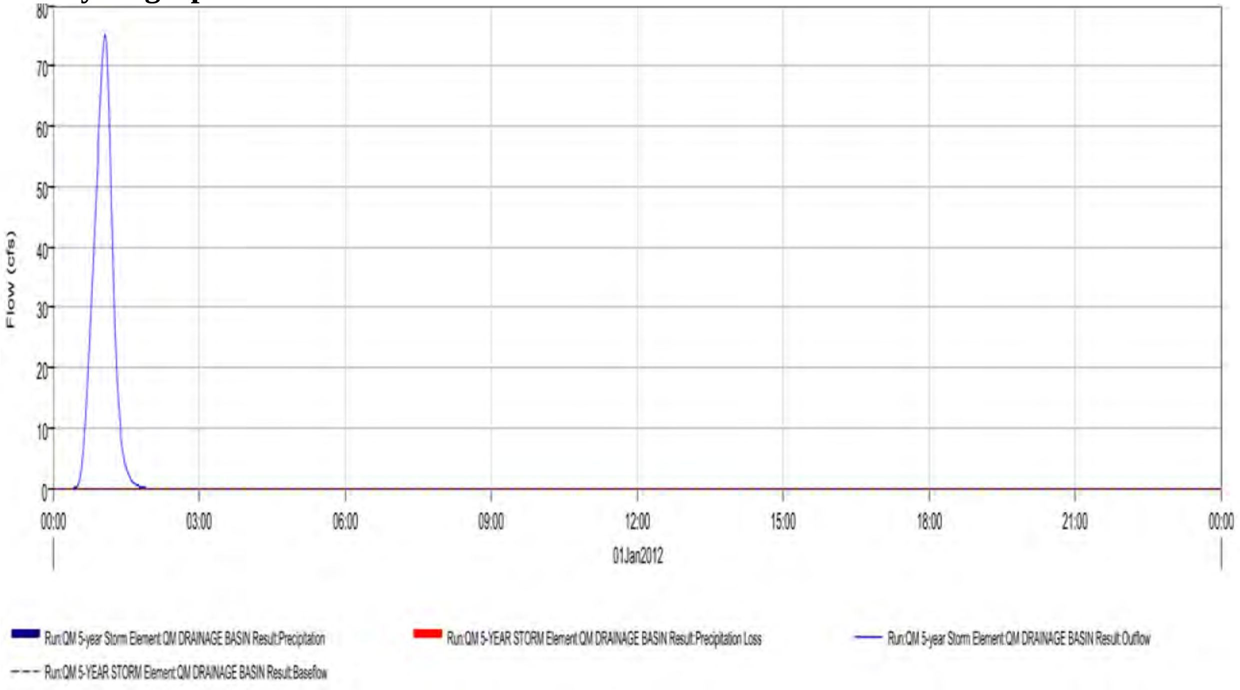
| | |
|---|---|
| Area: | 109 ac (0.1703 mi$^2$) |
| CN: | 65 |
| Tc: | 10.7 min |
| Rainfall 5-year/1 hour: | 2.61 in |
| Loss Method: | SCS Curve Number |
| Transform Method: | SCS Unit Hydrograph |

## A.2 HEC-HMS Simulation Results:

| | |
|---|---|
| Simulation Run: | QM 5-year Storm |
| Subbasin: | QM Drainage Basin |
| Meteorologic Model: | 5-year / 1 hour Storm |
| Control Specification: | Control -24-hour |

| Computed Results | | | |
|---|---|---|---|
| **Peak Discharge:** | **75.0 (cfs)** | **Time of Peak Discharge:** | **01:04** |
| **Total Precipitation:** | **22.7 (ac-ft)** | **Total Direct Runoff:** | **2.7 (ac-ft)** |
| **Total Loss:** | **20.0 (ac-ft)** | **Total Baseflow:** | **0.0 (ac-ft)** |
| **Total Excess:** | **2.7 (ac-ft)** | **Discharge:** | **2.7 (ac-ft)** |

## A3. Hydrograph



# D.Quartermaster 5-Year Detention Basin:

### B.1 Detention Basin Design:

| Elevation (ft) | Surf. Area (ac) | Increment Storage (ac-ft) | Cumulative Storage (ac-ft) |
|---|---|---|---|
| 23.00 | 0.180 | 0.000 | 0.000 |
| 24.00 | 0.460 | 0.320 | 0.320 |
| 25.00 | 0.480 | 0.470 | 0.790 |
| 26.00 | 0.510 | 0.495 | 1.285 |
| 28.00 | 0.570 | 1.080 | 2.365 |
| 30.00 | 0.630 | 1.200 | 3.565 |
| 32.00 | 0.690 | 1.320 | 4.885 |

### B.2 Outlet Design:

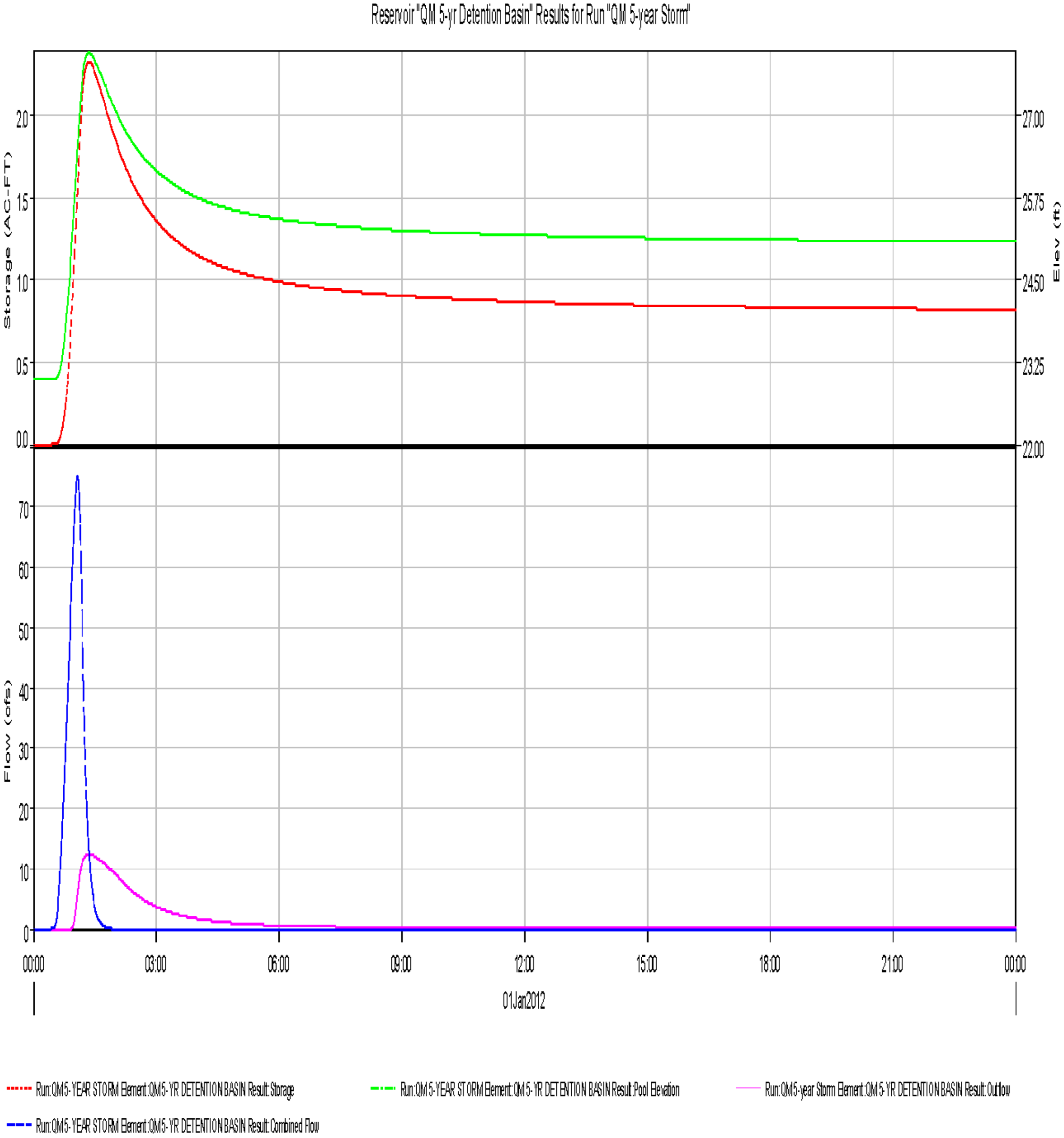
| | |
|---|---|
| Pipe: | RCP culvert (end-section conforming to fill) |
| Diameter: | 18 in |
| Length: | 100 ft |
| Inlet Elevation: | 25.00 ft |
| Outlet Elevation: | 24.00 ft |
| Entrance Coefficient: | 0.500 |
| Slope: | 0.010 |
| Outlet Coefficient: | 0.900 |
| Mannings n: | 0.013 |

### B.3 HEC-HMS Simulation:

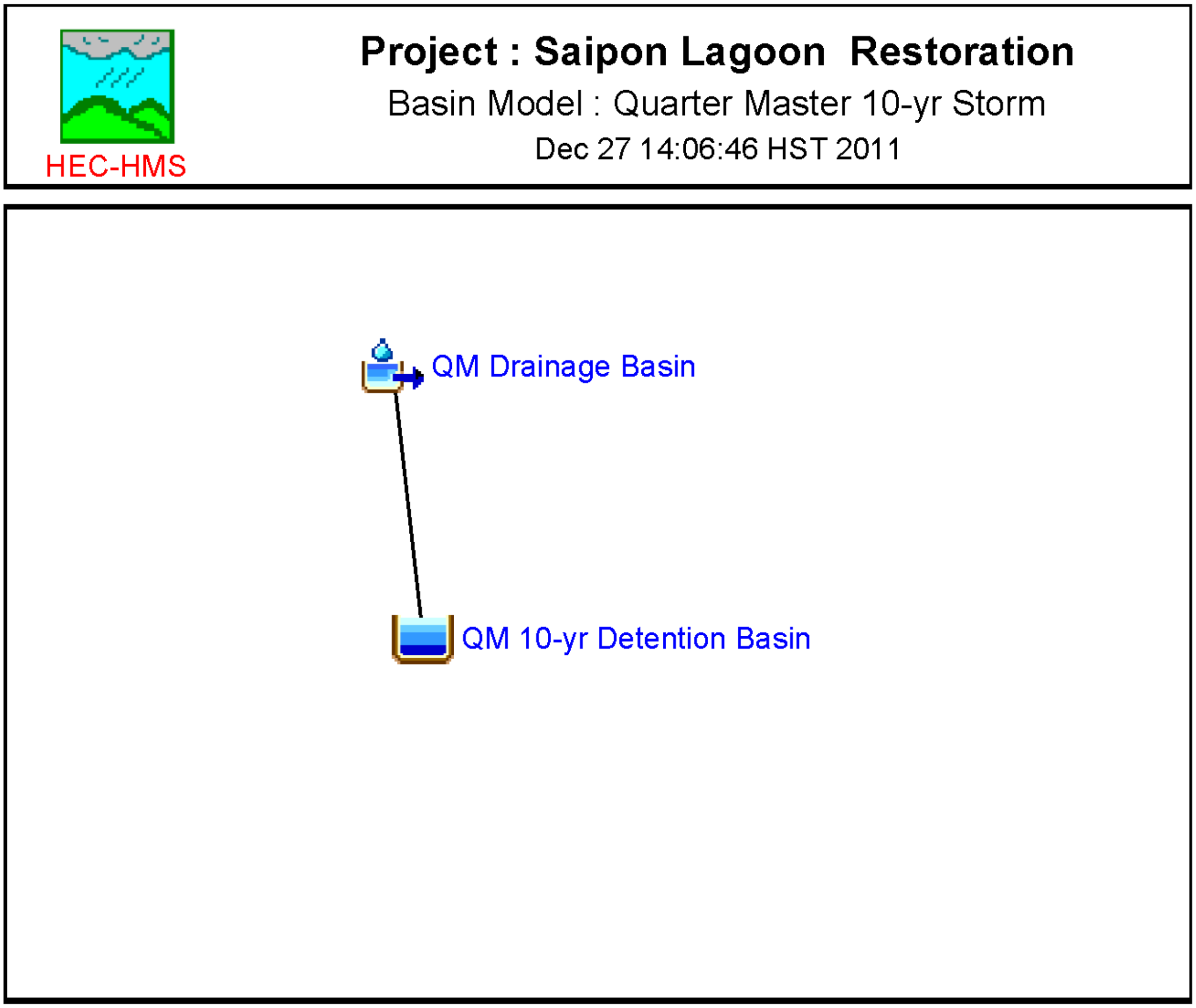
| | |
|---|---|
| Simulation Run: | QM 5-year Storm |
| Subbasin: | QM Drainage Basin |
| Meteorologic Model: | 5-year / 1 hour Storm |
| Control Specification: | Control -24-hour |

| Computed Results | | | |
|---|---|---|---|
| **Peak Inflow:** | **75.0 (cfs)** | **Time of Peak Inflow:** | **01:04** |
| **Peak Outflow:** | **12.4 (cfs)** | **Time of Peak Outflow:** | **01:21** |
| **Total Inflow:** | **2.7 (ac-ft)** | **Peak Storage:** | **2.3 (ac-ft)** |
| **Total Outflow:** | **1.9 (ac-ft)** | **Peak Elevation:** | **27.9 (ft)** |

## B.4 Hydrograph



# 3. Quartermaster Site: 10-Year Storm Event



Project : Saipon Lagoon Restoration
Basin Model : Quarter Master 10-yr Storm
Dec 27 14:06:46 HST 2011

# A.Quartermaster Drainage Basin:

## A.1 Basin Model:

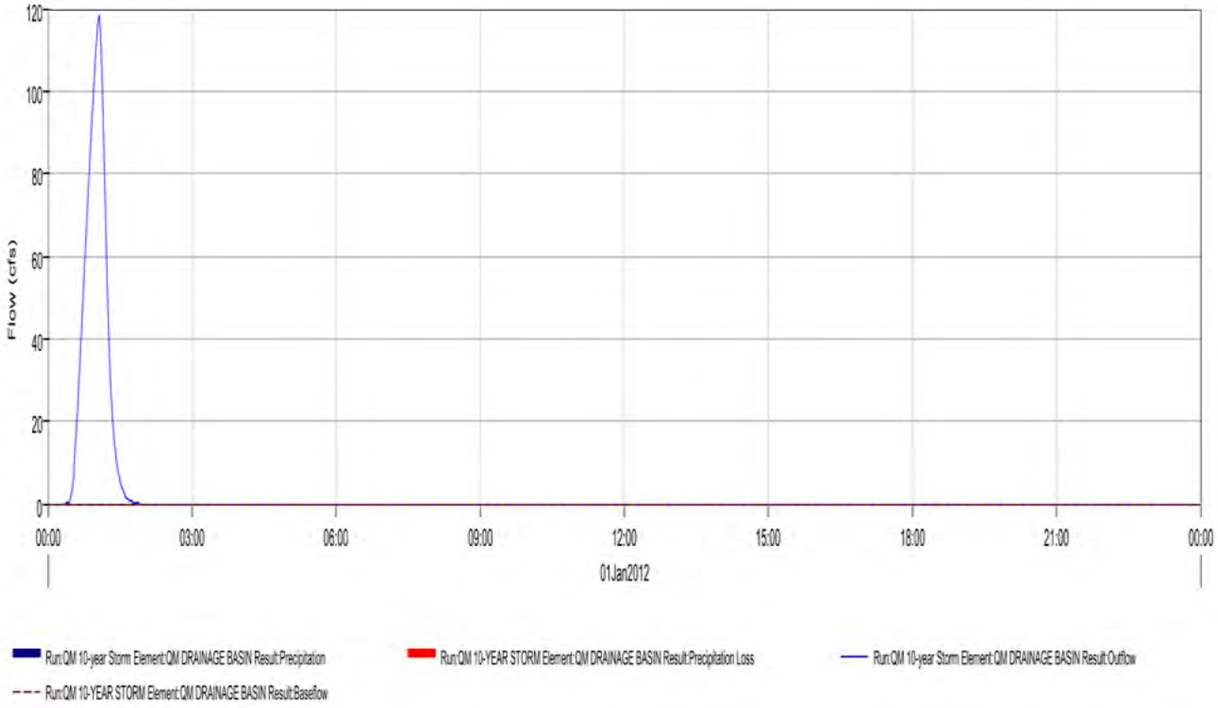
| | |
|---|---|
| Area: | 109 ac (0.1703 mi$^2$) |
| CN: | 65 |
| Tc: | 10.7 min |
| Rainfall 10-year/1 hour: | 3.06 in |
| Loss Method: | SCS Curve Number |
| Transform Method: | SCS Unit Hydrograph |

## A.2 HEC-HMS Simulation Results:

| | |
|---|---|
| Simulation Run: | QM 10-year Storm |
| Subbasin: | QM Drainage Basin |
| Meteorologic Model: | 10-year / 1 hour Storm |
| Control Specification: | Control -24-hour |

| Computed Results | | | |
|---|---|---|---|
| **Peak Discharge:** | **118.5 (cfs)** | **Time of Peak Discharge:** | **01:04** |
| **Total Precipitation:** | **27.5 (ac-ft)** | **Total Direct Runoff:** | **4.7 (ac-ft)** |
| **Total Loss:** | **22.8 (ac-ft)** | **Total Baseflow:** | **0.0 (ac-ft)** |
| **Total Excess:** | **4.7 (ac-ft)** | **Discharge:** | **4.7 (ac-ft)** |

## A3. Hydrograph



# B. Quartermaster 10-YearDetention Basin:

## B.1 Detention Basin Design:

| Elevation (ft) | Surf. Area (ac) | Increment Storage (ac-ft) | Cumulative Storage (ac-ft) |
|---|---|---|---|
| 23.00 | 0.180 | 0.000 | 0.000 |
| 24.00 | 0.680 | 0.430 | 0.430 |
| 25.00 | 0.710 | 0.695 | 1.125 |
| 26.00 | 0.740 | 0.725 | 1.850 |
| 28.00 | 0.810 | 1.550 | 3.400 |
| 30.00 | 0.880 | 1.690 | 5.090 |
| 32.00 | 0.950 | 1.830 | 6.920 |

## B.2 Outlet Design:

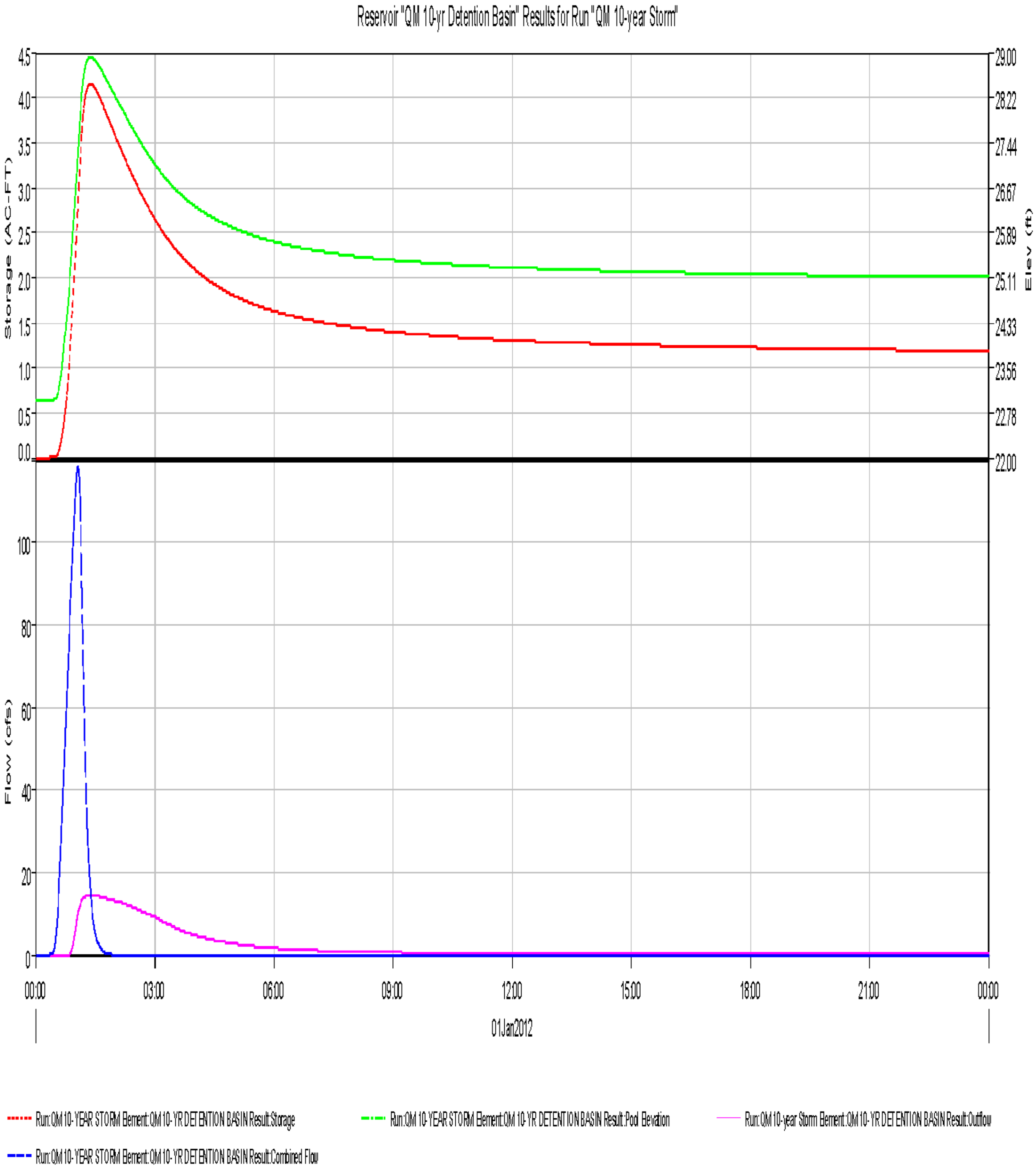
| | |
|---|---|
| Pipe: | RCP culvert (end-section conforming to fill) |
| Diameter: | 18 in |
| Length: | 100 ft |
| Inlet Elevation: | 25.00 ft |
| Outlet Elevation: | 24.00 ft |
| Entrance Coefficient: | 0.500 |
| Slope: | 0.010 |
| Outlet Coefficient: | 0.900 |
| Mannings n: | 0.013 |

## B.3 HEC-HMS Simulation:

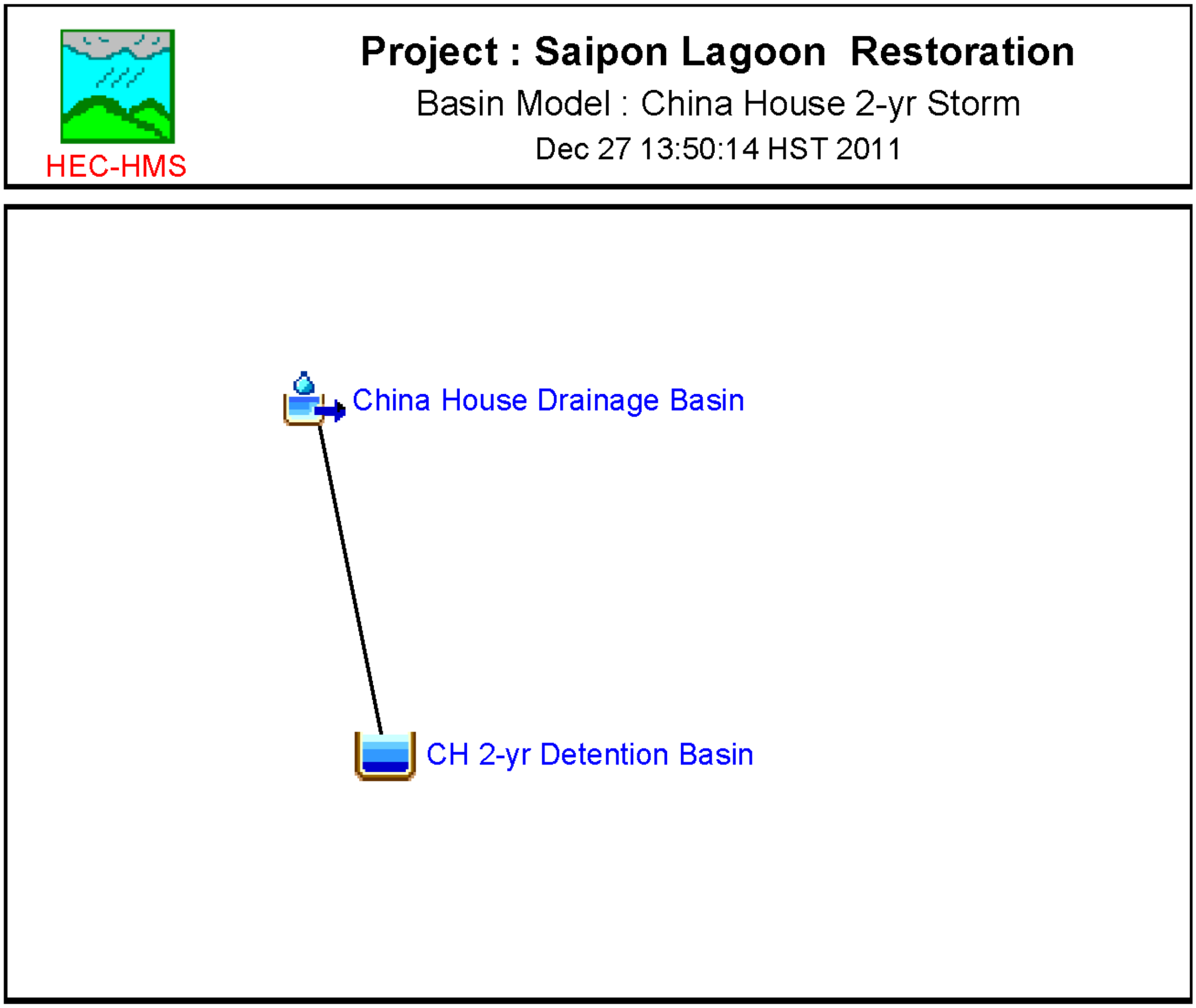
| | |
|---|---|
| Simulation Run: | QM 10-year Storm |
| Subbasin: | QM Drainage Basin |
| Meteorologic Model: | 10-year / 1 hour Storm |
| Control Specification: | Control -24-hour |

| Computed Results | | | |
|---|---|---|---|
| **Peak Inflow:** | **118.5 (cfs)** | **Time of Peak Inflow:** | **01:04** |
| **Peak Outflow:** | **14.5 (cfs)** | **Time of Peak Outflow:** | **01:23** |
| **Total Inflow:** | **4.7 (ac-ft)** | **Peak Storage:** | **4.2 (ac-ft)** |
| **Total Outflow:** | **3.5 (ac-ft)** | **Peak Elevation:** | **28.9 (ft)** |

## B.4 Hydrograph



# *4. China House Site: 2-Year Storm Event*



**Project : Saipon Lagoon Restoration**
Basin Model : China House 2-yr Storm
Dec 27 13:50:14 HST 2011

# A.China House Drainage Basin:

## A.1 Basin Model:

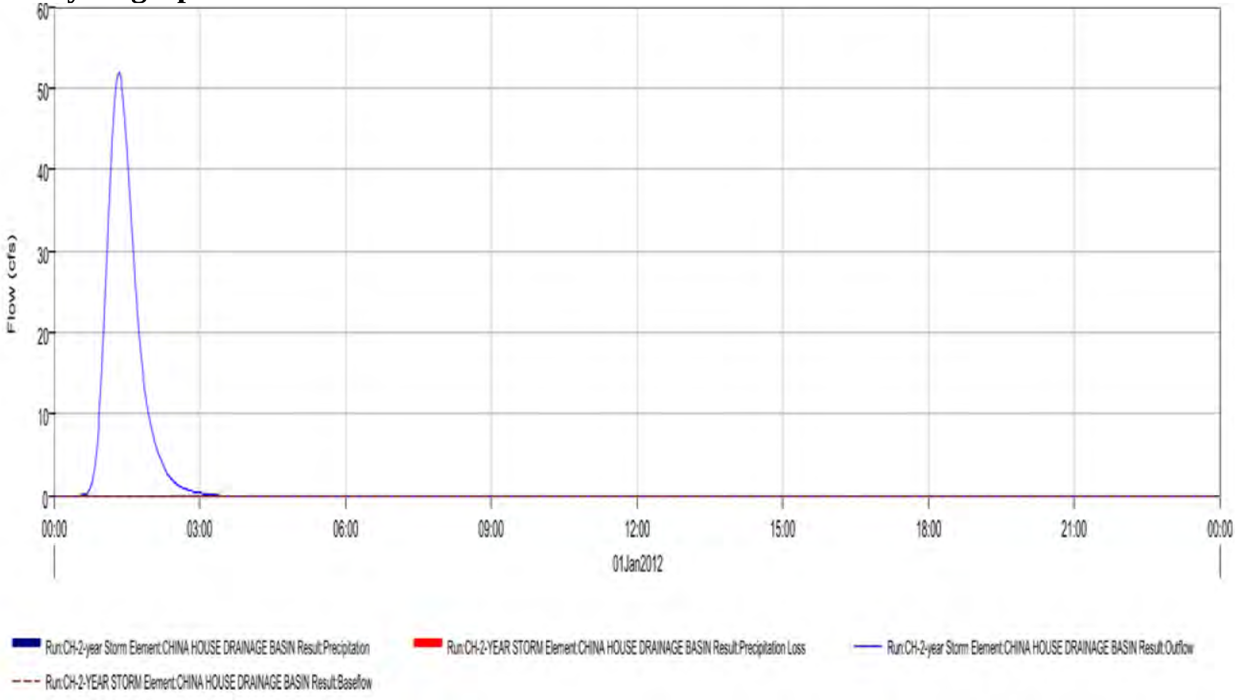
| | |
|---|---|
| Area: | 344 ac (0.5375 mi$^2$) |
| CN: | 68 |
| Tc: | 28.2 min |
| Rainfall 2-year/1 hour: | 1.93 in |
| Loss Method: | SCS Curve Number |
| Transform Method: | SCS Unit Hydrograph |

## A.2 HEC-HMS Simulation Results:

| | |
|---|---|
| Simulation Run: | CH 2-year Storm |
| Subbasin: | CH Drainage Basin |
| Meteorologic Model: | 2-year / 1 hour Storm |
| Control Specification: | Control -24-hour |

| Computed Results | | | |
|---|---|---|---|
| **Peak Discharge:** | **51.9 (cfs)** | **Time of Peak Discharge:** | **01:20** |
| **Total Precipitation:** | **48.6 (ac-ft)** | **Total Direct Runoff:** | **3.0 (ac-ft)** |
| **Total Loss:** | **45.6 (ac-ft)** | **Total Baseflow:** | **0.0 (ac-ft)** |
| **Total Excess:** | **3.0 (ac-ft)** | **Discharge:** | **3.0 (ac-ft)** |

## A3. Hydrograph



# B. China House 2-Year Detention Basin:

## B.1 Detention Basin Design:

| Elevation (ft) | Surf. Area (ac) | Increment Storage (ac-ft) | Cumulative Storage (ac-ft) |
|---|---|---|---|
| 20.00 | 0.190 | 0.000 | 0.000 |
| 21.00 | 0.450 | 0.320 | 0.320 |
| 22.00 | 0.470 | 0.460 | 0.780 |
| 24.00 | 0.530 | 1.000 | 1.780 |
| 26.00 | 0.580 | 1.110 | 2.890 |
| 28.00 | 0.640 | 1.220 | 4.110 |
| 29.00 | 0.670 | 0.655 | 4.765 |

## B.2 Outlet Design:

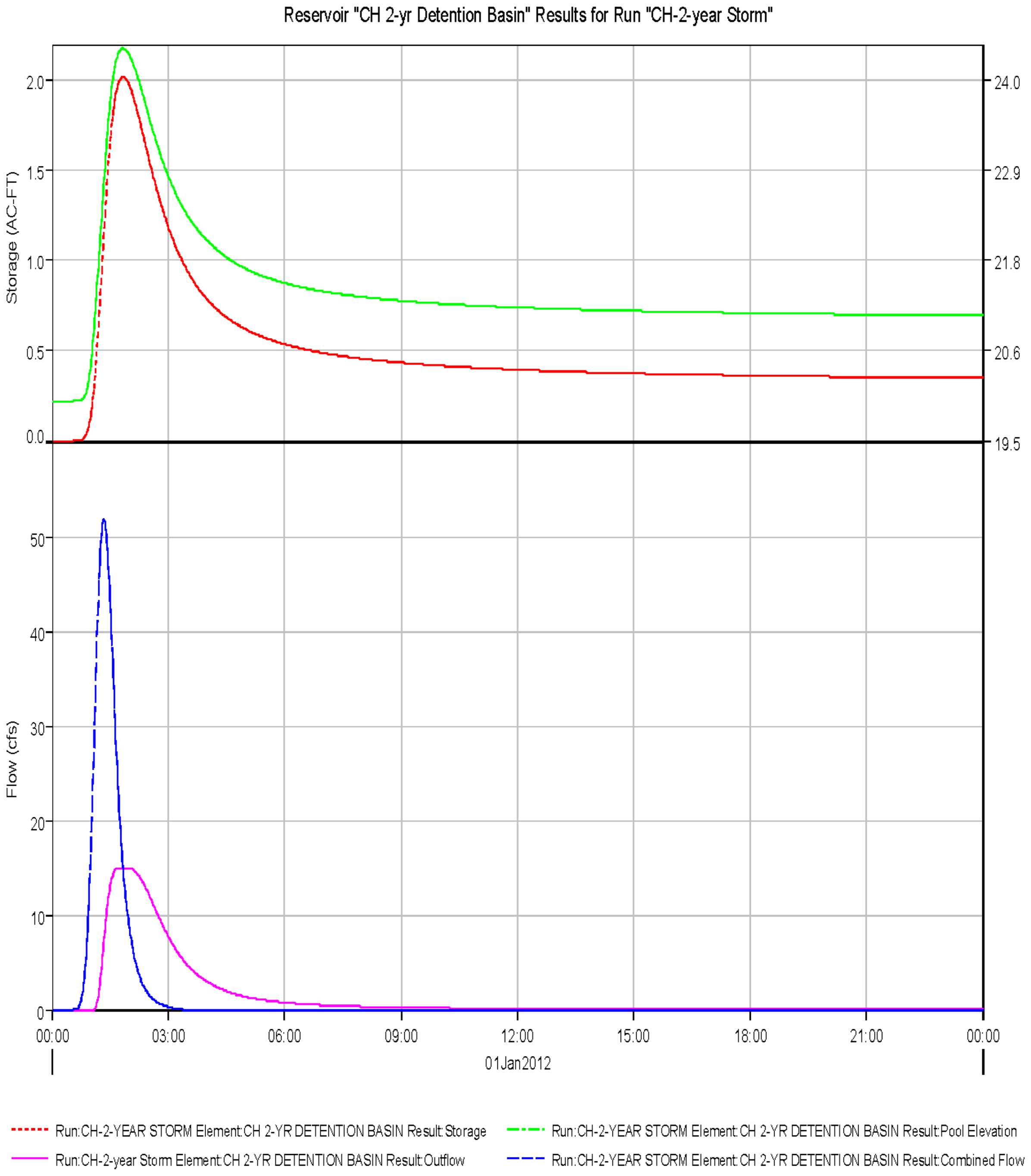
| | |
|---|---|
| Pipe: | RCP culvert (end-section conforming to fill) |
| Diameter: | 18 in |
| Length: | 750 ft |
| Inlet Elevation: | 21.00 ft |
| Outlet Elevation: | 7.00 ft |
| Entrance Coefficient: | 0.500 |
| Slope: | 0.0187 |
| Outlet Coefficient: | 0.900 |
| Mannings n: | 0.013 |

## B.3 HEC-HMS Simulation:

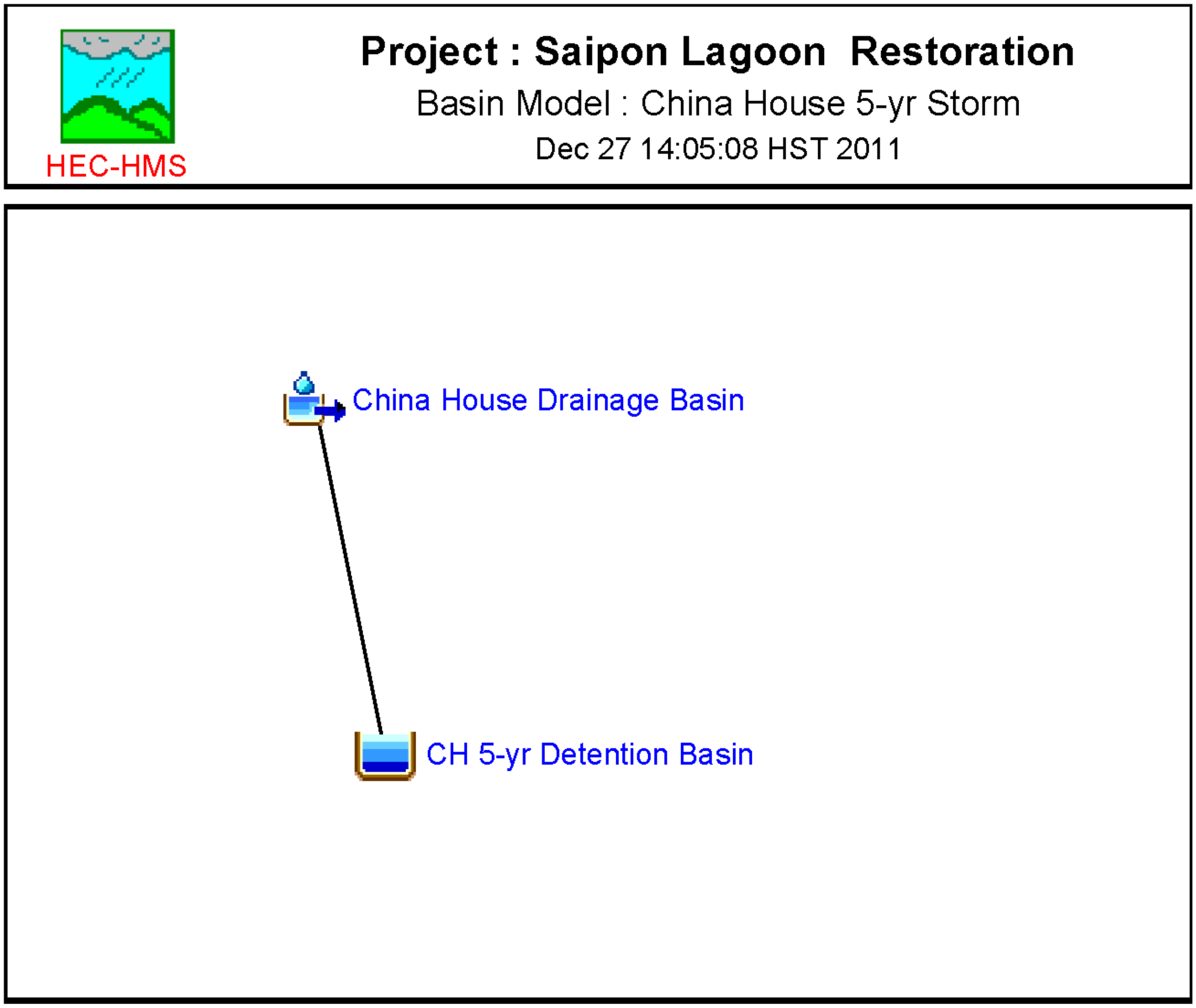
| | |
|---|---|
| Simulation Run: | CH 2-year Storm |
| Subbasin: | CH Drainage Basin |
| Meteorologic Model: | 2-year / 1 hour Storm |
| Control Specification: | Control -24-hour |

| Computed Results | | | |
|---|---|---|---|
| **Peak Inflow:** | **51.9 (cfs)** | **Time of Peak Inflow:** | **01:20** |
| **Peak Outflow:** | **15.0 (cfs)** | **Time of Peak Outflow:** | **02:01** |
| **Total Inflow:** | **3.0 (ac-ft)** | **Peak Storage:** | **2.0 (ac-ft)** |
| **Total Outflow:** | **2.6 (ac-ft)** | **Peak Elevation:** | **24.4 (ft)** |

## B.4 Hydrograph



# *5. China House Site: 5-Year Storm Event*



HEC-HMS

**Project : Saipon Lagoon Restoration**

Basin Model : China House 5-yr Storm

Dec 27 14:05:08 HST 2011

# A. China House Drainage Basin:

## A.1 Basin Model:

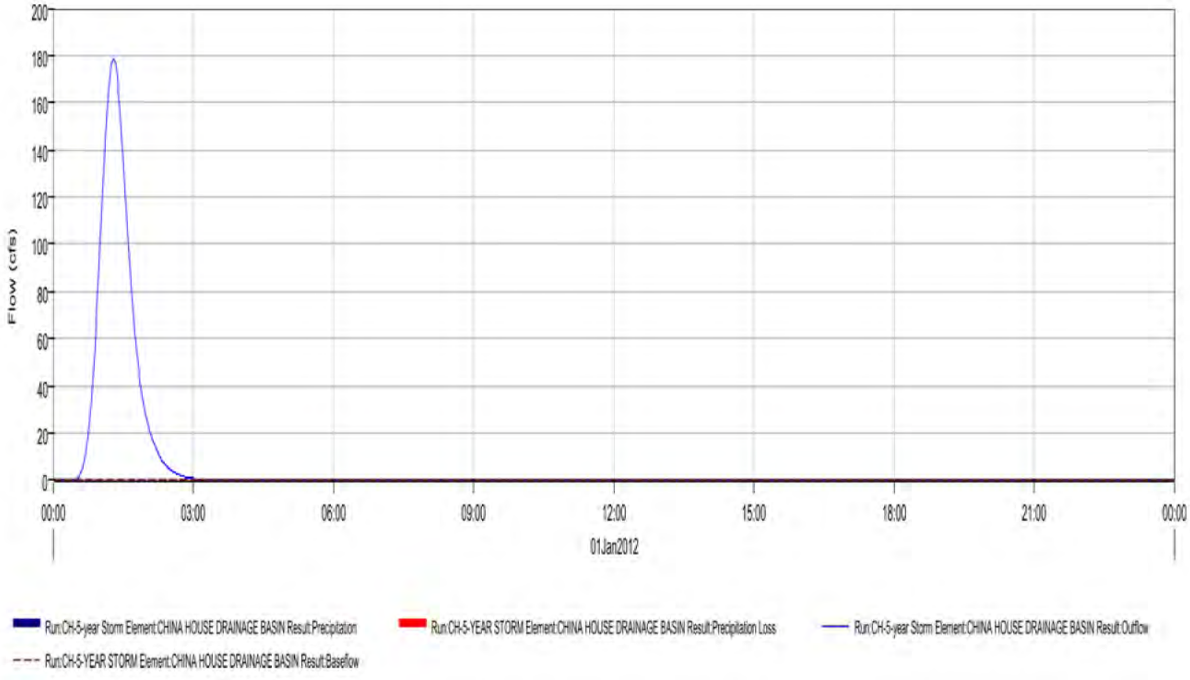
| | |
|---|---|
| Area: | 344 ac (0.5375 $mi^2$) |
| CN: | 68 |
| Tc: | 28.2 min |
| Rainfall 5-year/1 hour: | 2.61 in |
| Loss Method: | SCS Curve Number |
| Transform Method: | SCS Unit Hydrograph |

## A.2 HEC-HMS Simulation Results:

| | |
|---|---|
| Simulation Run: | CH 5-year Storm |
| Subbasin: | CH Drainage Basin |
| Meteorologic Model: | 5-year / 1 hour Storm |
| Control Specification: | Control -24-hour |

| Computed Results | | | |
|---|---|---|---|
| **Peak Discharge:** | **178.6 (cfs)** | **Time of Peak Discharge:** | **01:17** |
| **Total Precipitation:** | **71.6 (ac-ft)** | **Total Direct Runoff:** | **11.1 (ac-ft)** |
| **Total Loss:** | **60.5 (ac-ft)** | **Total Baseflow:** | **0.0 (ac-ft)** |
| **Total Excess:** | **11.1 (ac-ft)** | **Discharge:** | **11.1 (ac-ft)** |

## A3. Hydrograph



# B. China House 5-Year Detention Basin:

## B.1 Detention Basin Design:

| Elevation (ft) | Surf. Area (ac) | Increment Storage (ac-ft) | Cumulative Storage (ac-ft) |
|---|---|---|---|
| 19.00 | 0.190 | 0.000 | 0.000 |
| 20.00 | 0.740 | 0.465 | 0.465 |
| 21.00 | 1.310 | 1.025 | 1.490 |
| 22.00 | 1.360 | 1.335 | 2.825 |
| 24.00 | 1.450 | 2.810 | 5.635 |
| 26.00 | 1.550 | 3.000 | 8.635 |
| 28.00 | 1.650 | 3.200 | 11.835 |
| 29.00 | 1.760 | 1.705 | 13.540 |

## B.2 Outlet Design:

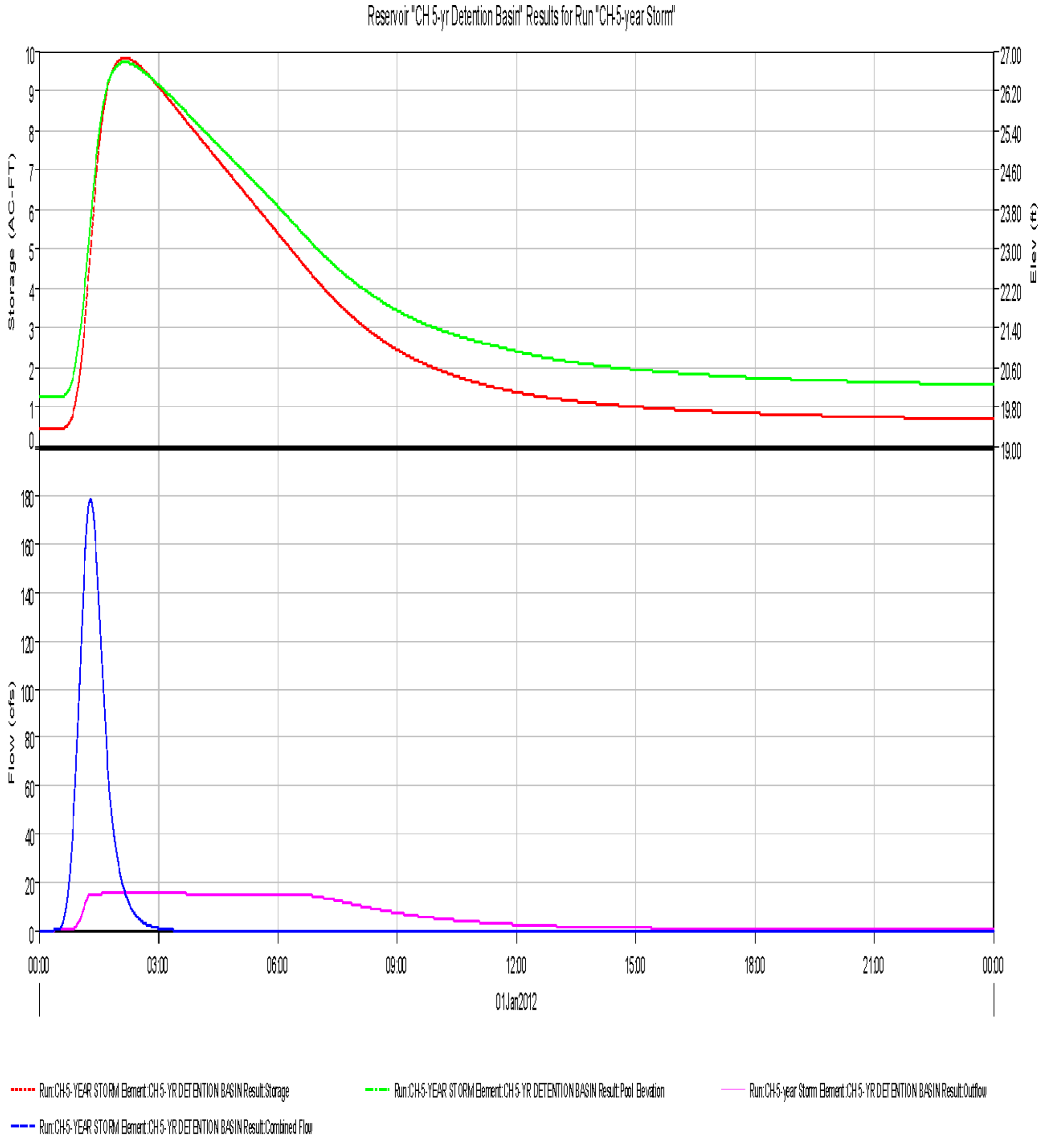
| | |
|---|---|
| Pipe: | RCP culvert (end-section conforming to fill) |
| Diameter: | 18 in |
| Length: | 750 ft |
| Inlet Elevation: | 20.00 ft |
| Outlet Elevation: | 7.00 ft |
| Entrance Coefficient: | 0.500 |
| Slope: | 0.0173 |
| Outlet Coefficient: | 0.900 |
| Mannings n: | 0.013 |

## B.3 HEC-HMS Simulation:

| | |
|---|---|
| Simulation Run: | CH 5-year Storm |
| Subbasin: | CH Drainage Basin |
| Meteorologic Model: | 5-year / 1 hour Storm |
| Control Specification: | Control -24-hour |

| Computed Results | | | |
|---|---|---|---|
| **Peak Inflow:** | **178.6 (cfs)** | **Time of Peak Inflow:** | **01:17** |
| **Peak Outflow:** | **15.6 (cfs)** | **Time of Peak Outflow:** | **02:09** |
| **Total Inflow:** | **11.1 (ac-ft)** | **Peak Storage:** | **9.8 (ac-ft)** |
| **Total Outflow:** | **10.9 (ac-ft)** | **Peak Elevation:** | **26.8 (ft)** |

## B.4 Hydrograph



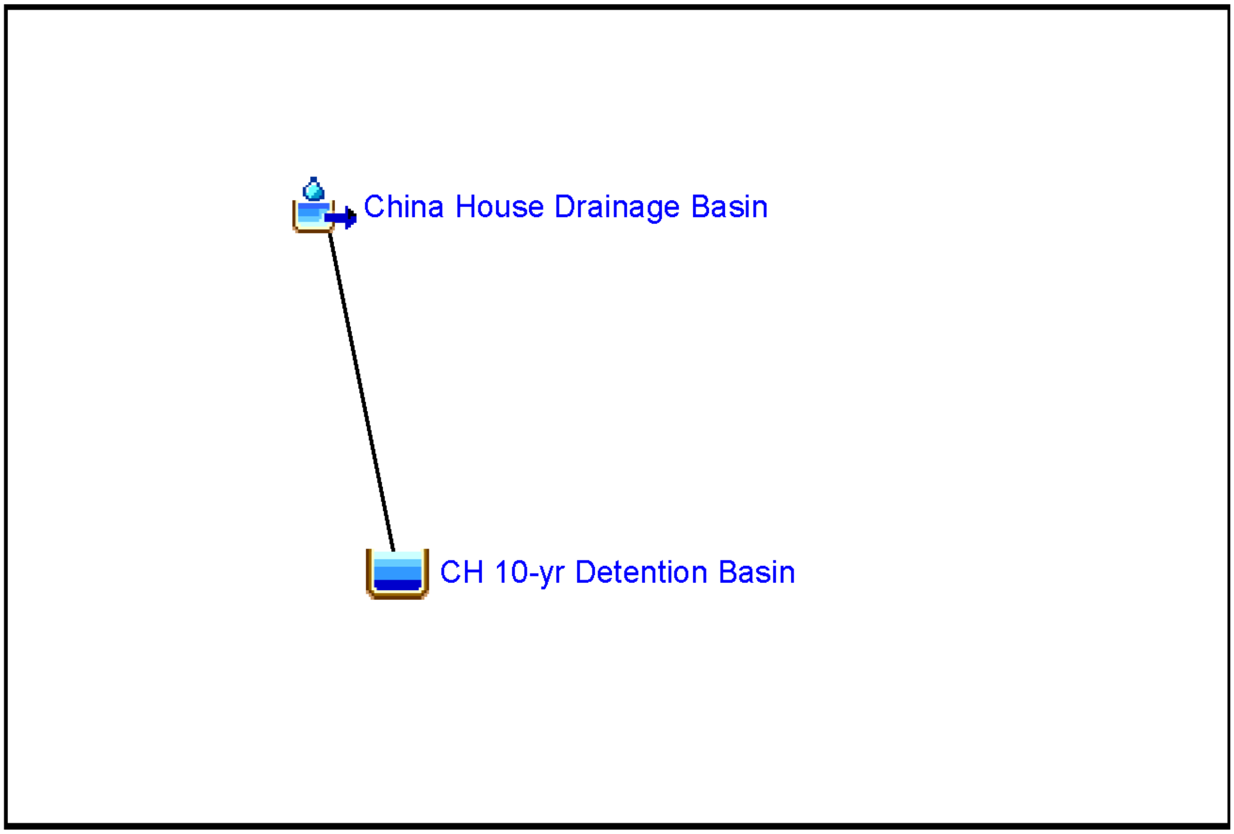
# *6. China House Site: 10-Year Storm Event*

HEC-HMS

**Project : Saipon Lagoon Restoration**

Basin Model : China House 10-yr Storm

Dec 27 11:56:18 HST 2011



# A.China House Drainage Basin:

## A.1 Basin Model:

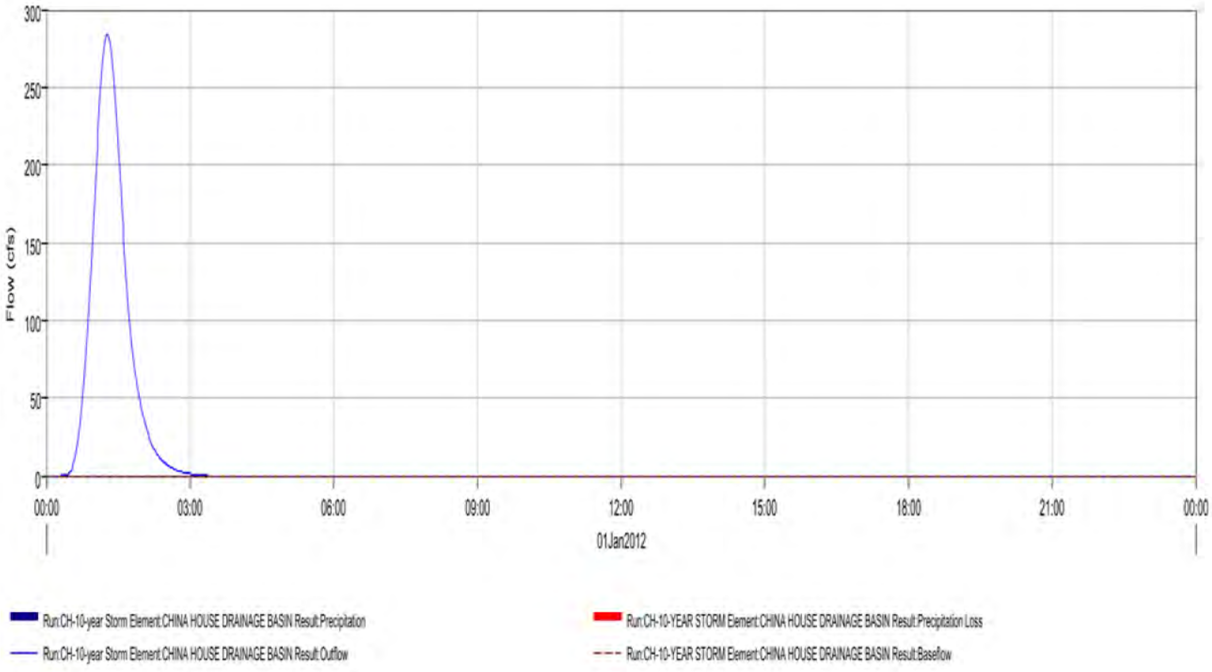
| | |
|---|---|
| Area: | 344 ac (0.5375 mi$^2$) |
| CN: | 68 |
| Tc: | 28.2 min |
| Rainfall 10-year/1 hour: | 3.06 in |
| Loss Method: | SCS Curve Number |
| Transform Method: | SCS Unit Hydrograph |

## A.2 HEC-HMS Simulation Results:

| | |
|---|---|
| Simulation Run: | CH 10-year Storm |
| Subbasin: | CH Drainage Basin |
| Meteorologic Model: | 10-year / 1 hour Storm |
| Control Specification: | Control -24-hour |

| Computed Results | | | |
|---|---|---|---|
| **Peak Discharge:** | **284.0 (cfs)** | **Time of Peak Discharge:** | **01:17** |
| **Total Precipitation:** | **86.6 (ac-ft)** | **Total Direct Runoff:** | **18.3 (ac-ft)** |
| **Total Loss:** | **68.3 (ac-ft)** | **Total Baseflow:** | **0.0 (ac-ft)** |
| **Total Excess:** | **18.3 (ac-ft)** | **Discharge:** | **18.3 (ac-ft)** |

## A3. Hydrograph



# B. China House 10-Year Detention Basin:

## B.1 Detention Basin Design:

| Elevation (ft) | Surf. Area (ac) | Increment Storage (ac-ft) | Cumulative Storage (ac-ft) |
|---|---|---|---|
| 18.00 | 0.001 | 0.000 | 0.000 |
| 19.00 | 0.191 | 0.096 | 0.096 |
| 20.00 | 0.743 | 0.467 | 0.563 |
| 21.00 | 1.312 | 1.028 | 1.590 |
| 22.00 | 1.412 | 1.362 | 2.953 |
| 24.00 | 1.509 | 2.921 | 5.873 |
| 26.00 | 1.609 | 3.118 | 8.992 |
| 28.00 | 1.711 | 3.320 | 12.312 |
| 29.00 | 1.764 | 1.737 | 14.049 |
| 30.00 | 1.817 | 1.790 | 15.839 |

## B.2 Outlet Design:

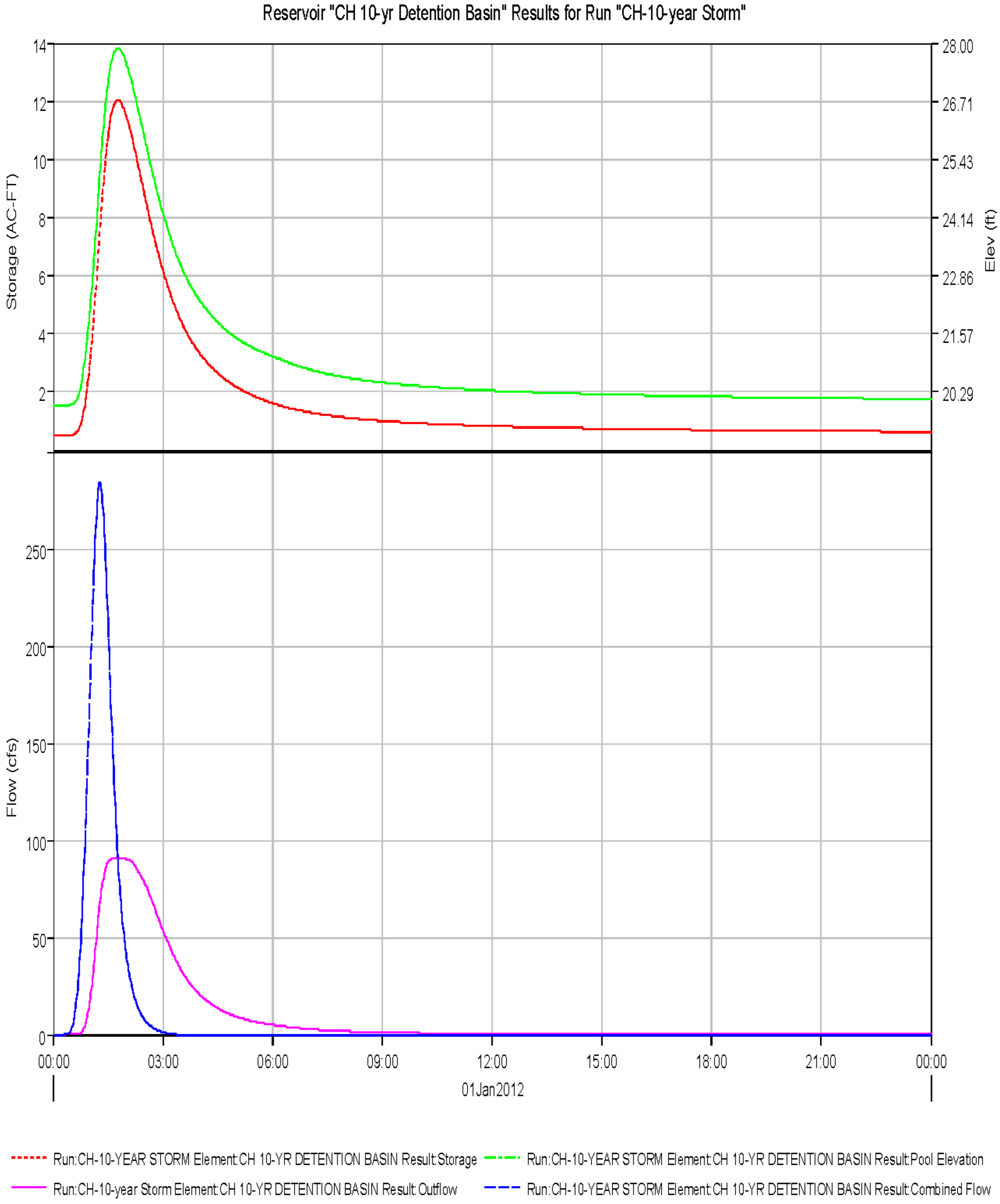
| | |
|---|---|
| Pipe: | RCP culvert (end-section conforming to fill) |
| Diameter: | 36 in |
| Length: | 750 ft |
| Inlet Elevation: | 20.00 ft |
| Outlet Elevation: | 7.00 ft |
| Entrance Coefficient: | 0.500 |
| Slope: | 0.0173 |
| Outlet Coefficient: | 0.900 |
| Mannings n: | 0.013 |

## B.3 HEC-HMS Simulation:

| | |
|---|---|
| Simulation Run: | CH 10-year Storm |
| Subbasin: | CH Drainage Basin |
| Meteorologic Model: | 10-year / 1 hour Storm |
| Control Specification: | Control -24-hour |

| Computed Results | | | |
|---|---|---|---|
| **Peak Inflow:** | **284.0 (cfs)** | **Time of Peak Inflow:** | **01:17** |
| **Peak Outflow:** | **91.1 (cfs)** | **Time of Peak Outflow:** | **01:46** |
| **Total Inflow:** | **18.3 (ac-ft)** | **Peak Storage:** | **12.0 (ac-ft)** |
| **Total Outflow:** | **18.1 (ac-ft)** | **Peak Elevation:** | **27.9 (ft)** |

## B.4 Hydrograph



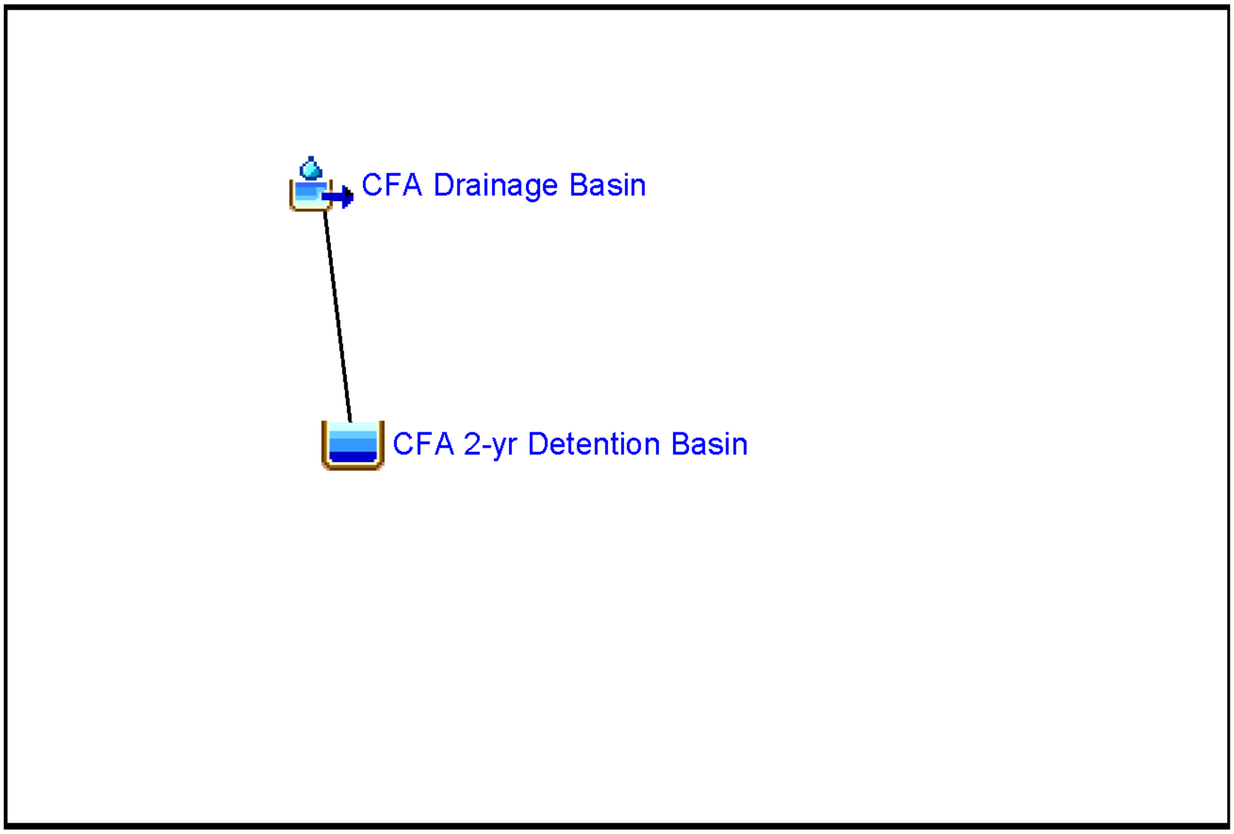
# *7. Cock Fight Arena Site: 2-Year Storm Event*

HEC-HMS

**Project : Saipon Lagoon Restoration**

Basin Model : Cock Fight Arena 2-yr Storm

Dec 27 14:28:22 HST 2011



# A.Cock Fight Arena Drainage Basin:

## A.1 Basin Model:

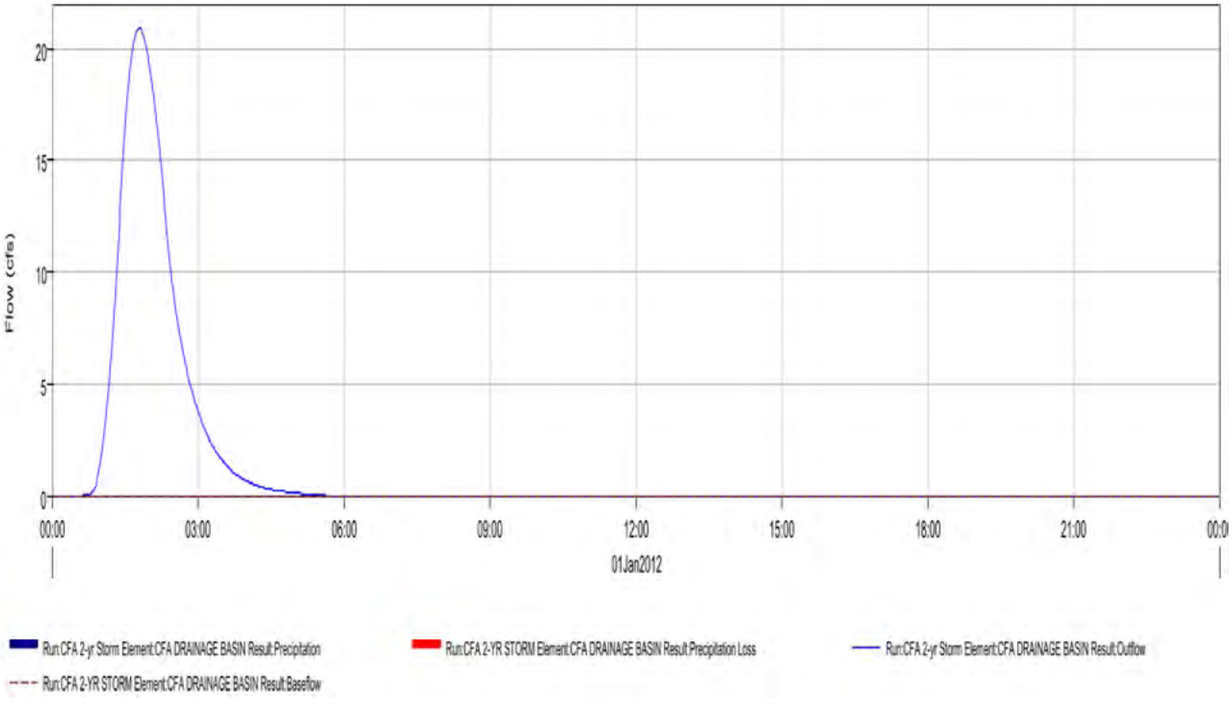
| | |
|---|---|
| Area: | 412.69 ac (0.6448 mi$^2$) |
| CN: | 65 |
| Tc: | 55.2 min |
| Rainfall 2-year/1 hour: | 1.93 in |
| Loss Method: | SCS Curve Number |
| Transform Method: | SCS Unit Hydrograph |

## A.2 HEC-HMS Simulation Results:

| | |
|---|---|
| Simulation Run: | CFA 2-year Storm |
| Subbasin: | CFA Drainage Basin |
| Meteorologic Model: | 2-year / 1 hour Storm |
| Control Specification: | Control -24-hour |

| Computed Results | | | |
|---|---|---|---|
| **Peak Discharge:** | **20.9 (cfs)** | **Time of Peak Discharge:** | **01:48** |
| **Total Precipitation:** | **58.2 (ac-ft)** | **Total Direct Runoff:** | **2.2 (ac-ft)** |
| **Total Loss:** | **56.0 (ac-ft)** | **Total Baseflow:** | **0.0 (ac-ft)** |
| **Total Excess:** | **2.2 (ac-ft)** | **Discharge:** | **2.2 (ac-ft)** |

## A3. Hydrograph



# B. Cock Fight Arena 2-Year Detention Basin:

## B.1 Detention Basin Design:

| Elevation (ft) | Surf. Area (ac) | Increment Storage (ac-ft) | Cumulative Storage (ac-ft) |
|---|---|---|---|
| 37.00 | 0.010 | 0.000 | 0.000 |
| 40.00 | 0.970 | 1.470 | 1.470 |
| 45.00 | 3.180 | 10.375 | 11.845 |

## B.2 Outlet Design:

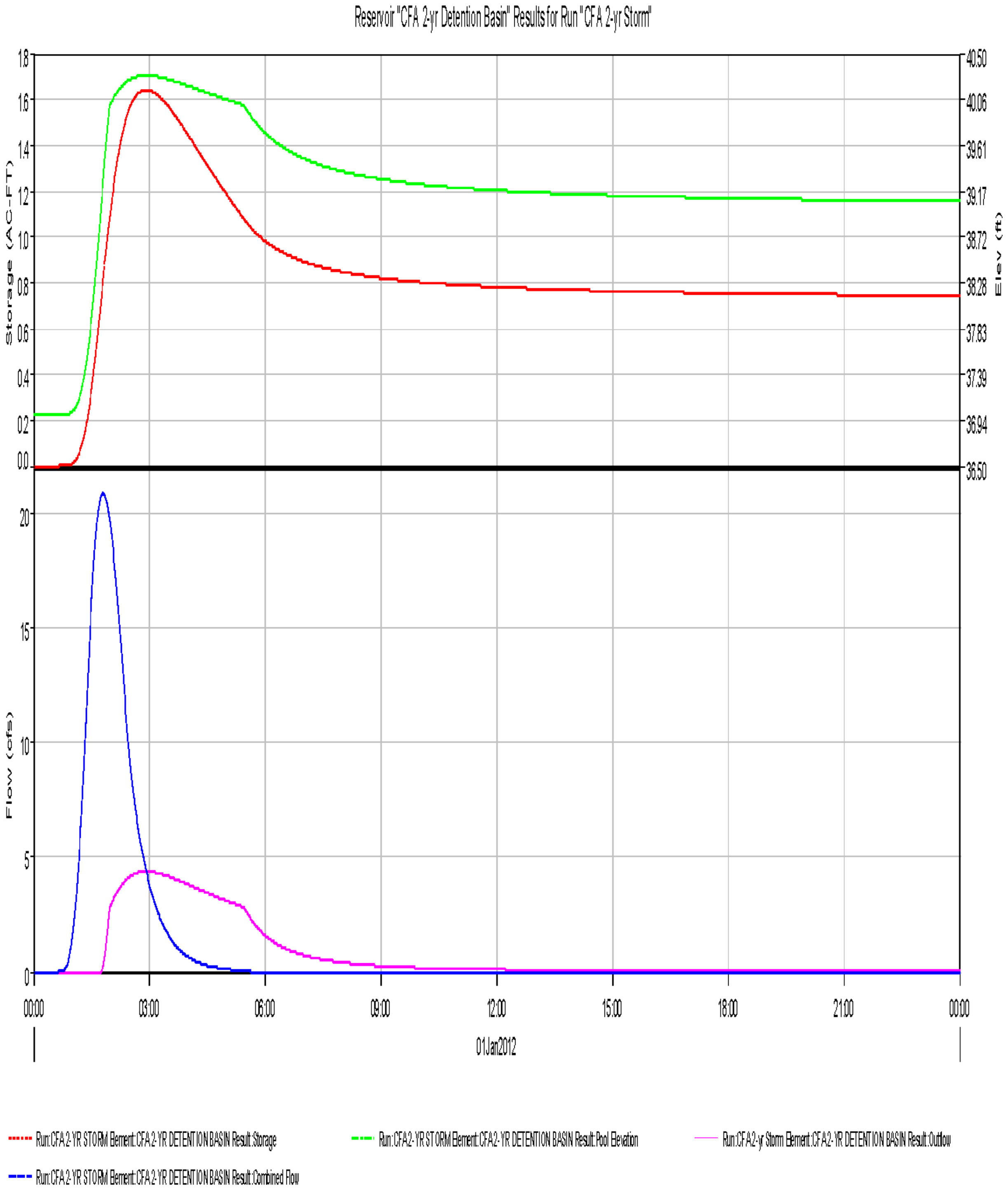
| | |
|---|---|
| Pipe: | RCP culvert (end-section conforming to fill) |
| Diameter: | 18 in |
| Length: | 2,200 ft |
| Inlet Elevation: | 39.00 ft |
| Outlet Elevation: | 7.00 ft |
| Entrance Coefficient: | 0.500 |
| Slope: | 0.0155 |
| Outlet Coefficient: | 0.900 |
| Mannings n: | 0.013 |

## B.3 HEC-HMS Simulation:

| | |
|---|---|
| Simulation Run: | CFA 2-year Storm |
| Subbasin: | CFA Drainage Basin |
| Meteorologic Model: | 2-year / 1 hour Storm |
| Control Specification: | Control -24-hour |

| Computed Results | | | |
|---|---|---|---|
| **Peak Inflow:** | **20.9 (cfs)** | **Time of Peak Inflow:** | **01:48** |
| **Peak Outflow:** | **4.4 (cfs)** | **Time of Peak Outflow:** | **02:55** |
| **Total Inflow:** | **2.2 (ac-ft)** | **Peak Storage:** | **1.6 (ac-ft)** |
| **Total Outflow:** | **1.4 (ac-ft)** | **Peak Elevation:** | **40.3 (ft)** |

## B.4 Hydrograph



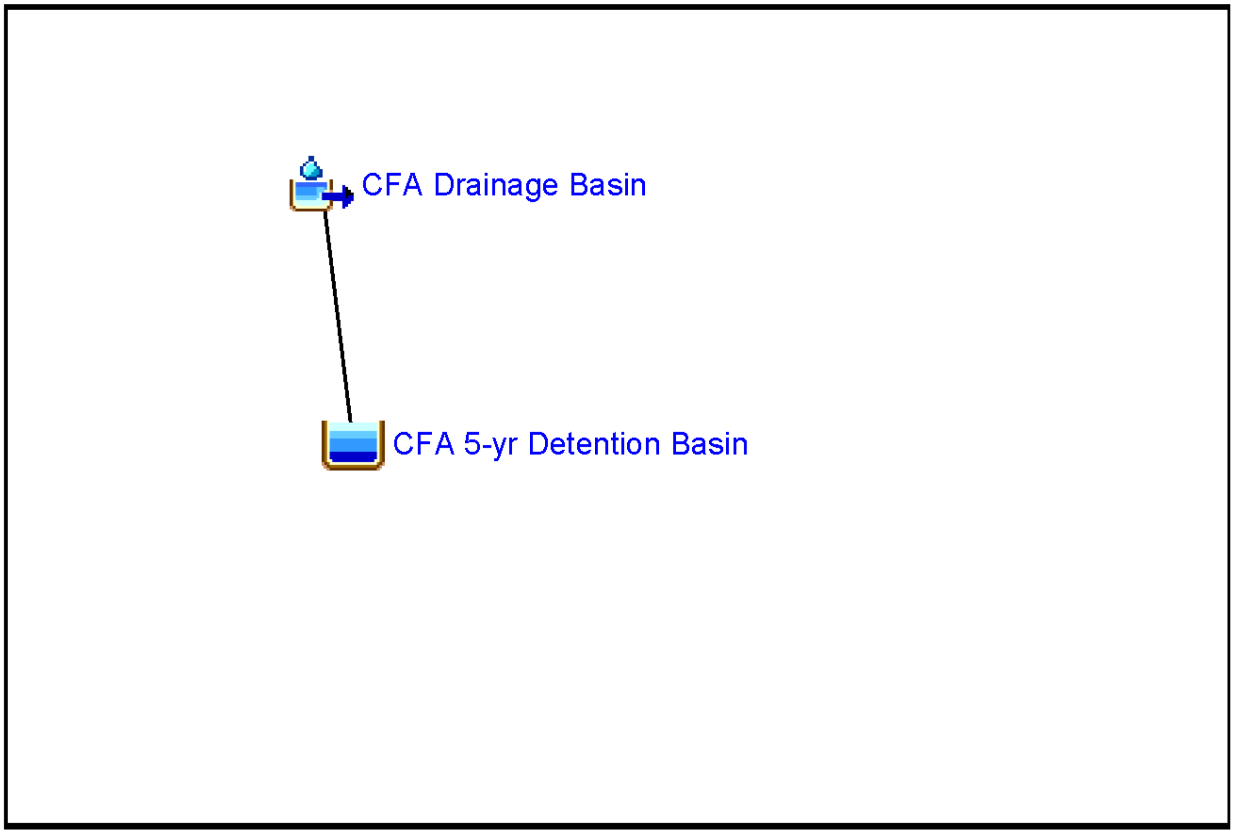
# 8. Cock Fight Arena Site: 5-Year Storm Event

HEC-HMS

**Project : Saipon Lagoon  Restoration**

Basin Model : Cock Fight Arena 5-yr Storm

Dec 27 13:39:27 HST 2011



# A. Cock Fight Arena Drainage Basin:

## A.1 Basin Model:

| | |
|---|---|
| Area: | 412.69 ac (0.6448 $mi^2$) |
| CN: | 65 |
| Tc: | 55.2 min |
| Rainfall 5-year/1 hour: | 2.61 in |
| Loss Method: | SCS Curve Number |
| Transform Method: | SCS Unit Hydrograph |

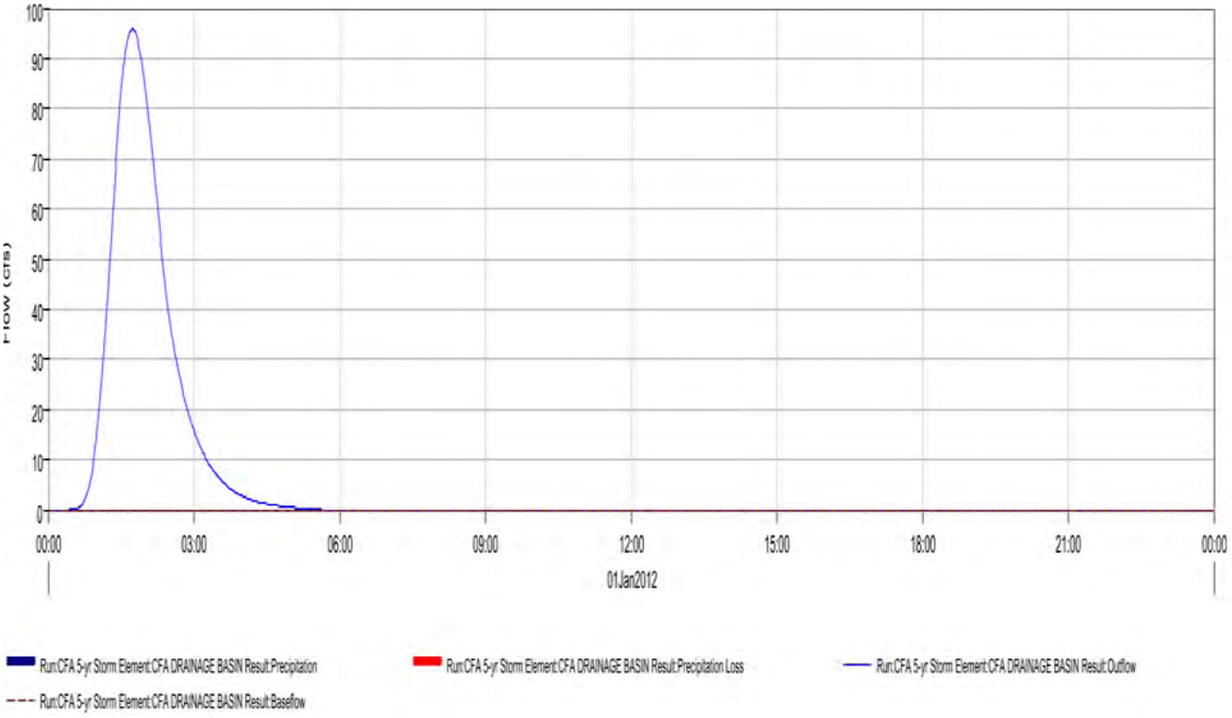
## A.2 HEC-HMS Simulation Results:

Simulation Run: CFA 5-year Storm
Subbasin: CFA Drainage Basin
Meteorologic Model: 5-year / 1 hour Storm
Control Specification: Control -24-hour

| Computed Results | | | |
|---|---|---|---|
| **Peak Discharge:** | **95.9 (cfs)** | **Time of Peak Discharge:** | **01:44** |
| **Total Precipitation:** | **85.9 (ac-ft)** | **Total Direct Runoff:** | **10.2 (ac-ft)** |
| **Total Loss:** | **75.7 (ac-ft)** | **Total Baseflow:** | **0.0 (ac-ft)** |
| **Total Excess:** | **10.2 (ac-ft)** | **Discharge:** | **10.2 (ac-ft)** |

## A3. Hydrograph

Cock Fight Arena -5-Year Storm



# B. Cock Fight Arena 5-Year Detention Basin:

## B.1 Detention Basin Design:

| Elevation (ft) | Surf. Area (ac) | Increment Storage (ac-ft) | Cumulative Storage (ac-ft) |
|---|---|---|---|
| 37.00 | 0.010 | 0.000 | 0.000 |
| 40.00 | 0.970 | 1.470 | 1.470 |
| 45.00 | 3.180 | 10.375 | 11.845 |

## B.2 Outlet Design:

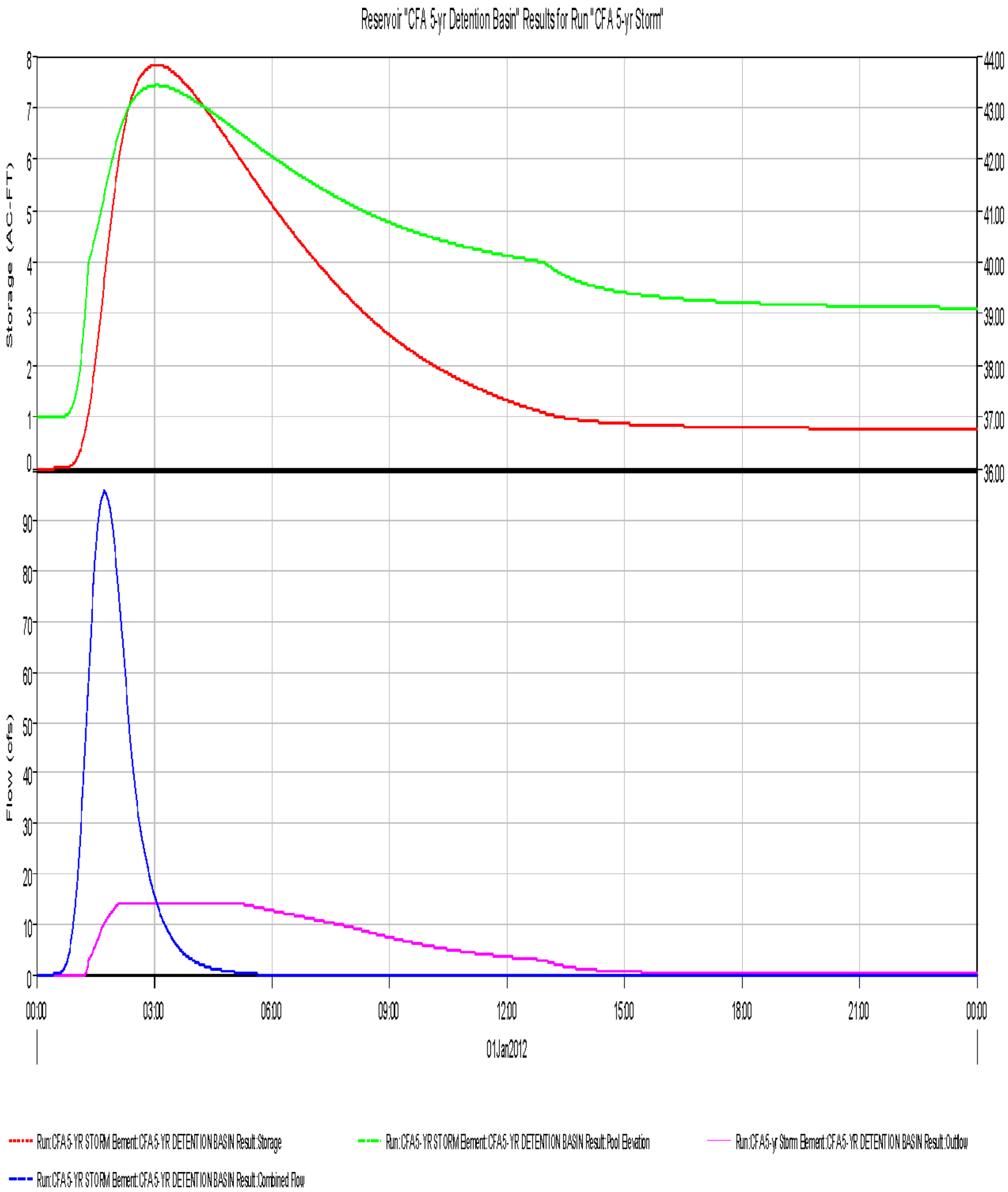
| | |
|---|---|
| Pipe: | RCP culvert (end-section conforming to fill) |
| Diameter: | 18 in |
| Length: | 2,200 ft |
| Inlet Elevation: | 39.00 ft |
| Outlet Elevation: | 7.00 ft |
| Entrance Coefficient: | 0.500 |
| Slope: | 0.0155 |
| Outlet Coefficient: | 0.900 |
| Mannings n: | 0.013 |

## B.3 HEC-HMS Simulation:

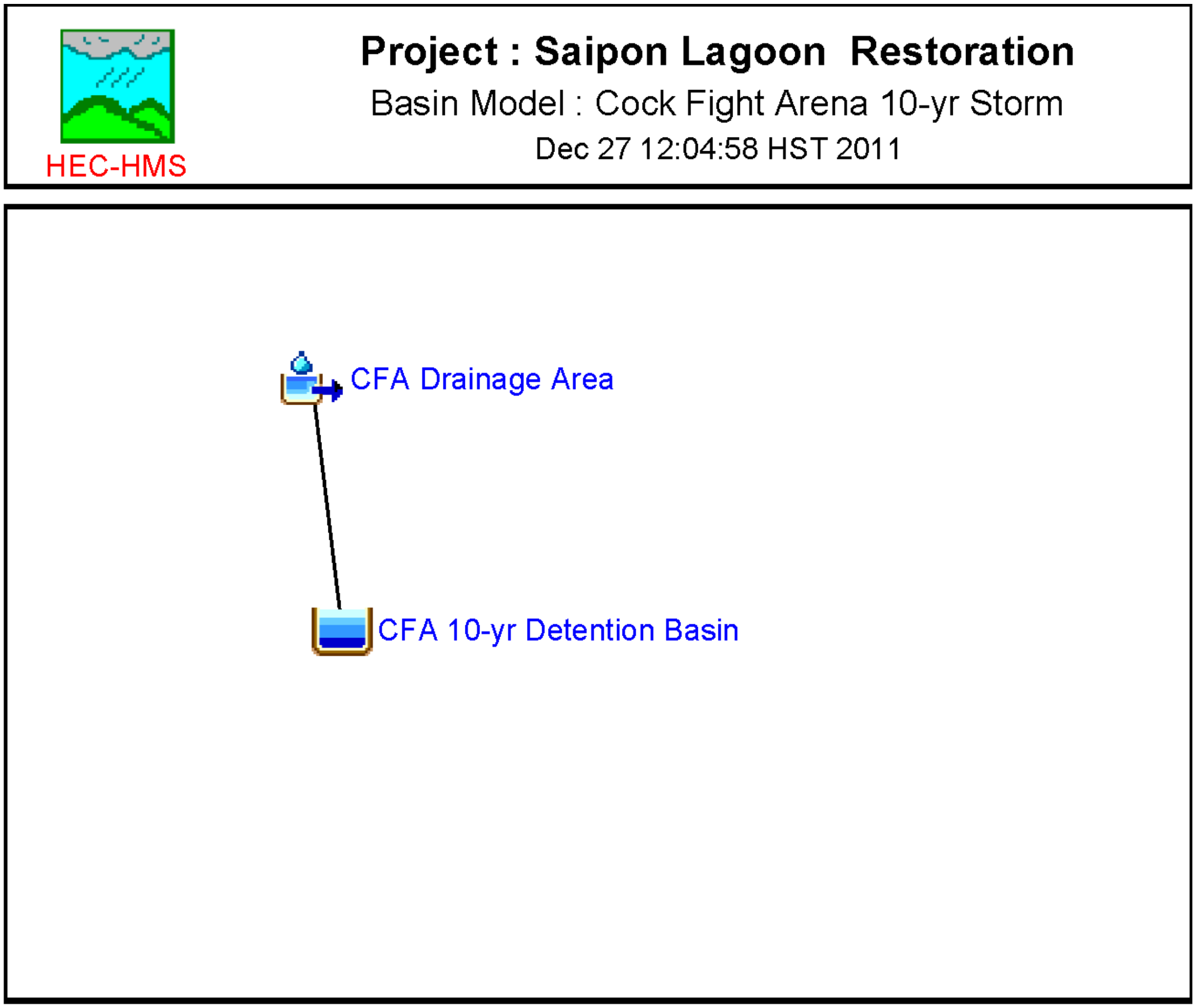
| | |
|---|---|
| Simulation Run: | CFA 5-year Storm |
| Subbasin: | CFA Drainage Basin |
| Meteorologic Model: | 5-year / 1 hour Storm |
| Control Specification: | Control -24-hour |

| Computed Results | | | |
|---|---|---|---|
| **Peak Inflow:** | **95.9 (cfs)** | **Time of Peak Inflow:** | **01:44** |
| **Peak Outflow:** | **14.0 (cfs)** | **Time of Peak Outflow:** | **05:01** |
| **Total Inflow:** | **10.2 (ac-ft)** | **Peak Storage:** | **7.8 (ac-ft)** |
| **Total Outflow:** | **9.4 (ac-ft)** | **Peak Elevation:** | **43.4 (ft)** |

## B.4 Hydrograph



# *9. Cock Fight Arena Site: 10-Year Storm Event*



HEC-HMS

**Project : Saipon Lagoon Restoration**

Basin Model : Cock Fight Arena 10-yr Storm

Dec 27 12:04:58 HST 2011

# A. Cock Fight Arena Drainage Basin:

## A.1 Basin Model:

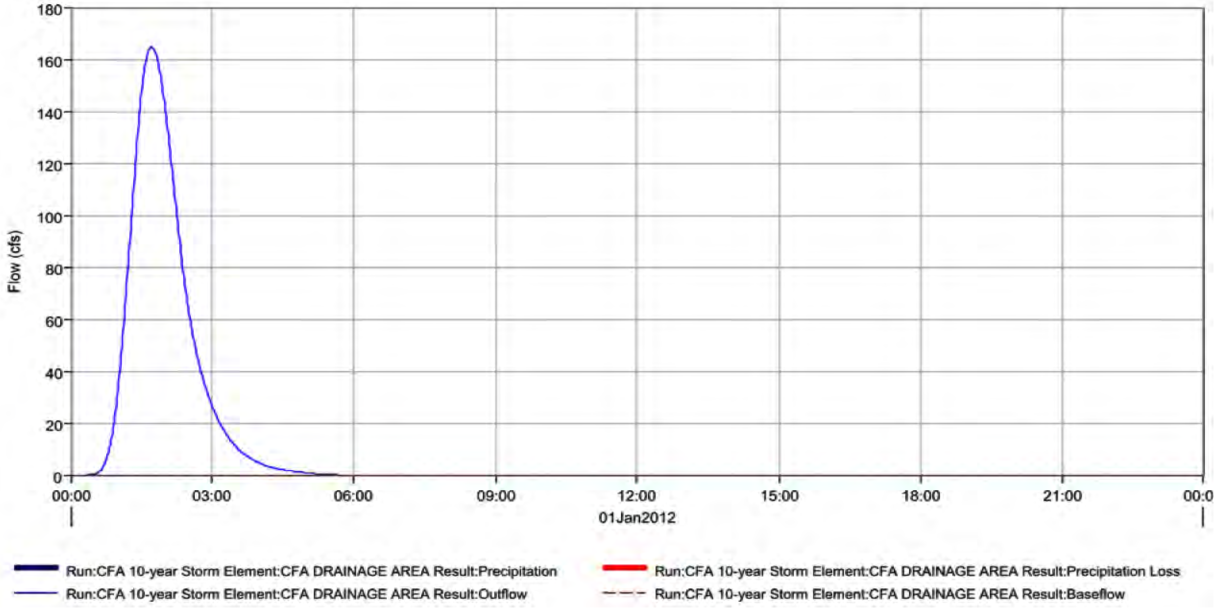
| | |
|---|---|
| Area: | 412.69 ac (0.6448 mi$^2$) |
| CN: | 65 |
| Tc: | 55.2 min |
| Rainfall 10-year/1 hour: | 3.06 in |
| Loss Method: | SCS Curve Number |
| Transform Method: | SCS Unit Hydrograph |

## A.2 HEC-HMS Simulation Results:

| | |
|---|---|
| Simulation Run: | CFA 10-year Storm |
| Subbasin: | CFA Drainage Basin |
| Meteorologic Model: | 10-year / 1 hour Storm |
| Control Specification: | Control -24-hour |

| Computed Results | | | |
|---|---|---|---|
| **Peak Discharge:** | **164.7 (cfs)** | **Time of Peak Discharge:** | **01:43** |
| **Total Precipitation:** | **103.8 (ac-ft)** | **Total Direct Runoff:** | **17.7 (ac-ft)** |
| **Total Loss:** | **86.1 (ac-ft)** | **Total Baseflow:** | **0.0 (ac-ft)** |
| **Total Excess:** | **17.7 (ac-ft)** | **Discharge:** | **17.7 (ac-ft)** |

## A3. Hydrograph



# A. Cock Fight Arena 10-Year Detention Basin:

## B.1 Detention Basin Design:

| Elevation (ft) | Surf. Area (ac) | Increment Storage (ac-ft) | Cumulative Storage (ac-ft) |
|---|---|---|---|
| 37.00 | 0.010 | 0.000 | 0.000 |
| 38.00 | 0.240 | 0.125 | 0.125 |
| 39.00 | 0.869 | 0.555 | 0.680 |
| 40.00 | 1.722 | 1.296 | 1.975 |
| 45.00 | 3.180 | 12.255 | 14.230 |

## B.2 Outlet Design:

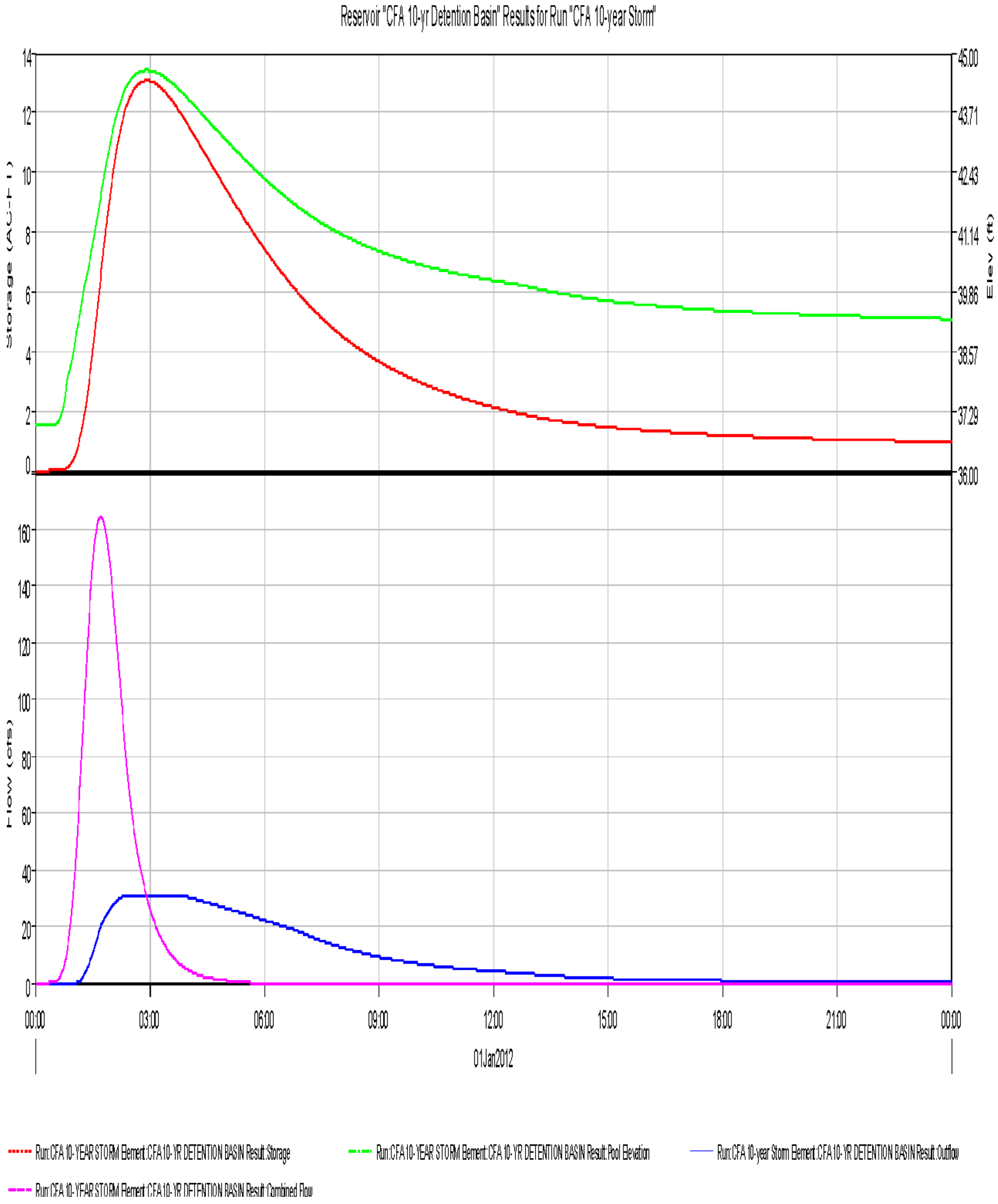
| | |
|---|---|
| Pipe: | RCP culvert (end-section conforming to fill) |
| Diameter: | 24 in |
| Length: | 2,200 ft |
| Inlet Elevation: | 39.00 ft |
| Outlet Elevation: | 7.00 ft |
| Entrance Coefficient: | 0.500 |
| Slope: | 0.0155 |
| Outlet Coefficient: | 0.900 |
| Mannings n: | 0.013 |

## B.3 HEC-HMS Simulation:

| | |
|---|---|
| Simulation Run: | CFA 10-year Storm |
| Subbasin: | CFA Drainage Basin |
| Meteorologic Model: | 10-year / 1 hour Storm |
| Control Specification: | Control -24-hour |

| Computed Results | | | |
|---|---|---|---|
| **Peak Inflow:** | **164.7 (cfs)** | **Time of Peak Inflow:** | **01:43** |
| **Peak Outflow:** | **30.3 (cfs)** | **Time of Peak Outflow:** | **03.55** |
| **Total Inflow:** | **17.7 (ac-ft)** | **Peak Storage:** | **13.1 (ac-ft)** |
| **Total Outflow:** | **16.7 (ac-ft)** | **Peak Elevation:** | **44.6 (ft)** |

## B.4 Hydrograph



# *Appendix G*
# *Real Estate Planning Report*

# Real Estate Planning Report

## Section 206 Continuing Authorities Program

## Aquatic Ecosystem Restoration Study
## Saipan Lagoon

## Saipan, Commonwealth of Northern Marianas Islands

**Prepared for**
**Honolulu District, USACE**

**Prepared by**
**Jim Doing, Real Estate Appraiser, HQ, RAO**
**2 October 2012**

# TABLE OF CONTENTS

Addenda

# EXECUTIVE SUMMARY

Numerous studies have been conducted throughout the island and the study area by various US agencies as well as the CNMI over the last few years. A phase I Aquatic Ecosystem Restoration study was conducted in June 2001 by Environet, Inc., under contract to USACE. A draft ERR was also prepared by the same company in June 2001, and they are currently working on a final ERR for 2012. The subject study is a continuing authorizes program authorized under section 206 of the Water Resources Development Act of 1996, and the purpose of this report is support the real estate requirements for a proposed project. At present the final alternative has not been defined and as such three alternative sites are valued with three flood frequency levels.

The study area involves approximately 2 miles of Lagoon along the west side of Saipan from about Fishing Base to Quartermaster Road. Three potential sites have been identified as well as the project features associated with those sites. The three sites from north to south are the Cock Fight Arena site, China House site, and Quartermaster Road site. Each site requires a retention basin and outlet works as the primary features. Two of the sites front on public roads and have readily available access for the project. China House site will require acquisition of adequate access. The specific route of this access has not been determined but has been estimated for planning purposes. A temporary staging area will be required and has been estimated for each site. There will be no requirement for disposal as this will be handled by a public land fill site.

The non-Federal sponsor is the CNMI government. They have not been assessed as to their acquisition capabilities but are believed to be fully capable. Per guidance, the CNMI will need to acquire the LERRD's for the project that they do not currently own. The estimated real estate costs for each of the sites is as follows:

Cock Fight Arena (all flood frequencies) = $1,012,000
China House (all flood frequencies) = $ 589,200
Quartermaster (2 year event) = $ 431,000
( 5 year event) = $ 578,700
(10 year event) = $ 817,700

The information provided in this report meets the requirements of EC 405-1-11.

## 1. AUTHORITY/PURPOSE

The study is being investigated under the authority of Section 206 of the 1996 Water Resources Development Act (WRDA), as amended. Section 206 authorizes the Secretary of the Army to carry out a program of aquatic ecosystem restoration with the objective of restoring degraded ecosystem structure, function, and dynamic processes to a less degraded, more natural condition, considering the ecosystem's natural integrity, productivity, stability and biological diversity. This authority is primarily used for manipulation of the hydrology in and along bodies of water, including wetlands and riparian areas. It is a Continuing Authorities Program (CAP), which focuses on water resource related projects that are relatively small in terms of scope, cost and complexity.

The Commonwealth of Northern Marianas Islands (CNMI) has requested the assistance of USACE in determining a cost effective means to improve the aquatic ecosystem of the Saipan Lagoon from approximately the Fishing Base in Garapan to Quartermaster Road to the south.   A phase I report has been prepared and an Environmental Restoration Report was originally prepared in 2007 and is currently being updated to 2012. Currently the study is in the Plan Formulation Stage in preparation of a selected NER plan for implementation.

This REPR will be included as a part of the Engineering Documentation Report and will be encompassed in the cost estimate for determination of the selected plan.

## 2. DESCRIPTION

The proposed project is located along an approximate 2 mile stretch of lagoon along the west side of Saipan from about Fishing Base to Quartermaster Road.  The project area involves three low lying areas in the West Takapochao watershed; the cockfight arena site; the China House site and the Quartermaster Road site.  These three sites encompass a large watershed drainage area in the mountains above the sites.

Middle Street provides the primary north/south access through the area and is a major traffic arterial.  The cockfight arena site and the Quartermaster Road site front on Middle Street and the China House site is approximately mid was between Middle Street and Beach Road.  The area is characterized as mixed urban and rural with commercial usage along Middle Street.  The mountainous area above Middle Street is most undeveloped but with a scattering of residential development.

Climate is summarized as warm and humid and the study area has an average rainfall of 75 to 80 inches per year.

Topography is generally level to slightly sloping and all three sites tend to flood during heavy rainfall.  Drainage is not well defined and most of the runoff is on the surface.

The ownerships impacted and required for acquisition of the fee interest for the three sites are as follows:

| Parcel | Owner | Area in Square Meters | | |
|---|---|---|---|---|
| Cockfight Arena Site: | | | | |
| 25-4 | Unknown | 10,080 | | |
| EA 693-2 | Unknown | 1,140 | | |
| 078 D01 | Unknown | 5,378 | | |
| Total | | 16,598 | | |
| China House Site: | | | | |
| 1833 | Unknown | 12,550 | | |
| Quartermaster Road Site: | | 2 YR. | 5 YR. | 10 YR. |
| 1826-4 | Unknown | 1,507 | 1,507 | 1,507 |
| 1826-R1 | Unknown | 2,000 | 3,780 | 6,113 |
| 1822 | Unknown | 946 | 2,000 | 2,500 |
| Total | | 4,453 | 7,287 | 10,120 |

Cockfight arena site is located just east of Middle Road and between Commonwealth Road and Japon Road. The property is improved with the cock fight arena, which is a large approximately 12,500 square foot structure which is in fair condition. It is a minimal functional building and will be acquired and demolished for the project. Parcel 078D01 is an entire acquisition and parcels 25-4 and EA 693-2 are a partial acquisitions. The remainders on the partial acquisition are of sufficient size and have adequate access to eliminate damages. In addition to the site itself, the preliminary plans call for approximately 2,200 lineal feet of 18” RCP for the diversion outlet flow.

China House site is located about midway between Middle Road and Beach Road. There is no direct public access to this property and it is unimproved. The acquisition will involve the entire ownership and there is no anticipated severance damage associated with the acquisition. This acquisition may involve two ownerships but the property is listed as one lot. There is an estimated 1,823 square meters of channel improvement easement required for the out-flow works. This site will also require permanent access, which is estimated from Middle Road and encompasses approximately 972 square meters.

Quartermaster Road site is located at the northwest corner of Middle Road and Quartermaster Road, and it has frontage on both roads. There are no improvements on this site. Parcel 1826-4 is an entire acquisition; parcel 1826-R1 is a partial acquisition of approximately half of the ownership in the 10 year event and the acquisition takes the Middle Street frontage. The remainder is damaged due to a loss of street frontage. Parcel 1822 is an acquisition of a small area of the ownership but it doesn't damage the remaining ownership. This site will require approximately 3,400 square meters for channel improvements to an existing swale.

All of the sites will require a temporary work area or staging area during construction. This has been estimated at approximately 2,024 square meters and is estimated for a one year construction period. This feature has been added to each alternative.

The China House site and Quartermaster Road site require excavation of material. Much of the material will be used on site for berms and the remaining excess will be disposed of in a public land fill. As such, there is no provision for a disposal LERRD requirement.

## 3. SPONSOR'S REAL ESTATE INTERESTS

The sponsor owns or has owned various parcels in the area but the current extent is unknown. If the sponsor currently owns some of the parcels they will still receive credit for the market value of the land but will have no acquisition costs associated with that parcel. None of the parcels were acquired in anticipation of the proposed federal project.

## 4. ESTATES TO BE ACQUIRED

<u>Fee</u>

The fee simple title to (the land described in Schedule A) (Tracts Nos. , and ), subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines.

<u>TEMPORARY WORK AREA EASEMENT:</u>

A temporary easement and right-of-way in, on, over and across (the land described in Schedule A) (Tracts Nos., and), for a period not to exceed__________, beginning with date possession of the land is granted to the United States, for use by the United States, its representatives, agents, and contractors as a (borrow area) (work area), including the right to borrow and/or deposit fill, spoil and waste material thereon). (move, store and remove equipment and supplies, and erect and. remove temporary * structures on the land and to perform any other work necessary and incident to the construction of the

Project, together with the right to trim, cut, fell and remove, therefore all trees, underbrush, obstructions, and any other vegetation, structures, or obstacles within the limits of the right-of-way; reserving, however, to the landowners, their heirs and assigns, all such rights and privileges as may be used without interfering with or abridging the rights and easement hereby acquired; subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines.

ROAD EASEMENT- PERPETUAL (std estate #11)

A perpetual and assignable easement and right-of-way in, on, over and across (the land described in Schedule A) (Tracts Nos. _____, ____, and ____) for the location, construction, operation, maintenance, alteration, replacement of (a) road(s) and appurtenances thereto; together with the right to trim, cut, fell and remove therefrom all trees, underbrush, obstructions and other vegetation, structures, or obstacles within the limits of the right-of-way; (reserving, however, to the owners, their heirs and assign, the right to cross over or under the right-of-way as access to their adjoining land at the locations indicated in Schedule B); 5/ subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines.

CHANNEL IMPROVEMENT EASEMENTS

A perpetual and assignable right and easement to construct, operate, and maintain channel improvement works on, over and across (the land described in Schedule A) (Tract Nos. __, __, and __.) for the purposes as authorized by the Act of Congress approved _______, including the right to clear, cut, fell, remove and dispose of any and all timber, trees, underbrush, buildings, improvements and/or other obstructions therefore; to excavate dredge, cut away, and remove any or all of said land and to place thereon dredge or spoil material; and for such other purposes as may be required in connection with said work of improvement; reserving, however, to the owners, their heirs and assigns, all such rights and privileges as may be used without interfering with or abridging the rights and easement hereby acquired; subject, however, to existing easements for public roads and highways, public utilities, railroads and Pipelines.

## 5. FEDERAL PROJECTS/OWNERSHIP

There are no federal projects or federal lands within the project area.

## 6. NAVIGATION SERVITUDE

The project sites are all fast land parcels and navigation servitude does not apply to these lands.

## 7. MAPS

Maps depicting the territory of Saipan, the project areas and impacted parcels are attached in the addendum.

## 8. FLOODING

There are no flood plain maps available for the project area, but the subject parcels all experience surface flooding during periods of heavy rainfall.

## 9. BASELINE COST ESTIMATE FOR REAL ESTATE

### Cock Fight Arena Site

| | |
|---|---|
| Fee Title | $ 596,300 |
| Perpetual Channel Improvement Easement | $ 125,700 |
| Perpetual Joint Use Road Easement | $ 0 |
| Temporary Work Area Easement | $ 5,000 |
| Improvements | $ 188,000 |
| Hazard Removals | $ 0 |
| Mineral Rights | $ 0 |
| Damages | $ 0 |
| Incremental real estate costs. | $ 47,000 |
| Relocations | $ 0 |
| Uniform Relocation Assistance (PL 91-646) | $ 0 |
| Acquisition Administrative Costs | $ 50,000 |
| TOTAL COST | $ 1,012,000 |

### China House Site

| | |
|---|---|
| Fee Title | $ 401,600 |
| Perpetual Channel Improvement Easement | $ 49,200 |

| | |
|---|---|
| Perpetual Joint Use Road Easement | $ 20,400 |
| Temporary Work Area Easement | $ 5,000 |
| Improvements | $ 0 |
| Hazard Removals | $ 0 |
| Mineral Rights | $ 0 |
| Damages | $ 0 |
| Incremental real estate costs. | $ 88,000 |
| Relocations | $ 0 |
| Uniform Relocation Assistance (PL 91-646) | $ 0 |
| Acquisition Administrative Costs | $ 25,000 |
| TOTAL COST | $ 589,200 |

**Quartermaster Road Site**

| | 2YR. | 5YR. | 10YR. |
|---|---|---|---|
| Fee Title | $186,500 | $305,100 | $423,700 |
| Perpetual Channel Improvement Easement | $93,500 | $93,500 | $93,500 |
| Perpetual Joint Use Road Easement | $0 | $0 | $0 |
| Temporary Work Area Easement | $5,000 | $5,000 | $5,000 |
| Improvements | $0 | $0 | $0 |
| Hazard Removals | $0 | $0 | $0 |
| Mineral Rights | $0 | $0 | $0 |
| Damages | $0 | $0 | $90,000 |
| Incremental real estate costs. | $71,000 | $100,100 | $130,500 |
| Relocations | $0 | $0 | $0 |

| | | | |
|---|---|---|---|
| Uniform Relocation Assistance (PL 91-646) | $0 | $0 | $0 |
| Acquisition Administrative Costs………… | $75,000 | $75,000 | $75,000 |
| TOTAL COST……………………………… | $431,000 | $578,700 | $817,700 |

### 10. PL 91-646 RELOCATION BENEFITS

Public Law 91-646, The Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended, commonly called the Uniform Act, is the primary law for acquisition and relocation activities on Federal or federally assisted projects and programs. The local sponsor is required to follow the guidance in this public law.

The only property that has potential 91-646 benefits is the cock fight arena site. The arena is an operating business and will be acquired if that site is selected as the alternative. No allowance has been made for this business as it may not be acceptable in the law as a legal business, and as such may not be eligible for the benefit.

### 11. MINERALS

There are no surface of subsurface minerals known that would impact the project or acquisition.

### 12. ASSESSMENT OF SPONSOR’S ACQUISITION CAPABILITY

An assessment of the sponsor’s acquisition capabilities to acquire the land necessary for this project has not been done. However, CNMI is considered fully capable.

### 13. ZONING

There is no zoning available on the subject properties and no zoning on the island. The area is a mixture of urban and rural.

### 14. MILESTONES

The sponsor will begin preliminary acquisition work approximately 6 months prior to PPA execution as follows:

| | |
|---|---|
| Survey/Maps/Title | 90 Days |

| | |
|---|---|
| Legal Descriptions | 30 Days |
| Appraisals | 90 Days |

The sponsor will complete acquisition of LERRD within 180 days after the PPA execution as follows:

| | |
|---|---|
| Documentation | 120 Days |
| Negotiations | 60 Days |
| Final Subdivision | 60 Days |
| Payments | 90 Days |

| | |
|---|---|
| LERRD certification | 21 Days |

## 15. PUBLIC UTILITIES RELOCATIONS

There are no known public utilities that are impacted by the project.

## 16. ENVIRONMENTAL IMPACTS

Environmental impacts, if any, are discussed in other sections of the Engineering Documentation Report.

## 17. ATTITUDES OF LANDOWNWERS

No information has been given as to public opinion about the project. To the extent that some local flooding will be reduced and the lagoon ecosystem will be improved, the project should be favorable.

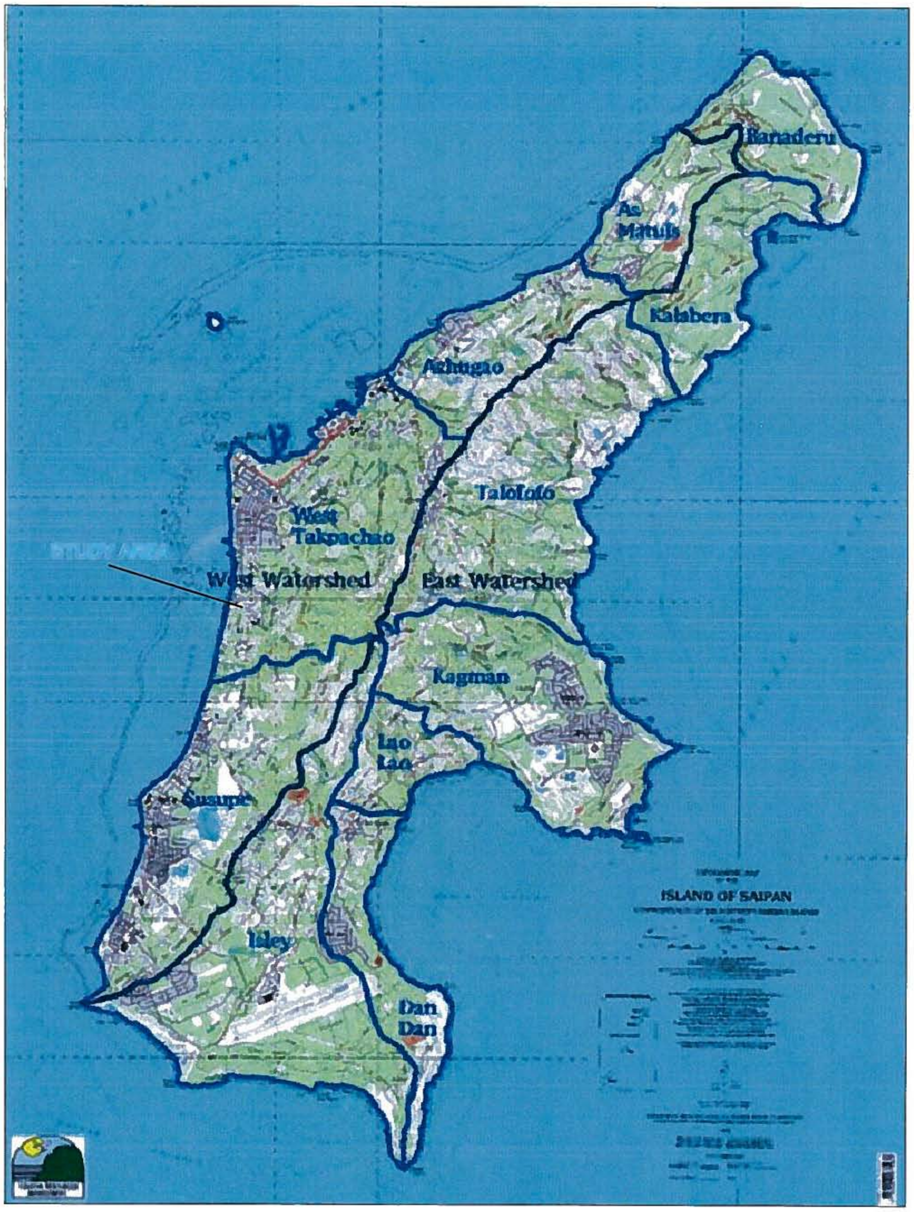
## 18. NOTIFICATION TO SPONSOR

The non-Federal sponsor, CNMI, is fully involved in the planning process although they have not been formally notified about the risks of acquiring the LERRD for the project prior to the PPA execution and the Government's formal notice to proceed. The written notice will be given once the final alternative is determined.

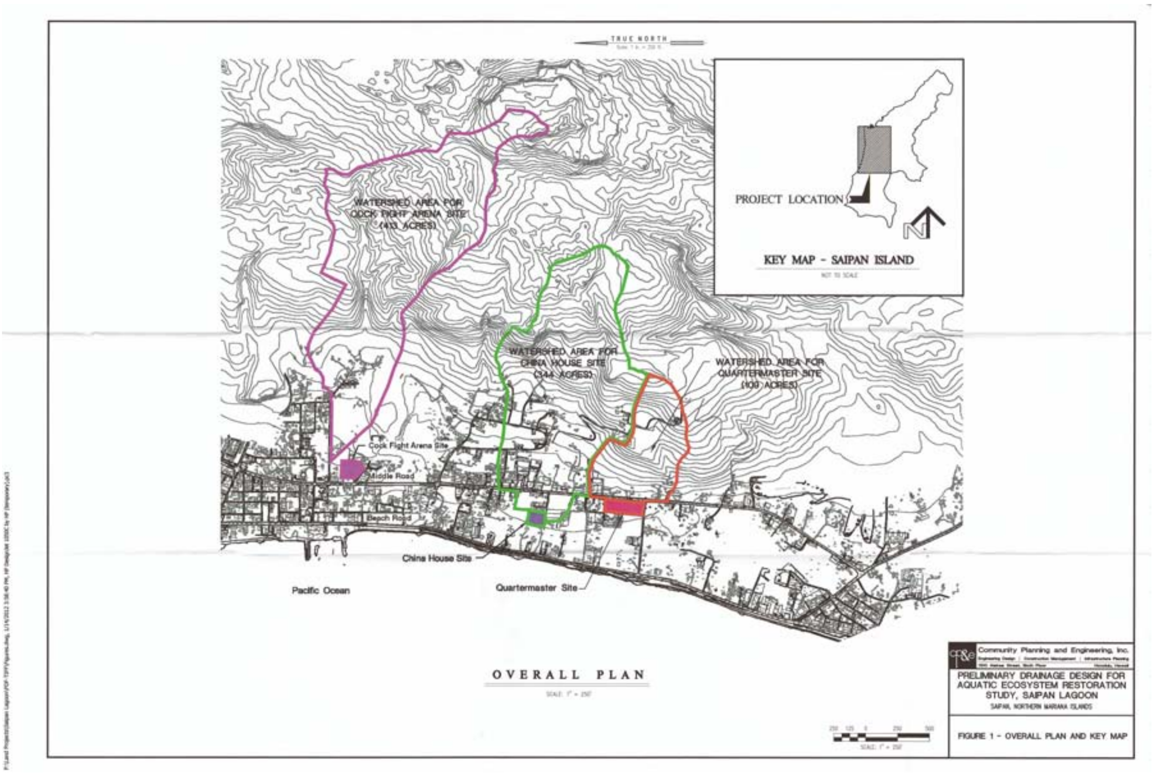
## ADDENDUM

Saipan Map
Project Location Map
Cock Fight Arena Aerial
China House Aerial
Quartermaster Road Aerial
Cock Fight Arena Preliminary Design
China House Preliminary Design
Quartermaster Road Preliminary Design

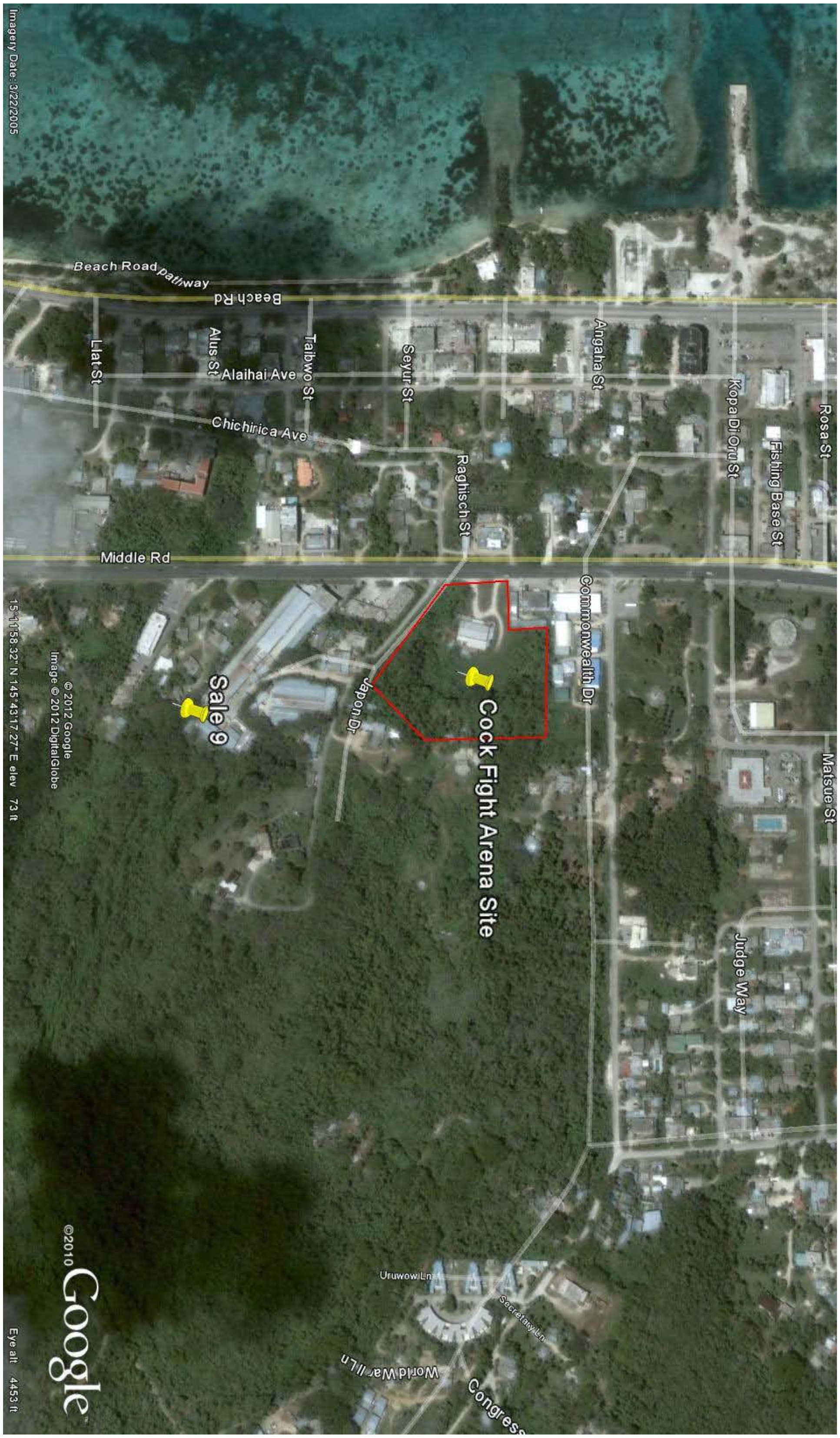
## Saipan Map


Banaderu
As Matuis
Kalabera
Achugao
Talofofo
West Takpachao
STUDY AREA
West Watershed
East Watershed
Kagman
Lao Lao
Susupe
Isley
Dan Dan
ISLAND OF SAIPAN

## Project Location

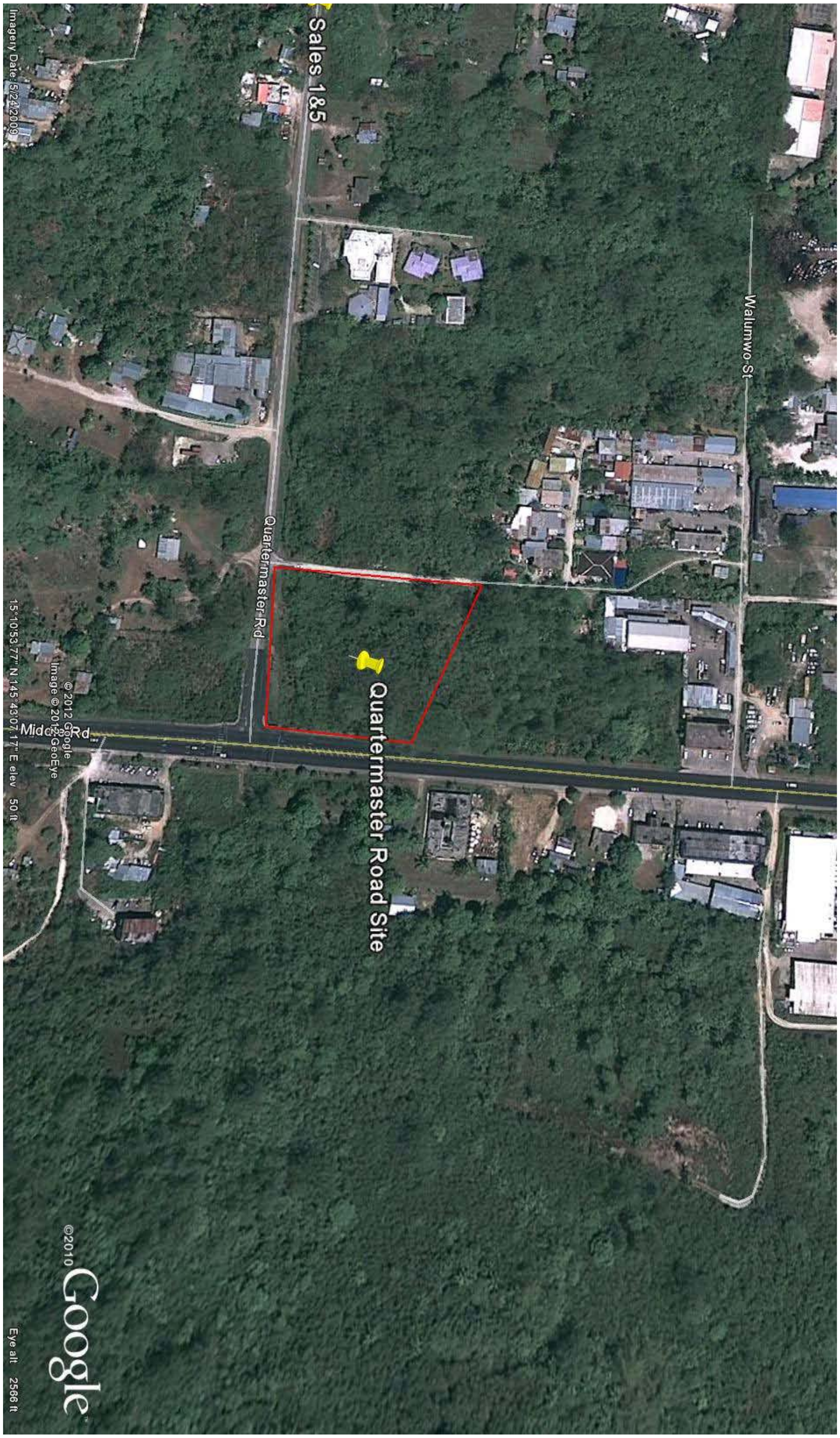


## Cock Fight Arena Site

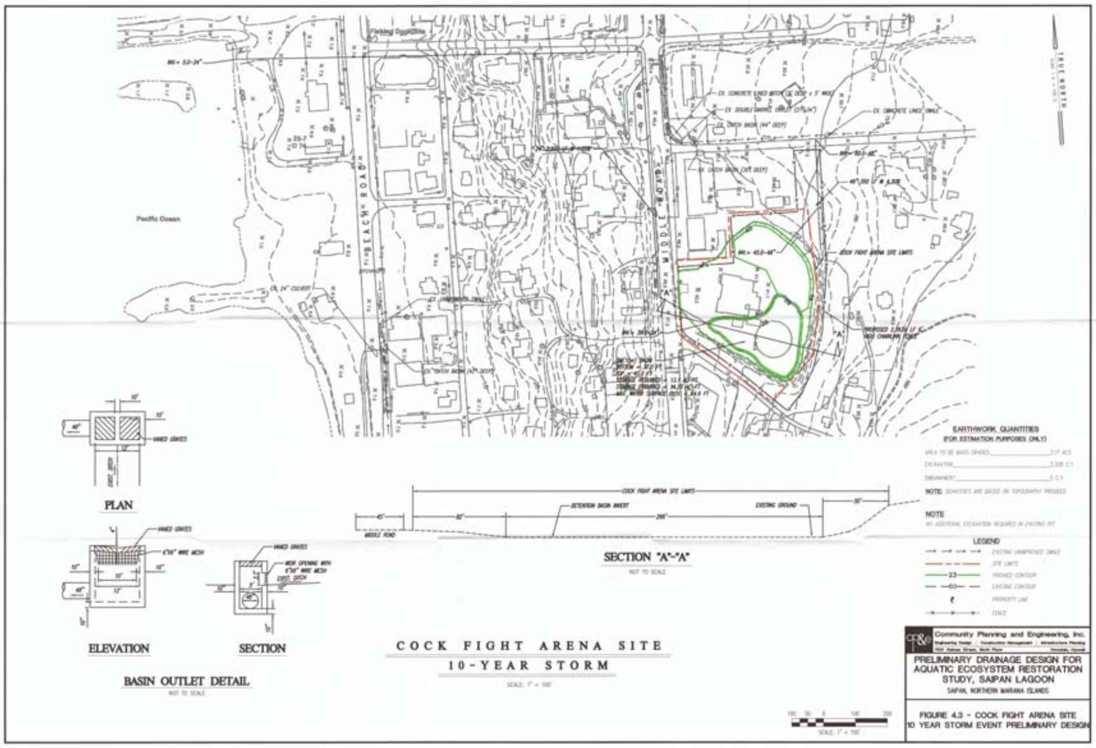


## China House Site

## Quartermaster Road Site

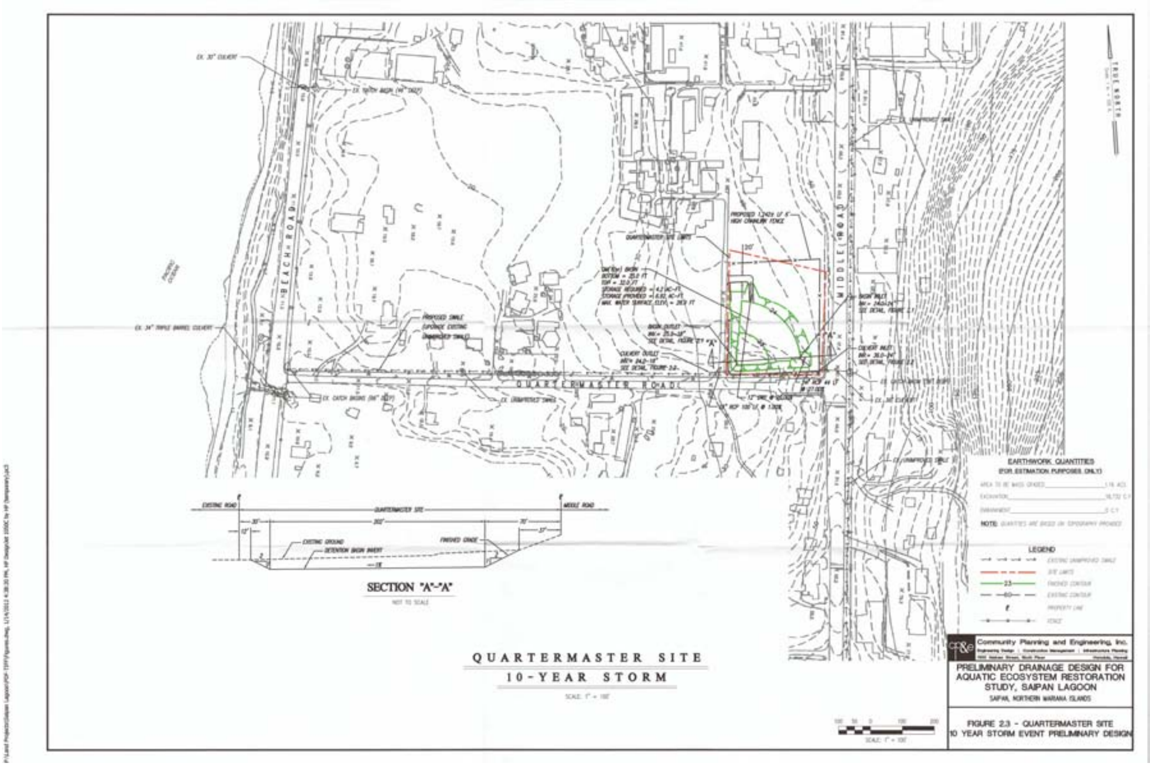


## Cock Fight Arena



## China House

## Quartermaster Road



# *Appendix H*
# *Cost Estimates*

# SAIPAN LAGOON ECOSYSTEM RESTORATION FEASIBILITY

## Total Project Cost Summary

The Army Corps of Engineers Cost Engineer was given nine alternatives to cost out. There were three different sites with three storm events represented for each site. An estimate was made for each alternative. These estimates were given to Environet, Inc. to conduct an incremental cost analysis and determine a combination of the three sites that would produce the most cost effective plan. From this incremental cost analysis, seven combinations were derived and four (including a no action plan) plans were chosen for further analysis. Environet, Inc. gave the four combination alternatives to the Corps and the construction costs from these site/storm combinations were used to determine a contingency value for each alternative.

The Corps performed an Abbreviated Cost and Schedule Risk Analysis for each combination alternative to determine a contingency value. First, a risk register was created for potential risk areas for each risk element to include, Project Scope, Acquisition Strategy, Construction Complexity, Volatile Commodities, Quantities, Fabrication & Project Installed Equipment, Cost Estimating Method, and External Project Risks. The PDT reviewed these risks and rated them for this project. Then a risk register was used to calculate a total contingency for each alternative. The Abbreviated Risk Analysis tables are provided in this Appendix for each combination alternative.

The contingencies were then inputted into the Total Project Cost Summary (TPCS) along with the Lands and Damages cost (taken from the Real Estate Planning Report, dated 2 October 2012), the Planning, Engineering and Design cost, and the Construction Management cost. All of these costs were added together, along with the monies spent and an escalation factor to determine the Total Project Cost. The Total Project Cost Summary tables are provided in this Appendix for each combination alternative.

The following assumptions were made in determining the cost estimates for each alternative:

- Project duration is 16 months.
- Project Management cost is $237k.
- Planning and Environmental Compliance cost is $1,099k.
- Engineering and Design cost is $244k.
- Engineering Tech Review ITR & VE cost is $50k.
- Contracting and Reprographics cost is $25k.
- Engineering During Construction cost is $100k.

- Construction Management cost is $346k.  Cost includes labor, travel and QA testing.

## Post-Construction Monitoring

Post-Construction Monitoring includes costs associated with the monitoring/sampling effort, project management, and preparation of annual monitoring reports for 5 years.  Costs are included in the estimate for 5 monitoring events (Year  1, 3, 5, 7, 10) after construction.

15-August-13

# Cost Assumptions

Saipan Lagoon Ecosystem Restoration - ROM

PM: Milton Yoshimoto

1. The estimate is based on the Environmental Restoration Report (Pre-Draft), dated January 2013, and the Preliminary Drainage Design.
2. It is estimated that the construction will take 16 months to complete and the overall project will take 20 months.
3. The construction start date is estimated to begin around July 2015.
4. The construction mid point is estimated to be January 2016.
5. Escalation Factor used is 3.21. (3/12 – 6/13)
6. For Alternative 2, items that are included in WBS 3 – Reservoirs is everything except for drainage item and post-construction monitoring.
7. For Alternative 3, items included in WBS 3 are everything except for drainage, driveway and basin, and post-construction monitoring.
8. For Alternative 4, items included in WBS 3 are everything except for drainage, driveway and basin, and post-construction monitoring.
9. Contingency is based on Abbreviated Cost and Schedule Risk Analysis.
10. SIOH is based on the duration of 16 months for the total project time.
11. CPM: Start date is 6/1/15 and End date is 9/30/16.
12. Rain Delay is 14 working days.
13. This estimate contains no overtime to complete the project.
14. Quantities are provided by Community Planning and Engineering, Inc.
15. Calculations based on plans are presented as take-offs (see QTO sheet).
16. The base estimate includes the fuel prices as follows for Saipan:
    Electricity: $0.36
    Gas: $5.23
    Diesel (Off-Road): $5.32
    Diesel (On-Road): $5.32
17. Sales Tax is 0%.
18. Labor rates were created as a MII Library called Saipan Labor rates. These rates were created in 2008. Labor rates were escalated to 2013 using the EM 1110-2-1304 Quarterly Cost Indexes by CWBS Feature Code, dated 31Mar13.
19. Equipment rates are from the 2011 MII Equipment Library.
20. All three sites are within 1.5 miles of each other.
21. There are contractors with the necessary equipment located in Saipan.

22. There are no manufacturers in the CNMI. All fabricated materials are imported from a variety of places.
23. All excess materials will be hauled to the landfill located in Marpi, about 10 miles away.
24. The source for the borrow/fill material will come from the sites.
25. Material used will be balanced, however, in the event there is excess embankment the material will be hauled to the Marpi landfill to be used as capping material.

# **** TOTAL PROJECT COST SUMMARY ****

PROJECT: **Saipan Lagoon Ecosystem Restoration**
DISTRICT: **NWW WALLA WALLA**
PREPARED: **6/18/2013**
PROJECT NO:
LOCATION: **Saipan Lagoon, Sasipan**
POC: **CHIEF, COST ENGINEERING, Gary F. Yamauchi**

This Estimate reflects the scope and schedule in report; CAP Feasibility STUDY - ECOSYSTEM RESTORATION REPORT

| **Civil Works Work Breakdown Structure** | | **ESTIMATED COST** | | | | **PROJECT FIRST COST (Constant Dollar Basis)** | | | | **TOTAL PROJECT COST (FULLY FUNDED)** | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Program Year (Budget EC): 2016<br>Effective Price Level Date: 1 OCT 15 | | | | Spent Thru: 10/1/2012 | | | | |
| WBS NUMBER | Civil Works Feature & Sub-Feature Description | COST ($K) | CNTG ($K) | CNTG (%) | TOTAL ($K) | ESC (%) | COST ($K) | CNTG ($K) | **TOTAL ($K)** | ($K) | | COST ($K) | CNTG ($K) | FULL ($K) |
| ***A*** | ***B*** | ***C*** | ***D*** | ***E*** | ***F*** | ***G*** | ***H*** | ***I*** | ***J*** | ***K*** | ***L*** | ***M*** | ***N*** | ***O*** |
| **03** | RESERVOIRS | $838 | $237 | 28% | $1,074.76 | 4.4% | $875 | $247 | $1,122 | | | $892 | $252 | $1,144 |
| **03** | RESERVOIRS | $621 | $176 | 28% | $796.62 | 4.4% | $648 | $183 | $832 | | | $703 | $199 | $901 |
| | (Post Construction Monitoring) | | | - | | - | | | | | | | | |
| **19** | BUILDINGS, GROUNDS & UTILITIES | $690 | $195 | 28% | $884.66 | 4.4% | $720 | $204 | $924 | | | $734 | $208 | $941 |
| | **CONSTRUCTION ESTIMATE TOTALS:** | $2,148 | $608 | | $2,756.04 | 4.4% | $2,244 | $634 | $2,878 | | | $2,328 | $658 | $2,986 |
| 01 | LANDS AND DAMAGES | $965 | $47 | 5% | $1,012.00 | 4.4% | $1,008 | $49 | $1,057 | | | $1,013 | $49 | $1,062 |
| 22 | FEASIBILITY STUDY (CAP studies) | | | | | | | | | $1,483 | | | | $1,483 |
| 30 | PLANNING, ENGINEERING & DESIGN | $1,841 | $352 | 19% | $2,193.37 | 6.5% | $1,962 | $375 | $2,337 | | | $1,968 | $377 | $2,345 |
| 31 | CONSTRUCTION MANAGEMENT | $443 | $75 | 17% | $518.44 | 6.5% | $472 | $80 | $552 | | | $492 | $84 | $576 |
| | **PROJECT COST TOTALS:** | $5,397 | $1,082 | 20% | $6,479.85 | | $5,685 | $1,139 | **$6,824** | $1,483 | | $5,800 | $1,168 | $8,451 |

Mandatory by Regulation CHIEF, COST ENGINEERING, Gary F. Yamauchi

Mandatory by Regulation PROJECT MANAGER, Milton Yoshimoto

Mandatory by Regulation CHIEF, REAL ESTATE, Craig H. Nakano

CHIEF, PLANNING, Anthony J. Paresa

CHIEF, ENGINEERING, Todd C. Barnes

CHIEF, OPERATIONS, Michael F. Wong

CHIEF, CONSTRUCTION, Louis Muzzarini

CHIEF, CONTRACTING, Roger David Williams

CHIEF, PM-PB, Roxanne E. Iseri

CHIEF, DPM, Milton Yoshimoto

| | | |
|---|---|---|
| ESTIMATED FEDERAL COST: | 65% | **$4,529** |
| ESTIMATED NON-FEDERAL COST: | 35% | **$2,439** |
| FEASIBILITY FEDERAL COST: | | **$792** |
| FEASIBILITY NON-FEDERAL COST: | | **$692** |
| **ESTIMATED TOTAL PROJECT COST:** | | **$8,451** |

## **** TOTAL PROJECT COST SUMMARY ****

### **** CONTRACT COST SUMMARY ****

PROJECT: Saipan Lagoon Ecosystem Restoration
LOCATION: Saipan Lagoon, Sasipan
This Estimate reflects the scope and schedule in report; CAP Feasibility STUDY - ECOSYSTEM RESTORATION REPORT

DISTRICT: NWW WALLA WALLA PREPARED: 6/18/2013
POC: CHIEF, COST ENGINEERING, Gary F. Yamauchi

| **WBS Structure** | | **ESTIMATED COST** | | | | **PROJECT FIRST COST (Constant Dollar Basis)** | | | | **TOTAL PROJECT COST (FULLY FUNDED)** | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Estimate Prepared: 3/22/2013<br>Effective Price Level: 10/1/2012 | | | | Program Year (Budget EC): 2016<br>Effective Price Level Date: 1 OCT 15 | | | | | | | | |
| | | | | RISK BASED | | | | | | | | | | |
| WBS NUMBER | Civil Works Feature & Sub-Feature Description | COST ($K) | CNTG ($K) | CNTG (%) | TOTAL ($K) | ESC (%) | COST ($K) | CNTG ($K) | TOTAL ($K) | Mid-Point Date | INFLATED (%) | COST ($K) | CNTG ($K) | FULL ($K) |
| *A* | *B* | *C* | *D* | *E* | *F* | *G* | *H* | *I* | *J* | *P* | *L* | *M* | *N* | *O* |
| | **PHASE 1 or CONTRACT 1** | | | | | | | | | | | | | |
| **03** | RESERVOIRS | $838 | $237 | 28.3% | $1,075 | 4.4% | $875 | $247 | $1,122 | 2016Q2 | 1.9% | $892 | $252 | $1,144 |
| **03** | RESERVOIRS<br>(Post Construction Monitoring) | $621 | $176 | 28.3% | $797 | 4.4% | $648 | $183 | $832 | 2019Q3 | 8.3% | $703 | $199 | $901 |
| **19** | BUILDINGS, GROUNDS & UTILITIES | $690 | $195 | 28.3% | $885 | 4.4% | $720 | $204 | $924 | 2016Q2 | 1.9% | $734 | $208 | $941 |
| | **CONSTRUCTION ESTIMATE TOTALS:** | $2,148 | $608 | 28.3% | **$2,756** | | $2,244 | $634 | $2,878 | | | $2,328 | $658 | $2,986 |
| **01** | LANDS AND DAMAGES | $965 | $47 | 4.9% | $1,012 | 4.4% | $1,008 | $49 | $1,057 | 2015Q3 | 0.5% | $1,013 | $49 | $1,062 |
| **30** | PLANNING, ENGINEERING & DESIGN | | | | | | | | | | | | | |
| *11.03%* | Project Management | $237 | $45 | 19.1% | $282 | 6.5% | $253 | $48 | $301 | 2015Q2 | | $253 | $48 | $301 |
| *51.16%* | Planning & Environmental Compliance | $1,099 | $210 | 19.1% | $1,309 | 6.5% | $1,171 | $224 | $1,395 | 2015Q2 | | $1,171 | $224 | $1,395 |
| *11.36%* | Engineering & Design | $244 | $47 | 19.1% | $291 | 6.5% | $260 | $50 | $310 | 2015Q2 | | $260 | $50 | $310 |
| *2.33%* | Engineering Tech Review ITR & VE | $50 | $10 | 19.1% | $60 | 6.5% | $53 | $10 | $63 | 2015Q2 | | $53 | $10 | $63 |
| *1.16%* | Contracting & Reprographics | $25 | $5 | 19.1% | $30 | 6.5% | $27 | $5 | $32 | 2015Q2 | | $27 | $5 | $32 |
| *4.66%* | Engineering During Construction | $100 | $19 | 19.1% | $119 | 6.5% | $107 | $20 | $127 | 2016Q2 | 4.2% | $111 | $21 | $132 |
| *2.00%* | Planning During Construction | $43 | $8 | 19.1% | $51 | 6.5% | $46 | $9 | $55 | 2016Q2 | 4.2% | $48 | $9 | $57 |
| *2.00%* | Project Operations | $43 | $8 | 19.1% | $51 | 6.5% | $46 | $9 | $55 | 2015Q2 | | $46 | $9 | $55 |
| **31** | CONSTRUCTION MANAGEMENT | | | | | | | | | | | | | |
| *16.11%* | Construction Management | $346 | $59 | 17.0% | $405 | 6.5% | $369 | $63 | $431 | 2016Q2 | 4.2% | $384 | $65 | $450 |
| *2.00%* | Project Operation: | $43 | $7 | 17.0% | $50 | 6.5% | $46 | $8 | $54 | 2016Q2 | 4.2% | $48 | $8 | $56 |
| *2.50%* | Project Management | $54 | $9 | 17.0% | $63 | 6.5% | $58 | $10 | $67 | 2016Q2 | 4.2% | $60 | $10 | $70 |
| | **CONTRACT COST TOTALS:** | $5,397 | $1,082 | | **$6,480** | | $5,685 | $1,139 | $6,824 | | | $5,800 | $1,168 | **$6,968** |

## Abbreviated Risk Analysis

Project (less than $40M): **Saipan Lagoon Ecosystem Restoration - TSP(C0Q0A1**
Project Development Stage: **Feasibility (Recommended Plan)**
Risk Category: **Moderate Risk: Typical Project or Possible Life Safety**

Total Construction Contract Cost = **$ 2,148,130**

| | CWWBS | Feature of Work | Contract Cost | | % Contingency | $ Contingency | Total |
|---|---|---|---|---|---|---|---|
| | 01 LANDS AND DAMAGES | Real Estate | **$ 965,000** | | **4.87%** | $ 47,000 | $ 1,012,000.33 |
| 1 | **03 RESERVOIRS** | **1 Mobilization - Demobilization** | **$ 41,723** | | 22.92% | $ 9,562 | $ 51,285.28 |
| 2 | **03 RESERVOIRS** | **2 Chainlink Fence** | **$ 111,299** | | 20.18% | $ 22,455 | $ 133,754.07 |
| 3 | **03 RESERVOIRS** | **3 Dewatering** | **$ 96,826** | | 26.96% | $ 26,103 | $ 122,929.38 |
| 4 | **03 RESERVOIRS** | **4 Road Crossing** | **$ 47,641** | | 13.14% | $ 6,260 | $ 53,901.46 |
| 5 | **03 RESERVOIRS** | **5 Grading** | **$ 540,336** | | 42.14% | $ 227,684 | $ 768,020.50 |
| 6 | **03 RESERVOIRS** | **6 Post-Construction Monitoring** | **$ 620,671** | | 7.04% | $ 43,671 | $ 664,342.45 |
| 7 | **19 BUILDINGS, GROUNDS, AND UTILITIES** | **7 Drainage** | **$ 689,634** | | 39.42% | $ 271,839 | $ 961,472.93 |
| 8 | | | | | 0.00% | $ - | $ - |
| 9 | | | | | 0.00% | $ - | $ - |
| 12 | | **Remaining Construction Items** | **$ -** | *0.0%* | 0.00% | $ - | $ - |
| 13 | 30 PLANNING, ENGINEERING, AND DESIGN | **Planning, Engineering, & Design** | **$ 1,841,000** | | 19.14% | $ 352,426 | $ 2,193,425.56 |
| 14 | 31 CONSTRUCTION MANAGEMENT | **Construction Management** | **$ 443,000** | | 17.03% | $ 75,458 | $ 518,457.73 |

| **Totals** | | | | |
|---|---|---|---|---|
| Real Estate | $ 965,000 | 4.87% | $ 47,000 | $ 1,012,000.33 |
| Total Construction Estimate | $ 2,148,130 | 28.28% | $ 607,576 | $ 2,755,706 |
| Total Planning, Engineering & Design | $ 1,841,000 | 19.14% | $ 352,426 | $ 2,193,426 |
| Total Construction Management | $ 443,000 | 17.03% | $ 75,458 | $ 518,458 |
| Total | $ 5,397,130 | | $ 1,082,460 | $ 6,479,590 |

# Abbreviated Risk Analysis

## Saipan Lagoon Ecosystem Restoration - C0Q0A1
## Feasibility

Meeting Date: 22-Mar-13

**PDT Members** (Typical Recommended)

Project Management: Milton Yoshimoto
Cost Estimator: Lana Murishige
Environmentalist: Sonia Shjesgadt
Environmentalist: Miya Akiba
Engineering & Design: Anson Murayama
Engineering & Design: Frank Camacho
Project Management: Uyen Tran

### Saipan Lagoon Ecosystem Restoration - TSP(C0Q0A1)
Feasibility (Recommended Plan)
Abbreviated Risk Analysis

**Meeting Date:** ########

**Risk Level**

|  |  |  |  |  |  |
|---|---|---|---|---|---|
| Very Likely | 2 | 3 | 4 | 5 | 5 |
| Likely | 1 | 2 | 3 | 4 | 5 |
| Possible | 0 | 1 | 2 | 3 | 4 |
| Unlikely | 0 | 0 | 1 | 2 | 3 |
|  | Negligible | Marginal | Significant | Critical | Crisis |

| Risk Element | Feature of Work | Concerns Pull Down Tab (ENABLE MACROS THRU TRUST CENTER) (Choose ALL that apply) | Concerns | PDT Discussions & Conclusions (Include logic & justification for choice of Likelihood & Impact) | Likelihood | Impact | Risk Level |
|---|---|---|---|---|---|---|---|
| **Project Scope Growth** |  |  |  |  |  |  |  |
|  |  |  |  |  |  | **Max Potential Cost Growth** | 75% |
| PS-1 | 1 Mobilization - Demobilization | • Project accomplish intent? | Schedule is assumed and subject to change. | A more detailed design will be required and the topo is anticipated to be out of date. | Possible | Marginal | 1 |
| PS-2 | 2 Chainlink Fence | • Potential for scope growth, added features and quantities? | Possible quantity differential if site limits change. |  | Likely | Marginal | 2 |
| PS-3 | 3 Dewatering | • Investigations sufficient to support design assumptions? | Schedule is assumed and subject to change. Soil report will be needed. | A more detailed design will be required and the topo is anticipated to be out of date. | Likely | Marginal | 2 |
| PS-4 | 4 Road Crossing | • Investigations sufficient to support design assumptions? | Topo may not be most current thus affecting assumed locations of road and utilities. |  | Possible | Negligible | 0 |
| PS-5 | 5 Grading | • Design confidence? | 10% conceptual design only. Existing topo may not be most current. | A more detailed design will be required and the topo is anticipated to be out of date. | Likely | Significant | 3 |
| PS-6 | 6 Post-Construction Monitoring | • Potential for scope growth, added features and quantities? | Additional monitoring may be required if performance standards aren't met. | It is unlikely that there would be any changes after construction. | Unlikely | Marginal | 0 |
| PS-7 | 7 Drainage | • Potential for scope growth, added features and quantities? | 10% conceptual design only. Condition of existing utilities may be different. | A more detailed design will be required. The condition of the existing utilities is unknown and the assumption was made that the existing utilities will convey all the runoff from the watershed to the basin. | Likely | Significant | 3 |
| PS-8 | 0 | • Potential for scope growth, added features and quantities? |  |  | Unlikely | Negligible | 0 |
| PS-9 | 0 | • Potential for scope growth, added features and quantities? |  |  | Unlikely | Negligible | 0 |
| PS-10 | 0 | • Potential for scope growth, added features and quantities? |  |  | Unlikely | Negligible | 0 |
| PS-11 | 0 | • Potential for scope growth, added features and quantities? |  |  | Unlikely | Negligible | 0 |
| PS-12 | Remaining Construction Items | • Potential for scope growth, added features and quantities? | None. |  | Unlikely | Negligible | 0 |
| PS-13 | Planning, Engineering, & Design | • Potential for scope growth, added features and quantities? | Need to provide 100% Design. | A more detailed design will be required and the topo is anticipated to be out of date. The condition of the existing utilities is unknown and the assumption was made that the existing utilities will convey all the runoff from the watershed to the basin. | Likely | Marginal | 2 |
| PS-14 | Construction Management | • Potential for scope growth, added features and quantities? | Need to provide 100% Design. | A more detailed design will be required and the topo is anticipated to be out of date. The condition of the existing utilities is unknown and the assumption was made that the existing utilities will convey all the runoff from the watershed to the basin. | Likely | Marginal | 2 |

## Acquisition Strategy

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | **Max Potential Cost Growth** | **30%** |
| AS-1 | 1 Mobilization - Demobilization | • Contracting plan firmly established? | | | Unlikely | Negligible | **0** |
| AS-2 | 2 Chainlink Fence | • Contracting plan firmly established? | | | Unlikely | Negligible | **0** |
| AS-3 | 3 Dewatering | • Contracting plan firmly established? | | Due to unknown contract schedule, plans may be altered. | Unlikely | Marginal | **0** |
| AS-4 | 4 Road Crossing | • Contracting plan firmly established? | Topo may not be most current thus affecting assumed locations of road and utilities for easement purposes. | | Unlikely | Negligible | **0** |
| AS-5 | 5 Grading | • Contracting plan firmly established? | Contracting plan established. | Due to unknown contract schedule, plans may be altered. | Unlikely | Marginal | **0** |
| AS-6 | 6 Post-Construction Monitoring | • Contracting plan firmly established? | Contract acquisition strategy is assumed as full and open, invitation for bid. | The reasonable assumption is that the prime contractor will be performing most of the work. | Unlikely | Marginal | **0** |
| AS-7 | 7 Drainage | • Contracting plan firmly established? | Contracting plan established. | Due to unknown contract schedule, plans may be altered. | Unlikely | Marginal | **0** |
| AS-8 | 0 | • Contracting plan firmly established? | | | Unlikely | Negligible | **0** |
| AS-9 | 0 | • Contracting plan firmly established? | | | Unlikely | Negligible | **0** |
| AS-10 | 0 | • Contracting plan firmly established? | | | Unlikely | Negligible | **0** |
| AS-11 | 0 | • Contracting plan firmly established? | | | Unlikely | Negligible | **0** |
| AS-12 | Remaining Construction Items | • Contracting plan firmly established? | None. | | Unlikely | Negligible | **0** |
| AS-13 | Planning, Engineering, & Design | • Contracting plan firmly established? | None. | | Unlikely | Negligible | **0** |
| AS-14 | Construction Management | • Contracting plan firmly established? | None. | | Unlikely | Negligible | **0** |

**Construction Elements**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | **Max Potential Cost Growth** | **25%** |
| CE-1 | 1 Mobilization - Demobilization | • Accelerated schedule or harsh weather schedule? | Major clearing and grubbing required. Soil conditions. Location of project requires special mobilization. There is a possibility for major construction modifications if special equipment or subcontractors need to be transported to the site. Fuel for equipment. | A soils report was never performed for this study, only research was taken into account. The likelihood of the anticipated soils type to change is very unlikely, however in the case an unanticipated soil type is found the impact would have a marginal effect. Fuel costs are likely to fluctuate, however the fuel costs are a small percentage to the price of the project as a whole. | Likely | Marginal | **2** |
| CE-2 | 2 Chainlink Fence | • Accelerated schedule or harsh weather schedule? | | | Unlikely | Negligible | **0** |
| CE-3 | 3 Dewatering | • Accelerated schedule or harsh weather schedule? | Major clearing and grubbing required. Soil conditions. Location of project requires special mobilization. There is a possibility for major construction modifications if special equipment or subcontractors need to be transported to the site. Fuel for equipment. | A soils report was never performed for this study, only research was taken into account. The likelihood of the anticipated soils type to change is very unlikely, however in the case an unanticipated soil type is found the impact would have a marginal effect. Fuel costs are likely to fluctuate, however the fuel costs are a small percentage to the price of the project as a whole. | Likely | Marginal | **2** |
| CE-4 | 4 Road Crossing | • Accelerated schedule or harsh weather schedule? | Fuel for equipment. | Fuel costs are likely to fluctuate, however the fuel costs are a small percentage to the price of the project as a whole. | Likely | Negligible | **1** |
| CE-5 | 5 Grading | • Accelerated schedule or harsh weather schedule? | Major clearing and grubbing required. Soil conditions. Location of project requires special mobilization. There is a possibility for major construction modifications if special equipment or subcontractors need to be transported to the site. Fuel for equipment. | A soils report was never performed for this study, only research was taken into account. The likelihood of the anticipated soils type to change is very unlikely, however in the case an unanticipated soil type is found the impact would have a marginal effect. Fuel costs are likely to fluctuate, however the fuel costs are a small percentage to the price of the project as a whole. | Likely | Marginal | **2** |
| CE-6 | 6 Post-Construction Monitoring | • Accelerated schedule or harsh weather schedule? | Project complexity of these items may impact construction bid, site complexity, possible contract modifications. | The listed cost items are fairly simple. Any risk is likely low. | Unlikely | Negligible | **0** |
| CE-7 | 7 Drainage | • Accelerated schedule or harsh weather schedule? | Soil conditions. Location of project requires special mobilization. Fuel for equipment. | A soils report was never performed for this study, only research was taken into account. The likelihood of the anticipated soils type to change is very unlikely, however in the case an unanticipated soil type is found the impact would have a marginal effect. Fuel costs are likely to fluctuate, however the fuel costs are a small percentage to the price of the project as a whole. | Likely | Marginal | **2** |
| CE-8 | 0 | • Accelerated schedule or harsh weather schedule? | | | Unlikely | Negligible | **0** |
| CE-9 | 0 | • Accelerated schedule or harsh weather schedule? | | | Unlikely | Negligible | **0** |
| CE-10 | 0 | • Accelerated schedule or harsh weather schedule? | | | Unlikely | Negligible | **0** |
| CE-11 | 0 | • Accelerated schedule or harsh weather schedule? | | | Unlikely | Negligible | **0** |
| CE-12 | Remaining Construction Items | • Accelerated schedule or harsh weather schedule? | None. | | Unlikely | Negligible | **0** |
| CE-13 | Planning, Engineering, & Design | • Accelerated schedule or harsh weather schedule? | None. | | Unlikely | Negligible | **0** |
| CE-14 | Construction Management | • Accelerated schedule or harsh weather schedule? | None. | | Unlikely | Negligible | **0** |

## Quantities for Current Scope

Max Potential Cost Growth 20%

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Q-1 | 1 Mobilization - Demobilization | • Level of confidence based on design and assumptions? | Topo may not be most current thus affecting the grading quantities. Design is conceptual. | The topo is anticipated to be out of date, therefore the grading quantities are likely to change but should only change to have a marginal impact to the project. | Likely | Marginal | 2 |
| Q-2 | 2 Chainlink Fence | • Level of confidence based on design and assumptions? | Location of properties on topo may not be most current affecting perimeter locations. | The topo is anticipated to be out of date, therefore the grading quantities are likely to change but should only change to have a marginal impact to the project. | Likely | Marginal | 2 |
| Q-3 | 3 Dewatering | • Level of confidence based on design and assumptions? | Topo may not be most current thus affecting the grading quantities. Design is conceptual. | The topo is anticipated to be out of date, therefore the grading quantities are likely to change but should only change to have a marginal impact to the project. | Likely | Negligible | 1 |
| Q-4 | 4 Road Crossing | • Level of confidence based on design and assumptions? | | | Unlikely | Negligible | 0 |
| Q-5 | 5 Grading | • Level of confidence based on design and assumptions? | Topo may not be most current thus affecting the grading quantities. Design is conceptual. | The topo is anticipated to be out of date, therefore the grading quantities are likely to change but should only change to have a marginal impact to the project. | Likely | Significant | 3 |
| Q-6 | 6 Post-Construction Monitoring | • Level of confidence based on design and assumptions? | As design evolves quantities on current project scope may change due to refinement. | It is unlikely that there would be any changes after construction. | Unlikely | Marginal | 0 |
| Q-7 | 7 Drainage | • Level of confidence based on design and assumptions? | Design is conceptual. | With a complete design infrastructure quantities may change slightly. | Likely | Marginal | 2 |
| Q-8 | 0 | • Level of confidence based on design and assumptions? | | | Unlikely | Negligible | 0 |
| Q-9 | 0 | • Level of confidence based on design and assumptions? | | | Unlikely | Negligible | 0 |
| Q-10 | 0 | • Level of confidence based on design and assumptions? | | | Unlikely | Negligible | 0 |
| Q-11 | 0 | • Level of confidence based on design and assumptions? | | | Unlikely | Negligible | 0 |
| Q-12 | Remaining Construction Items | • Level of confidence based on design and assumptions? | None. | | Unlikely | Negligible | 0 |
| Q-13 | Planning, Engineering, & Design | • Level of confidence based on design and assumptions? | None. | | Unlikely | Negligible | 0 |
| Q-14 | Construction Management | • Level of confidence based on design and assumptions? | None. | | Unlikely | Negligible | 0 |

**Specialty Fabrication or Equipment**

| | | | | | | Max Potential Cost Growth | 75% |
|---|---|---|---|---|---|---|---|
| FE-1 | 1 Mobilization - Demobilization | • Unusual parts, material or equipment manufactured or installed? | Any specialized fabrication could impact cost due to change of material costs, complex designs, sole source fabrications that are not competitive. | | Possible | Marginal | **1** |
| FE-2 | 2 Chainlink Fence | • Unusual parts, material or equipment manufactured or installed? | | | Unlikely | Marginal | **0** |
| FE-3 | 3 Dewatering | • Unusual parts, material or equipment manufactured or installed? | Installation of the basin inlet and outlet. | A more detailed design of the basin inlet and outlet will likely be needed, but the impact of the difference compared to the conceptual design should be negligible. | Possible | Marginal | **1** |
| FE-4 | 4 Road Crossing | • Unusual parts, material or equipment manufactured or installed? | | | Unlikely | Negligible | **0** |
| FE-5 | 5 Grading | • Unusual parts, material or equipment manufactured or installed? | Installation of the basin inlet and outlet. | A more detailed design of the basin inlet and outlet will likely be needed, but the impact of the difference compared to the conceptual design should be negligible. | Possible | Significant | **2** |
| FE-6 | 6 Post-Construction Monitoring | • Unusual parts, material or equipment manufactured or installed? | Any specialized fabrication could impact cost due to change of material costs, complex designs, sole source fabrications that are not competitive. | Not applicable. | Unlikely | Negligible | **0** |
| FE-7 | 7 Drainage | • Unusual parts, material or equipment manufactured or installed? | Installation of the culvert inlet and outlet. Fabrication of manholes. | A more detailed design of the culvert inlet and outlet will likely be needed, but the impact of the difference compared to the conceptual design should be negligible and the addition of the drain manholes will have a more marginal impact. | Possible | Significant | **2** |
| FE-8 | 0 | • Unusual parts, material or equipment manufactured or installed? | | | Unlikely | Negligible | **0** |
| FE-9 | 0 | • Unusual parts, material or equipment manufactured or installed? | | | Unlikely | Negligible | **0** |
| FE-10 | 0 | • Unusual parts, material or equipment manufactured or installed? | | | Unlikely | Negligible | **0** |
| FE-11 | 0 | • Unusual parts, material or equipment manufactured or installed? | | | Unlikely | Negligible | **0** |
| FE-12 | Remaining Construction Items | • Unusual parts, material or equipment manufactured or installed? | None. | | Unlikely | Negligible | **0** |
| FE-13 | Planning, Engineering, & Design | • Unusual parts, material or equipment manufactured or installed? | None. | | Unlikely | Negligible | **0** |
| FE-14 | Construction Management | • Unusual parts, material or equipment manufactured or installed? | None. | | Unlikely | Negligible | **0** |

## Cost Estimate Assumptions

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | Max Potential Cost Growth | 35% |
| CT-1 | 1 Mobilization - Demobilization | • Reliability and number of key quotes? | Assumptions based on concept design. Assumptions were used to establish costs and are relative to contractor markups and assignment, quantities, crews and productivities, quotes and historical cost data. Cost is based on current pricing. | Depending on when the construction takes place, prices could vary greatly and is dependent on the economy. Major quantities were provided by the AE and the critical cost items were adjusted to reflect reasonable cost as if this were a bid item. As further details are developed, the major line item costs will be refined which could significantly affect the cost. | Possible | Significant | 2 |
| CT-2 | 2 Chainlink Fence | • Reliability and number of key quotes? | Assumptions based on concept design. Assumptions were used to establish costs and are relative to contractor markups and assignment, quantities, crews and productivities, quotes and historical cost data. Cost is based on current pricing. | Depending on when the construction takes place, prices could vary greatly and is dependent on the economy. Major quantities were provided by the AE and the critical cost items were adjusted to reflect reasonable cost as if this were a bid item. As further details are developed, the major line item costs will be refined which could significantly affect the cost. | Possible | Significant | 2 |
| CT-3 | 3 Dewatering | • Reliability and number of key quotes? | Assumptions based on concept design. Assumptions were used to establish costs and are relative to contractor markups and assignment, quantities, crews and productivities, quotes and historical cost data. Cost is based on current pricing. | Depending on when the construction takes place, prices could vary greatly and is dependent on the economy. Major quantities were provided by the AE and the critical cost items were adjusted to reflect reasonable cost as if this were a bid item. As further details are developed, the major line item costs will be refined which could significantly affect the cost. | Possible | Significant | 2 |
| CT-4 | 4 Road Crossing | • Reliability and number of key quotes? | Assumptions based on concept design. Assumptions were used to establish costs and are relative to contractor markups and assignment, quantities, crews and productivities, quotes and historical cost data. Cost is based on current pricing. | Depending on when the construction takes place, prices could vary greatly and is dependent on the economy. Major quantities were provided by the AE and the critical cost items were adjusted to reflect reasonable cost as if this were a bid item. As further details are developed, the major line item costs will be refined which could significantly affect the cost. | Possible | Significant | 2 |
| CT-5 | 5 Grading | • Reliability and number of key quotes? | Assumptions based on concept design. Assumptions were used to establish costs and are relative to contractor markups and assignment, quantities, crews and productivities, quotes and historical cost data. Cost is based on current pricing. | Depending on when the construction takes place, prices could vary greatly and is dependent on the economy. Major quantities were provided by the AE and the critical cost items were adjusted to reflect reasonable cost as if this were a bid item. As further details are developed, the major line item costs will be refined which could significantly affect the cost. | Possible | Significant | 2 |
| CT-6 | 6 Post-Construction Monitoring | • Reliability and number of key quotes? | Assumptions based on concept design. Assumptions were used to establish costs and are relative to contractor markups and assignment, quantities, crews and productivities, quotes and historical cost data. Cost is based on current pricing. | Depending on when the construction takes place, prices could vary greatly and is dependent on the economy. Major quantities were provided by the AE and the critical cost items were adjusted to reflect reasonable cost as if this were a bid item. As further details are developed, the major line item costs will be refined which could significantly affect the cost. | Possible | Marginal | 1 |
| CT-7 | 7 Drainage | • Reliability and number of key quotes? | Assumptions based on concept design. Assumptions were used to establish costs and are relative to contractor markups and assignment, quantities, crews and productivities, quotes and historical cost data. Cost is based on current pricing. | Depending on when the construction takes place, prices could vary greatly and is dependent on the economy. Major quantities were provided by the AE and the critical cost items were adjusted to reflect reasonable cost as if this were a bid item. As further details are developed, the major line item costs will be refined which could significantly affect the cost. | Possible | Significant | 2 |
| CT-8 | 0 | • Reliability and number of key quotes? | | | Unlikely | Negligible | 0 |
| CT-9 | 0 | • Reliability and number of key quotes? | | | Unlikely | Negligible | 0 |
| CT-10 | 0 | • Reliability and number of key quotes? | | | Unlikely | Negligible | 0 |
| CT-11 | 0 | • Reliability and number of key quotes? | | | Unlikely | Negligible | 0 |
| CT-12 | Remaining Construction Items | • Reliability and number of key quotes? | None. | | Unlikely | Negligible | 0 |
| CT-13 | Planning, Engineering, & Design | • Reliability and number of key quotes? | Assumptions based on concept design. Assumptions were used to establish costs and are relative to contractor markups and assignment, quantities, crews and productivities, quotes and historical cost data. Cost is based on current pricing. | | Possible | Significant | 2 |
| CT-14 | Construction Management | • Reliability and number of key quotes? | Assumptions based on concept design. Assumptions were used to establish costs and are relative to contractor markups and assignment, quantities, crews and productivities, quotes and historical cost data. Cost is based on current pricing. | | Possible | Marginal | 1 |

## External Project Risks

| | | | | | | Max Potential Cost Growth | 40% |
|---|---|---|---|---|---|---|---|
| EX-1 | 1 Mobilization - Demobilization | • Potential for severe adverse weather? | External risks such as failure to obtain permits in a timely manner, political risks, delays or cancellation of funding sources could impact project costs. Potential for adverse weather. | Depending on the project schedule, weather is likely to affect the project schedule. However, the construction of the basin would be part of the critical path so the impact would have a marginal effect. | Possible | Marginal | 1 |
| EX-2 | 2 Chainlink Fence | • Potential for severe adverse weather? | External risks such as failure to obtain permits in a timely manner, political risks, delays or cancellation of funding sources could impact project costs. Potential for adverse weather. | Depending on the project schedule, weather is likely to affect the project schedule. However, the construction of the basin would be part of the critical path so the impact would have a marginal effect. | Possible | Marginal | 1 |
| EX-3 | 3 Dewatering | • Potential for severe adverse weather? | External risks such as failure to obtain permits in a timely manner, political risks, delays or cancellation of funding sources could impact project costs. Potential for adverse weather. | Depending on the project schedule, weather is likely to affect the project schedule. However, the construction of the basin would be part of the critical path so the impact would have a marginal effect. | Possible | Significant | 2 |
| EX-4 | 4 Road Crossing | • Potential for severe adverse weather? | External risks such as failure to obtain permits in a timely manner, political risks, delays or cancellation of funding sources could impact project costs. Potential for adverse weather. | Depending on the project schedule, weather is likely to affect the project schedule. However, the construction of the basin would be part of the critical path so the impact would have a marginal effect. | Possible | Marginal | 1 |
| EX-5 | 5 Grading | • Potential for severe adverse weather? | External risks such as failure to obtain permits in a timely manner, political risks, delays or cancellation of funding sources could impact project costs. Potential for adverse weather. | Depending on the project schedule, weather is likely to affect the project schedule. However, the construction of the basin would be part of the critical path so the impact would have a marginal effect. | Possible | Significant | 2 |
| EX-6 | 6 Post-Construction Monitoring | • Potential for severe adverse weather? | External risks such as failure to obtain permits in a timely manner, political risks, delays or cancellation of funding sources could impact project costs. Potential for adverse weather. | Depending on the project schedule, weather is likely to affect the project schedule. However, the construction of the basin would be part of the critical path so the impact would have a marginal effect. | Possible | Negligible | 0 |
| EX-7 | 7 Drainage | • Potential for severe adverse weather? | External risks such as failure to obtain permits in a timely manner, political risks, delays or cancellation of funding sources could impact project costs. Ability to establish easement agreements. Potential for adverse weather. | Depending on the project schedule, weather is likely to affect the project schedule. However, the construction of the basin would be part of the critical path so the impact would have a marginal effect. The ability to establish easements which may be needed to convey the discharge to the lagoon may have a marginal effect on the project. | Possible | Significant | 2 |
| EX-8 | 0 | • Potential for severe adverse weather? | | | Unlikely | Negligible | 0 |
| EX-9 | 0 | • Potential for severe adverse weather? | | | Unlikely | Negligible | 0 |
| EX-10 | 0 | • Potential for severe adverse weather? | | | Unlikely | Negligible | 0 |
| EX-11 | 0 | • Potential for severe adverse weather? | | | Unlikely | Negligible | 0 |
| EX-12 | Remaining Construction Items | • Potential for severe adverse weather? | None. | | Unlikely | Negligible | 0 |
| EX-13 | Planning, Engineering, & Design | • Potential for severe adverse weather? | External risks such as political, funding sources could impact project costs over time. | Changes to permitting and other requirements could result in added coordination and design efforts. | Possible | Significant | 2 |
| EX-14 | Construction Management | • Potential for severe adverse weather? | Potential for adverse weather. | Severe weather could impact the grading of the site and impact the schedule. | Possible | Significant | 2 |

## Saipan Lagoon Ecosystem Restoration - TSP(C0Q0A1)

Feasibility (Recommended Plan)

Abbreviated Risk Analysis

| Typical Risk Elements | **Potential Risk Areas** | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 Mobilization - Demobilization | 2 Chainlink Fence | 3 Dewatering | 4 Road Crossing | 5 Grading | 6 Post-Construction Monitoring | 7 Drainage | 0 | 0 | 0 | 0 | Remaining Construction Ite | Planning, Engineering, & Design | Construction Management |
| **Project Scope Growth** | 1 | 2 | 2 | - | 3 | - | 3 | - | - | - | - | - | 2 | 2 |
| **Acquisition Strategy** | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **Construction Elements** | 2 | - | 2 | 1 | 2 | - | 2 | - | - | - | - | - | - | - |
| **Quantities for Current Scope** | 2 | 2 | 1 | - | 3 | - | 2 | - | - | - | - | - | - | - |
| **Specialty Fabrication or Equipment** | 1 | - | 1 | - | 2 | - | 2 | - | - | - | - | - | - | - |
| **Cost Estimate Assumptions** | 2 | 2 | 2 | 2 | 2 | 1 | 2 | - | - | - | - | - | 2 | 1 |
| **External Project Risks** | 1 | 1 | 2 | 1 | 2 | - | 2 | - | - | - | - | - | 2 | 2 |

# **** TOTAL PROJECT COST SUMMARY ****

PROJECT: **Saipan Lagoon Ecosystem Restoration** DISTRICT: **NWW WALLA WALLA** PREPARED: **6/18/2013**
PROJECT NO:
LOCATION: **Saipan Lagoon, Sasipan** POC: **CHIEF, COST ENGINEERING, Gary F. Yamauchi**

This Estimate reflects the scope and schedule in report; CAP Feasibility STUDY - ECOSYSTEM RESTORATION REPORT

| **Civil Works Work Breakdown Structure** | | **ESTIMATED COST** | | | | **PROJECT FIRST COST (Constant Dollar Basis)** | | | | **TOTAL PROJECT COST (FULLY FUNDED)** | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Program Year (Budget EC): | | | 2016 | | | | | |
| | | | | | | Effective Price Level Date: | | | 1 OCT 15 | | | | | |
| WBS NUMBER | Civil Works Feature & Sub-Feature Description | COST ($K) | CNTG ($K) | CNTG (%) | TOTAL ($K) | ESC (%) | COST ($K) | CNTG ($K) | **TOTAL ($K)** | Spent Thru: 10/1/2012 ($K) | | COST ($K) | CNTG ($K) | FULL ($K) |
| ***A*** | ***B*** | ***C*** | ***D*** | ***E*** | ***F*** | ***G*** | ***H*** | ***I*** | ***J*** | ***K*** | ***L*** | ***M*** | ***N*** | ***O*** |
| **03** | RESERVOIRS | $1,127 | $346 | 31% | $1,472.88 | 4.4% | $1,177 | $361 | $1,538 | | | $1,199 | $368 | $1,567 |
| **03** | RESERVOIRS | $1,241 | $381 | 31% | $1,621.86 | 4.4% | $1,296 | $398 | $1,694 | | | $1,404 | $431 | $1,835 |
| | (Post Construction Monitoring) | | | - | | - | | | | | | | | |
| **19** | BUILDINGS, GROUNDS & UTILITIES | $3,140 | $964 | 31% | $4,103.67 | 4.4% | $3,279 | $1,006 | $4,285 | | | $3,341 | $1,025 | $4,367 |
| | **CONSTRUCTION ESTIMATE TOTALS:** | $5,508 | $1,690 | | $7,198.41 | 4.4% | $5,752 | $1,765 | $7,517 | | | $5,944 | $1,824 | $7,769 |
| 01 | LANDS AND DAMAGES | $1,466 | $135 | 9% | $1,600.98 | 4.4% | $1,531 | $141 | $1,672 | | | $1,538 | $142 | $1,680 |
| 22 | FEASIBILITY STUDY (CAP studies) | | | | | | | | | $1,483 | | | | $1,483 |
| 30 | PLANNING, ENGINEERING & DESIGN | $1,975 | $418 | 21% | $2,392.52 | 6.5% | $2,104 | $445 | $2,549 | | | $2,114 | $447 | $2,561 |
| 31 | CONSTRUCTION MANAGEMENT | $594 | $113 | 19% | $707.04 | 6.5% | $633 | $120 | $753 | | | $659 | $125 | $785 |
| | **PROJECT COST TOTALS:** | $9,543 | $2,356 | 25% | $11,898.94 | | $10,020 | $2,471 | **$12,491** | $1,483 | | $10,256 | $2,538 | $14,277 |

| | |
|---|---|
| Mandatory by Regulation | CHIEF, COST ENGINEERING, Gary F. Yamauchi |
| Mandatory by Regulation | PROJECT MANAGER, Milton Yoshimoto |
| Mandatory by Regulation | CHIEF, REAL ESTATE, Craig H. Nakano |
| | CHIEF, PLANNING, Anthony J. Paresa |
| | CHIEF, ENGINEERING, Todd C. Barnes |
| | CHIEF, OPERATIONS, Michael F. Wong |
| | CHIEF, CONSTRUCTION, Louis Muzzarini |
| | CHIEF, CONTRACTING, Roger David Williams |
| | CHIEF, PM-PB, Roxanne E. Iseri |
| | CHIEF, DPM, Milton Yoshimoto |

| | | |
|---|---|---|
| ESTIMATED FEDERAL COST: | 65% | **$8,316** |
| ESTIMATED NON-FEDERAL COST: | 35% | **$4,478** |
| FEASIBILITY FEDERAL COST: | | **$792** |
| FEASIBILITY NON-FEDERAL COST: | | **$692** |
| **ESTIMATED TOTAL PROJECT COST:** | | **$14,277** |

## **** TOTAL PROJECT COST SUMMARY ****

### **** CONTRACT COST SUMMARY ****

PROJECT: Saipan Lagoon Ecosystem Restoration
LOCATION: Saipan Lagoon, Sasipan
This Estimate reflects the scope and schedule in report; CAP Feasibility STUDY - ECOSYSTEM RESTORATION REPORT

DISTRICT: NWW WALLA WALLA PREPARED: 6/18/2013
POC: CHIEF, COST ENGINEERING, Gary F. Yamauchi

| **WBS Structure** | | **ESTIMATED COST** | | | | **PROJECT FIRST COST (Constant Dollar Basis)** | | | | **TOTAL PROJECT COST (FULLY FUNDED)** | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Estimate Prepared: | | | 3/22/2013 | Program Year (Budget EC): | | | 2016 | | | | | |
| | | Effective Price Level: | | | 10/1/2012 | Effective Price Level Date: | | | 1 OCT 15 | | | | | |
| | | | RISK BASED | | | | | | | | | | | |
| WBS NUMBER | Civil Works Feature & Sub-Feature Description | COST ($K) | CNTG ($K) | CNTG (%) | TOTAL ($K) | ESC (%) | COST ($K) | CNTG ($K) | TOTAL ($K) | Mid-Point Date | INFLATED (%) | COST ($K) | CNTG ($K) | FULL ($K) |
| *A* | *B* | *C* | *D* | *E* | *F* | *G* | *H* | *I* | *J* | *P* | *L* | *M* | *N* | *O* |
| | **PHASE 1 or CONTRACT 1** | | | | | | | | | | | | | |
| **03** | RESERVOIRS | $1,127 | $346 | 30.7% | $1,473 | 4.4% | $1,177 | $361 | $1,538 | 2016Q2 | 1.9% | $1,199 | $368 | $1,567 |
| **03** | RESERVOIRS<br>(Post Construction Monitoring) | $1,241 | $381 | 30.7% | $1,622 | 4.4% | $1,296 | $398 | $1,694 | 2019Q3 | 8.3% | $1,404 | $431 | $1,835 |
| **19** | BUILDINGS, GROUNDS & UTILITIES | $3,140 | $964 | 30.7% | $4,104 | 4.4% | $3,279 | $1,006 | $4,285 | 2016Q2 | 1.9% | $3,341 | $1,025 | $4,367 |
| | **CONSTRUCTION ESTIMATE TOTALS:** | $5,508 | $1,690 | 30.7% | **$7,198** | | $5,752 | $1,765 | $7,517 | | | $5,944 | $1,824 | $7,769 |
| **01** | LANDS AND DAMAGES | $1,466 | $135 | 9.2% | $1,601 | 4.4% | $1,531 | $141 | $1,672 | 2015Q3 | 0.5% | $1,538 | $142 | $1,680 |
| **30** | PLANNING, ENGINEERING & DESIGN | | | | | | | | | | | | | |
| *4.30%* | Project Management | $237 | $50 | 21.1% | $287 | 6.5% | $253 | $53 | $306 | 2015Q2 | | $253 | $53 | $306 |
| *19.95%* | Planning & Environmental Compliance | $1,099 | $232 | 21.1% | $1,331 | 6.5% | $1,171 | $248 | $1,419 | 2015Q2 | | $1,171 | $248 | $1,419 |
| *4.43%* | Engineering & Design | $244 | $52 | 21.1% | $296 | 6.5% | $260 | $55 | $315 | 2015Q2 | | $260 | $55 | $315 |
| *0.91%* | Engineering Tech Review ITR & VE | $50 | $11 | 21.1% | $61 | 6.5% | $53 | $11 | $65 | 2015Q2 | | $53 | $11 | $65 |
| *0.45%* | Contracting & Reprographics | $25 | $5 | 21.1% | $30 | 6.5% | $27 | $6 | $32 | 2015Q2 | | $27 | $6 | $32 |
| *1.82%* | Engineering During Construction | $100 | $21 | 21.1% | $121 | 6.5% | $107 | $23 | $129 | 2016Q2 | 4.2% | $111 | $23 | $134 |
| *2.00%* | Planning During Construction | $110 | $23 | 21.1% | $133 | 6.5% | $117 | $25 | $142 | 2016Q2 | 4.2% | $122 | $26 | $148 |
| *2.00%* | Project Operations | $110 | $23 | 21.1% | $133 | 6.5% | $117 | $25 | $142 | 2015Q2 | | $117 | $25 | $142 |
| **31** | CONSTRUCTION MANAGEMENT | | | | | | | | | | | | | |
| *6.28%* | Construction Management | $346 | $66 | 19.0% | $412 | 6.5% | $369 | $70 | $439 | 2016Q2 | 4.2% | $384 | $73 | $457 |
| *2.00%* | Project Operation: | $110 | $21 | 19.0% | $131 | 6.5% | $117 | $22 | $140 | 2016Q2 | 4.2% | $122 | $23 | $145 |
| *2.50%* | Project Management | $138 | $26 | 19.0% | $164 | 6.5% | $147 | $28 | $175 | 2016Q2 | 4.2% | $153 | $29 | $182 |
| | **CONTRACT COST TOTALS:** | $9,543 | $2,356 | | **$11,899** | | $10,020 | $2,471 | $12,491 | | | $10,256 | $2,538 | **$12,794** |

## Abbreviated Risk Analysis

Project (less than $40M): **Saipan Lagoon Ecosystem Restoration - Alt 3 (C2Q0A**
Project Development Stage: **Feasibility (Alternatives)**
Risk Category: **Moderate Risk: Typical Project or Possible Life Safety**

Total Construction Contract Cost = **$ 5,508,242**

| | CWWBS | Feature of Work | Contract Cost | | % Contingency | $ Contingency | Total |
|---|---|---|---|---|---|---|---|
| | 01 LANDS AND DAMAGES | Real Estate | **$ 1,466,200** | | **9.21%** | $ 135,000 | $ 1,601,200.37 |
| 1 | **03 RESERVOIRS** | **1 Mobilization - Demobilization** | **$ 97,806** | | 24.92% | $ 24,372 | $ 122,177.78 |
| 2 | **03 RESERVOIRS** | **2 Chainlink Fence** | **$ 168,897** | | 22.18% | $ 37,454 | $ 206,350.66 |
| 3 | **03 RESERVOIRS** | **3 Dewatering** | **$ 175,314** | | 28.96% | $ 50,769 | $ 226,083.29 |
| 4 | **03 RESERVOIRS** | **4 Road Crossing** | **$ 52,614** | | 15.14% | $ 7,966 | $ 60,580.24 |
| 5 | **03 RESERVOIRS** | **5 Grading** | **$ 632,725** | | 44.14% | $ 279,269 | $ 911,994.48 |
| 6 | **03 RESERVOIRS** | **6 Post-Construction Monitoring** | **$ 1,241,342** | | 9.04% | $ 112,170 | $ 1,353,511.75 |
| 7 | **19 BUILDINGS, GROUNDS, AND UTILITIES** | **7 Drainage** | **$ 1,089,350** | | 41.42% | $ 451,185 | $ 1,540,535.40 |
| 8 | **19 BUILDINGS, GROUNDS, AND UTILITIES** | **8 Driveway** | **$ 36,363** | | 17.42% | $ 6,336 | $ 42,698.56 |
| 9 | **19 BUILDINGS, GROUNDS, AND UTILITIES** | **9 Basin** | **$ 2,013,831** | | 35.79% | $ 720,833 | $ 2,734,664.16 |
| 12 | | **Remaining Construction Items** | **$ -** | *0.0%* | 0.00% | $ - | $ - |
| 13 | 30 PLANNING, ENGINEERING, AND DESIGN | **Planning, Engineering, & Design** | **$ 1,975,000** | | 21.14% | $ 417,577 | $ 2,392,577.39 |
| 14 | 31 CONSTRUCTION MANAGEMENT | **Construction Management** | **$ 594,000** | | 19.03% | $ 113,058 | $ 707,058.08 |

**Totals**

| | Contract Cost | % Contingency | $ Contingency | Total |
|---|---|---|---|---|
| Real Estate | $ 1,466,200 | 9.21% | $ 135,000 | $ 1,601,200.37 |
| Total Construction Estimate | $ 5,508,242 | 30.69% | $ 1,690,354 | $ 7,198,596 |
| Total Planning, Engineering & Design | $ 1,975,000 | 21.14% | $ 417,577 | $ 2,392,577 |
| Total Construction Management | $ 594,000 | 19.03% | $ 113,058 | $ 707,058 |
| Total | $ 9,543,442 | | $ 2,355,990 | $ 11,899,432 |

# Abbreviated Risk Analysis

## Saipan Lagoon Ecosystem Restoration - C2Q0A1

## Feasibility

Meeting Date: 22-Mar-13

**PDT Members** (Typical Recommended)

| | |
|---|---|
| Project Management: | Milton Yoshimoto |
| Cost Estimator: | Lana Murishige |
| Environmentalist: | Sonia Shjesgadt |
| Environmentalist: | Miya Akiba |
| Engineering & Design: | Anson Murayama |
| Engineering & Design: | Frank Camacho |
| Project Management: | Uyen Tran |

## Saipan Lagoon Ecosystem Restoration - Alt 3 (C2Q0A1)

Feasibility (Alternatives)
Abbreviated Risk Analysis

**Meeting Date:** ########

**Risk Level**

| | | | | | |
|---|---|---|---|---|---|
| Very Likely | 2 | 3 | 4 | 5 | 5 |
| Likely | 1 | 2 | 3 | 4 | 5 |
| Possible | 0 | 1 | 2 | 3 | 4 |
| Unlikely | 0 | 0 | 1 | 2 | 3 |
| | Negligible | Marginal | Significant | Critical | Crisis |

### Project Scope Growth

**Max Potential Cost Growth** 75%

| Risk Element | Feature of Work | Concerns Pull Down Tab (ENABLE MACROS THRU TRUST CENTER) (Choose ALL that apply) | Concerns | PDT Discussions & Conclusions (Include logic & justification for choice of Likelihood & Impact) | Likelihood | Impact | Risk Level |
|---|---|---|---|---|---|---|---|
| PS-1 | 1 Mobilization - Demobilization | • Project accomplish intent? | Schedule is assumed and subject to change. | A more detailed design will be required and the topo is anticipated to be out of date. | Possible | Marginal | 1 |
| PS-2 | 2 Chainlink Fence | • Potential for scope growth, added features and quantities? | Possible quantity differential if site limits change. | | Likely | Marginal | 2 |
| PS-3 | 3 Dewatering | • Investigations sufficient to support design assumptions? | Schedule is assumed and subject to change. Soil report will be needed. | A more detailed design will be required and the topo is anticipated to be out of date. | Likely | Marginal | 2 |
| PS-4 | 4 Road Crossing | • Investigations sufficient to support design assumptions? | Topo may not be most current thus affecting assumed locations of road and utilities. | | Possible | Negligible | 0 |
| PS-5 | 5 Grading | • Design confidence? | 10% conceptual design only. Existing topo may not be most current. | A more detailed design will be required and the topo is anticipated to be out of date. | Likely | Significant | 3 |
| PS-6 | 6 Post-Construction Monitoring | • Potential for scope growth, added features and quantities? | Additional monitoring may be required if performance standards aren't met. | It is unlikely that there would be any changes after construction. | Unlikely | Marginal | 0 |
| PS-7 | 7 Drainage | • Potential for scope growth, added features and quantities? | 10% conceptual design only. Condition of existing utilities may be different. | A more detailed design will be required. The condition of the existing utilities is unknown and the assumption was made that the existing utilities will convey all the runoff from the watershed to the basin. | Likely | Significant | 3 |
| PS-8 | 8 Driveway | • Potential for scope growth, added features and quantities? | Topo may not be most current thus affecting assumed locations of road and utilities. | | Possible | Negligible | 0 |
| PS-9 | 9 Basin | • Potential for scope growth, added features and quantities? | 10% conceptual design only. Condition of existing utilities may be different. | A more detailed design will be required. The condition of the existing utilities is unknown and the assumption was made that the existing utilities will convey all the runoff from the watershed to the basin. | Likely | Significant | 3 |
| PS-10 | 0 | • Potential for scope growth, added features and quantities? | | | Unlikely | Negligible | 0 |
| PS-11 | 0 | • Potential for scope growth, added features and quantities? | | | Unlikely | Negligible | 0 |
| PS-12 | Remaining Construction Items | • Potential for scope growth, added features and quantities? | None. | | Unlikely | Negligible | 0 |
| PS-13 | Planning, Engineering, & Design | • Potential for scope growth, added features and quantities? | Need to provide 100% Design. | A more detailed design will be required and the topo is anticipated to be out of date. The condition of the existing utilities is unknown and the assumption was made that the existing utilities will convey all the runoff from the watershed to the basin. | Likely | Marginal | 2 |
| PS-14 | Construction Management | • Potential for scope growth, added features and quantities? | Need to provide 100% Design. | A more detailed design will be required and the topo is anticipated to be out of date. The condition of the existing utilities is unknown and the assumption was made that the existing utilities will convey all the runoff from the watershed to the basin. | Likely | Marginal | 2 |

## Acquisition Strategy

| | | | | | | Max Potential Cost Growth | 30% |
|---|---|---|---|---|---|---|---|
| AS-1 | 1 Mobilization - Demobilization | • Contracting plan firmly established? | | | Unlikely | Negligible | 0 |
| AS-2 | 2 Chainlink Fence | • Contracting plan firmly established? | | | Unlikely | Negligible | 0 |
| AS-3 | 3 Dewatering | • Contracting plan firmly established? | | Due to unknown contract schedule, plans may be altered. | Unlikely | Marginal | 0 |
| AS-4 | 4 Road Crossing | • Contracting plan firmly established? | Topo may not be most current thus affecting assumed locations of road and utilities for easement purposes. | | Unlikely | Negligible | 0 |
| AS-5 | 5 Grading | • Contracting plan firmly established? | Contracting plan established. | Due to unknown contract schedule, plans may be altered. | Unlikely | Marginal | 0 |
| AS-6 | 6 Post-Construction Monitoring | • Contracting plan firmly established? | Contract acquisition strategy is assumed as full and open, invitation for bid. | The reasonable assumption is that the prime contractor will be performing most of the work. | Unlikely | Marginal | 0 |
| AS-7 | 7 Drainage | • Contracting plan firmly established? | Contracting plan established. | Due to unknown contract schedule, plans may be altered. | Unlikely | Marginal | 0 |
| AS-8 | 8 Driveway | • Contracting plan firmly established? | Topo may not be most current thus affecting assumed locations of road and utilities for easement purposes. | | Unlikely | Negligible | 0 |
| AS-9 | 9 Basin | • Contracting plan firmly established? | Contracting plan established. | Due to unknown contract schedule, plans may be altered. | Unlikely | Marginal | 0 |
| AS-10 | 0 | • Contracting plan firmly established? | | | Unlikely | Negligible | 0 |
| AS-11 | 0 | • Contracting plan firmly established? | | | Unlikely | Negligible | 0 |
| AS-12 | Remaining Construction Items | • Contracting plan firmly established? | None. | | Unlikely | Negligible | 0 |
| AS-13 | Planning, Engineering, & Design | • Contracting plan firmly established? | None. | | Unlikely | Negligible | 0 |
| AS-14 | Construction Management | • Contracting plan firmly established? | None. | | Unlikely | Negligible | 0 |

**Construction Elements**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | Max Potential Cost Growth | 25% |
| CE-1 | 1 Mobilization - Demobilization | • Accelerated schedule or harsh weather schedule? | Major clearing and grubbing required. Soil conditions. Location of project requires special mobilization. There is a possibility for major construction modifications if special equipment or subcontractors need to be transported to the site. Fuel for equipment. | A soils report was never performed for this study, only research was taken into account. The likelihood of the anticipated soils type to change is very unlikely, however in the case an unanticipated soil type is found the impact would have a marginal effect. Fuel costs are likely to fluctuate, however the fuel costs are a small percentage to the price of the project as a whole. | Likely | Marginal | 2 |
| CE-2 | 2 Chainlink Fence | • Accelerated schedule or harsh weather schedule? | | | Unlikely | Negligible | 0 |
| CE-3 | 3 Dewatering | • Accelerated schedule or harsh weather schedule? | Major clearing and grubbing required. Soil conditions. Location of project requires special mobilization. There is a possibility for major construction modifications if special equipment or subcontractors need to be transported to the site. Fuel for equipment. | A soils report was never performed for this study, only research was taken into account. The likelihood of the anticipated soils type to change is very unlikely, however in the case an unanticipated soil type is found the impact would have a marginal effect. Fuel costs are likely to fluctuate, however the fuel costs are a small percentage to the price of the project as a whole. | Likely | Marginal | 2 |
| CE-4 | 4 Road Crossing | • Accelerated schedule or harsh weather schedule? | Fuel for equipment. | Fuel costs are likely to fluctuate, however the fuel costs are a small percentage to the price of the project as a whole. | Likely | Negligible | 1 |
| CE-5 | 5 Grading | • Accelerated schedule or harsh weather schedule? | Major clearing and grubbing required. Soil conditions. Location of project requires special mobilization. There is a possibility for major construction modifications if special equipment or subcontractors need to be transported to the site. Fuel for equipment. | A soils report was never performed for this study, only research was taken into account. The likelihood of the anticipated soils type to change is very unlikely, however in the case an unanticipated soil type is found the impact would have a marginal effect. Fuel costs are likely to fluctuate, however the fuel costs are a small percentage to the price of the project as a whole. | Likely | Marginal | 2 |
| CE-6 | 6 Post-Construction Monitoring | • Accelerated schedule or harsh weather schedule? | Project complexity of these items may impact construction bid, site complexity, possible contract modifications. | The listed cost items are fairly simple. Any risk is likely low. | Unlikely | Negligible | 0 |
| CE-7 | 7 Drainage | • Accelerated schedule or harsh weather schedule? | Soil conditions. Location of project requires special mobilization. Fuel for equipment. | A soils report was never performed for this study, only research was taken into account. The likelihood of the anticipated soils type to change is very unlikely, however in the case an unanticipated soil type is found the impact would have a marginal effect. Fuel costs are likely to fluctuate, however the fuel costs are a small percentage to the price of the project as a whole. | Likely | Marginal | 2 |
| CE-8 | 8 Driveway | • Accelerated schedule or harsh weather schedule? | Fuel for equipment. | Fuel costs are likely to fluctuate, however the fuel costs are a small percentage to the price of the project as a whole. | Likely | Negligible | 1 |
| CE-9 | 9 Basin | • Accelerated schedule or harsh weather schedule? | Soil conditions. Location of project requires special mobilization. Fuel for equipment. | A soils report was never performed for this study, only research was taken into account. The likelihood of the anticipated soils type to change is very unlikely, however in the case an unanticipated soil type is found the impact would have a marginal effect. Fuel costs are likely to fluctuate, however the fuel costs are a small percentage to the price of the project as a whole. | Likely | Marginal | 2 |
| CE-10 | 0 | • Accelerated schedule or harsh weather schedule? | | | Unlikely | Negligible | 0 |
| CE-11 | 0 | • Accelerated schedule or harsh weather schedule? | | | Unlikely | Negligible | 0 |
| CE-12 | Remaining Construction Items | • Accelerated schedule or harsh weather schedule? | None. | | Unlikely | Negligible | 0 |
| CE-13 | Planning, Engineering, & Design | • Accelerated schedule or harsh weather schedule? | None. | | Unlikely | Negligible | 0 |
| CE-14 | Construction Management | • Accelerated schedule or harsh weather schedule? | None. | | Unlikely | Negligible | 0 |

## Quantities for Current Scope

| | | | | | | Max Potential Cost Growth | 20% |
|---|---|---|---|---|---|---|---|
| Q-1 | 1 Mobilization - Demobilization | • Level of confidence based on design and assumptions? | Topo may not be most current thus affecting the grading quantities. Design is conceptual. | The topo is anticipated to be out of date, therefore the grading quantities are likely to change but should only change to have a marginal impact to the project. | Likely | Marginal | 2 |
| Q-2 | 2 Chainlink Fence | • Level of confidence based on design and assumptions? | Location of properties on topo may not be most current affecting perimeter locations. | The topo is anticipated to be out of date, therefore the grading quantities are likely to change but should only change to have a marginal impact to the project. | Likely | Marginal | 2 |
| Q-3 | 3 Dewatering | • Level of confidence based on design and assumptions? | Topo may not be most current thus affecting the grading quantities. Design is conceptual. | The topo is anticipated to be out of date, therefore the grading quantities are likely to change but should only change to have a marginal impact to the project. | Likely | Negligible | 1 |
| Q-4 | 4 Road Crossing | • Level of confidence based on design and assumptions? | | | Unlikely | Negligible | 0 |
| Q-5 | 5 Grading | • Level of confidence based on design and assumptions? | Topo may not be most current thus affecting the grading quantities. Design is conceptual. | The topo is anticipated to be out of date, therefore the grading quantities are likely to change but should only change to have a marginal impact to the project. | Likely | Significant | 3 |
| Q-6 | 6 Post-Construction Monitoring | • Level of confidence based on design and assumptions? | As design evolves quantities on current project scope may change due to refinement. | It is unlikely that there would be any changes after construction. | Unlikely | Marginal | 0 |
| Q-7 | 7 Drainage | • Level of confidence based on design and assumptions? | Design is conceptual. | With a complete design infrastructure quantities may change slightly. | Likely | Marginal | 2 |
| Q-8 | 8 Driveway | • Level of confidence based on design and assumptions? | | | Unlikely | Negligible | 0 |
| Q-9 | 9 Basin | • Level of confidence based on design and assumptions? | Design is conceptual. | With a complete design infrastructure quantities may change slightly. | Likely | Marginal | 2 |
| Q-10 | 0 | • Level of confidence based on design and assumptions? | | | Unlikely | Negligible | 0 |
| Q-11 | 0 | • Level of confidence based on design and assumptions? | | | Unlikely | Negligible | 0 |
| Q-12 | Remaining Construction Items | • Level of confidence based on design and assumptions? | None. | | Unlikely | Negligible | 0 |
| Q-13 | Planning, Engineering, & Design | • Level of confidence based on design and assumptions? | None. | | Unlikely | Negligible | 0 |
| Q-14 | Construction Management | • Level of confidence based on design and assumptions? | None. | | Unlikely | Negligible | 0 |

## Specialty Fabrication or Equipment

| | | | | | | Max Potential Cost Growth | 75% |
|---|---|---|---|---|---|---|---|
| FE-1 | 1 Mobilization - Demobilization | • Unusual parts, material or equipment manufactured or installed? | Any specialized fabrication could impact cost due to change of material costs, complex designs, sole source fabrications that are not competitive. | | Possible | Marginal | 1 |
| FE-2 | 2 Chainlink Fence | • Unusual parts, material or equipment manufactured or installed? | | | Unlikely | Marginal | 0 |
| FE-3 | 3 Dewatering | • Unusual parts, material or equipment manufactured or installed? | Installation of the basin inlet and outlet. | A more detailed design of the basin inlet and outlet will likely be needed, but the impact of the difference compared to the conceptual design should be negligible. | Possible | Marginal | 1 |
| FE-4 | 4 Road Crossing | • Unusual parts, material or equipment manufactured or installed? | | | Unlikely | Negligible | 0 |
| FE-5 | 5 Grading | • Unusual parts, material or equipment manufactured or installed? | Installation of the basin inlet and outlet. | A more detailed design of the basin inlet and outlet will likely be needed, but the impact of the difference compared to the conceptual design should be negligible. | Possible | Significant | 2 |
| FE-6 | 6 Post-Construction Monitoring | • Unusual parts, material or equipment manufactured or installed? | Any specialized fabrication could impact cost due to change of material costs, complex designs, sole source fabrications that are not competitive. | Not applicable. | Unlikely | Negligible | 0 |
| FE-7 | 7 Drainage | • Unusual parts, material or equipment manufactured or installed? | Installation of the culvert inlet and outlet. Fabrication of manholes. | A more detailed design of the culvert inlet and outlet will likely be needed, but the impact of the difference compared to the conceptual design should be negligible and the addition of the drain manholes will have a more marginal impact. | Possible | Significant | 2 |
| FE-8 | 8 Driveway | • Unusual parts, material or equipment manufactured or installed? | | | Unlikely | Negligible | 0 |
| FE-9 | 9 Basin | • Unusual parts, material or equipment manufactured or installed? | | | Unlikely | Negligible | 0 |
| FE-10 | 0 | • Unusual parts, material or equipment manufactured or installed? | | | Unlikely | Negligible | 0 |
| FE-11 | 0 | • Unusual parts, material or equipment manufactured or installed? | | | Unlikely | Negligible | 0 |
| FE-12 | Remaining Construction Items | • Unusual parts, material or equipment manufactured or installed? | None. | | Unlikely | Negligible | 0 |
| FE-13 | Planning, Engineering, & Design | • Unusual parts, material or equipment manufactured or installed? | None. | | Unlikely | Negligible | 0 |
| FE-14 | Construction Management | • Unusual parts, material or equipment manufactured or installed? | None. | | Unlikely | Negligible | 0 |

## Cost Estimate Assumptions

| | | | | | | Max Potential Cost Growth | 35% |
|---|---|---|---|---|---|---|---|
| CT-1 | 1 Mobilization - Demobilization | • Reliability and number of key quotes? | Assumptions based on concept design. Assumptions were used to establish costs and are relative to contractor markups and assignment, quantities, crews and productivities, quotes and historical cost data. Cost is based on current pricing. | Depending on when the construction takes place, prices could vary greatly and is dependent on the economy. Major quantities were provided by the AE and the critical cost items were adjusted to reflect reasonable cost as if this were a bid item. As further details are developed, the major line item costs will be refined which could significantly affect the cost. | Possible | Significant | **2** |
| CT-2 | 2 Chainlink Fence | • Reliability and number of key quotes? | Assumptions based on concept design. Assumptions were used to establish costs and are relative to contractor markups and assignment, quantities, crews and productivities, quotes and historical cost data. Cost is based on current pricing. | Depending on when the construction takes place, prices could vary greatly and is dependent on the economy. Major quantities were provided by the AE and the critical cost items were adjusted to reflect reasonable cost as if this were a bid item. As further details are developed, the major line item costs will be refined which could significantly affect the cost. | Possible | Significant | **2** |
| CT-3 | 3 Dewatering | • Reliability and number of key quotes? | Assumptions based on concept design. Assumptions were used to establish costs and are relative to contractor markups and assignment, quantities, crews and productivities, quotes and historical cost data. Cost is based on current pricing. | Depending on when the construction takes place, prices could vary greatly and is dependent on the economy. Major quantities were provided by the AE and the critical cost items were adjusted to reflect reasonable cost as if this were a bid item. As further details are developed, the major line item costs will be refined which could significantly affect the cost. | Possible | Significant | **2** |
| CT-4 | 4 Road Crossing | • Reliability and number of key quotes? | Assumptions based on concept design. Assumptions were used to establish costs and are relative to contractor markups and assignment, quantities, crews and productivities, quotes and historical cost data. Cost is based on current pricing. | Depending on when the construction takes place, prices could vary greatly and is dependent on the economy. Major quantities were provided by the AE and the critical cost items were adjusted to reflect reasonable cost as if this were a bid item. As further details are developed, the major line item costs will be refined which could significantly affect the cost. | Possible | Significant | **2** |
| CT-5 | 5 Grading | • Reliability and number of key quotes? | Assumptions based on concept design. Assumptions were used to establish costs and are relative to contractor markups and assignment, quantities, crews and productivities, quotes and historical cost data. Cost is based on current pricing. | Depending on when the construction takes place, prices could vary greatly and is dependent on the economy. Major quantities were provided by the AE and the critical cost items were adjusted to reflect reasonable cost as if this were a bid item. As further details are developed, the major line item costs will be refined which could significantly affect the cost. | Possible | Significant | **2** |
| CT-6 | 6 Post-Construction Monitoring | • Reliability and number of key quotes? | Assumptions based on concept design. Assumptions were used to establish costs and are relative to contractor markups and assignment, quantities, crews and productivities, quotes and historical cost data. Cost is based on current pricing. | Depending on when the construction takes place, prices could vary greatly and is dependent on the economy. Major quantities were provided by the AE and the critical cost items were adjusted to reflect reasonable cost as if this were a bid item. As further details are developed, the major line item costs will be refined which could significantly affect the cost. | Possible | Marginal | **1** |
| CT-7 | 7 Drainage | • Reliability and number of key quotes? | Assumptions based on concept design. Assumptions were used to establish costs and are relative to contractor markups and assignment, quantities, crews and productivities, quotes and historical cost data. Cost is based on current pricing. | Depending on when the construction takes place, prices could vary greatly and is dependent on the economy. Major quantities were provided by the AE and the critical cost items were adjusted to reflect reasonable cost as if this were a bid item. As further details are developed, the major line item costs will be refined which could significantly affect the cost. | Possible | Significant | **2** |
| CT-8 | 8 Driveway | • Reliability and number of key quotes? | Assumptions based on concept design. Assumptions were used to establish costs and are relative to contractor markups and assignment, quantities, crews and productivities, quotes and historical cost data. Cost is based on current pricing. | Depending on when the construction takes place, prices could vary greatly and is dependent on the economy. Major quantities were provided by the AE and the critical cost items were adjusted to reflect reasonable cost as if this were a bid item. As further details are developed, the major line item costs will be refined which could significantly affect the cost. | Possible | Significant | **2** |
| CT-9 | 9 Basin | • Reliability and number of key quotes? | Assumptions based on concept design. Assumptions were used to establish costs and are relative to contractor markups and assignment, quantities, crews and productivities, quotes and historical cost data. Cost is based on current pricing. | Depending on when the construction takes place, prices could vary greatly and is dependent on the economy. Major quantities were provided by the AE and the critical cost items were adjusted to reflect reasonable cost as if this were a bid item. As further details are developed, the major line item costs will be refined which could significantly affect the cost. | Possible | Significant | **2** |
| CT-10 | 0 | • Reliability and number of key quotes? | | | Unlikely | Negligible | **0** |
| CT-11 | 0 | • Reliability and number of key quotes? | | | Unlikely | Negligible | **0** |
| CT-12 | Remaining Construction Items | • Reliability and number of key quotes? | None. | | Unlikely | Negligible | **0** |
| CT-13 | Planning, Engineering, & Design | • Reliability and number of key quotes? | Assumptions based on concept design. Assumptions were used to establish costs and are relative to contractor markups and assignment, quantities, crews and productivities, quotes and historical cost data. Cost is based on current pricing. | | Possible | Significant | **2** |
| CT-14 | Construction Management | • Reliability and number of key quotes? | Assumptions based on concept design. Assumptions were used to establish costs and are relative to contractor markups and assignment, quantities, crews and productivities, quotes and historical cost data. Cost is based on current pricing. | | Possible | Marginal | **1** |

## External Project Risks

| | | | | | | **Max Potential Cost Growth** | **40%** |
|---|---|---|---|---|---|---|---|
| EX-1 | 1 Mobilization - Demobilization | • Potential for severe adverse weather? | External risks such as failure to obtain permits in a timely manner, political risks, delays or cancellation of funding sources could impact project costs. Potential for adverse weather. | Depending on the project schedule, weather is likely to affect the project schedule. However, the construction of the basin would be part of the critical path so the impact would have a marginal effect. | Possible | Marginal | **1** |
| EX-2 | 2 Chainlink Fence | • Potential for severe adverse weather? | External risks such as failure to obtain permits in a timely manner, political risks, delays or cancellation of funding sources could impact project costs. Potential for adverse weather. | Depending on the project schedule, weather is likely to affect the project schedule. However, the construction of the basin would be part of the critical path so the impact would have a marginal effect. | Possible | Marginal | **1** |
| EX-3 | 3 Dewatering | • Potential for severe adverse weather? | External risks such as failure to obtain permits in a timely manner, political risks, delays or cancellation of funding sources could impact project costs. Potential for adverse weather. | Depending on the project schedule, weather is likely to affect the project schedule. However, the construction of the basin would be part of the critical path so the impact would have a marginal effect. | Possible | Significant | **2** |
| EX-4 | 4 Road Crossing | • Potential for severe adverse weather? | External risks such as failure to obtain permits in a timely manner, political risks, delays or cancellation of funding sources could impact project costs. Potential for adverse weather. | Depending on the project schedule, weather is likely to affect the project schedule. However, the construction of the basin would be part of the critical path so the impact would have a marginal effect. | Possible | Marginal | **1** |
| EX-5 | 5 Grading | • Potential for severe adverse weather? | External risks such as failure to obtain permits in a timely manner, political risks, delays or cancellation of funding sources could impact project costs. Potential for adverse weather. | Depending on the project schedule, weather is likely to affect the project schedule. However, the construction of the basin would be part of the critical path so the impact would have a marginal effect. | Possible | Significant | **2** |
| EX-6 | 6 Post-Construction Monitoring | • Potential for severe adverse weather? | External risks such as failure to obtain permits in a timely manner, political risks, delays or cancellation of funding sources could impact project costs. Potential for adverse weather. | Depending on the project schedule, weather is likely to affect the project schedule. However, the construction of the basin would be part of the critical path so the impact would have a marginal effect. | Possible | Negligible | **0** |
| EX-7 | 7 Drainage | • Potential for severe adverse weather? | External risks such as failure to obtain permits in a timely manner, political risks, delays or cancellation of funding sources could impact project costs. Ability to establish easement agreements. Potential for adverse weather. | Depending on the project schedule, weather is likely to affect the project schedule. However, the construction of the basin would be part of the critical path so the impact would have a marginal effect. The ability to establish easements which may be needed to convey the discharge to the lagoon may have a marginal effect on the project. | Possible | Significant | **2** |
| EX-8 | 8 Driveway | • Potential for severe adverse weather? | External risks such as failure to obtain permits in a timely manner, political risks, delays or cancellation of funding sources could impact project costs. Ability to establish easement agreements. Potential for adverse weather. | Depending on the project schedule, weather is likely to affect the project schedule. However, the construction of the basin would be part of the critical path so the impact would have a marginal effect. The ability to establish easements which may be needed to convey the discharge to the lagoon may have a marginal effect on the project. | Possible | Significant | **2** |
| EX-9 | 9 Basin | • Potential for severe adverse weather? | External risks such as failure to obtain permits in a timely manner, political risks, delays or cancellation of funding sources could impact project costs. Ability to establish easement agreements. Potential for adverse weather. | Depending on the project schedule, weather is likely to affect the project schedule. However, the construction of the basin would be part of the critical path so the impact would have a marginal effect. The ability to establish easements which may be needed to convey the discharge to the lagoon may have a marginal effect on the project. | Possible | Significant | **2** |
| EX-10 | 0 | • Potential for severe adverse weather? | | | Unlikely | Negligible | **0** |
| EX-11 | 0 | • Potential for severe adverse weather? | | | Unlikely | Negligible | **0** |
| EX-12 | Remaining Construction Items | • Potential for severe adverse weather? | None. | | Unlikely | Negligible | **0** |
| EX-13 | Planning, Engineering, & Design | • Potential for severe adverse weather? | External risks such as political, funding sources could impact project costs over time. | Changes to permitting and other requirements could result in added coordination and design efforts. | Possible | Significant | **2** |
| EX-14 | Construction Management | • Potential for severe adverse weather? | Potential for adverse weather. | Severe weather could impact the grading of the site and impact the schedule. | Possible | Significant | **2** |

## Saipan Lagoon Ecosystem Restoration - Alt 3 (C2Q0A1)

Feasibility (Alternatives)
Abbreviated Risk Analysis

| Typical Risk Elements | Potential Risk Areas | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 Mobilization - Demobilization | 2 Chainlink Fence | 3 Dewatering | 4 Road Crossing | 5 Grading | 6 Post-Construction Monitoring | 7 Drainage | 8 Driveway | 9 Basin | 0 | 0 | Remaining Construction Item | Planning, Engineering, & Design | Construction Management |
| Project Scope Growth | 1 | 2 | 2 | - | 3 | - | 3 | - | 3 | - | - | - | 2 | 2 |
| Acquisition Strategy | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Construction Elements | 2 | - | 2 | 1 | 2 | - | 2 | 1 | 2 | - | - | - | - | - |
| Quantities for Current Scope | 2 | 2 | 1 | - | 3 | - | 2 | - | 2 | - | - | - | - | - |
| Specialty Fabrication or Equipment | 1 | - | 1 | - | 2 | - | 2 | - | - | - | - | - | - | - |
| Cost Estimate Assumptions | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | - | - | - | 2 | 1 |
| External Project Risks | 1 | 1 | 2 | 1 | 2 | - | 2 | 2 | 2 | - | - | - | 2 | 2 |

# **** TOTAL PROJECT COST SUMMARY ****

PROJECT: **Saipan Lagoon Ecosystem Restoration**
PROJECT NO:
LOCATION: **Saipan Lagoon, Sasipan**

DISTRICT: **NWW WALLA WALLA** PREPARED: **6/18/2013**
POC: **CHIEF, COST ENGINEERING, Gary F. Yamauchi**

This Estimate reflects the scope and schedule in report; CAP Feasibility STUDY - ECOSYSTEM RESTORATION REPORT

| **Civil Works Work Breakdown Structure** | | **ESTIMATED COST** | | | | **PROJECT FIRST COST (Constant Dollar Basis)** | | | | **TOTAL PROJECT COST (FULLY FUNDED)** | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Program Year (Budget EC): | | 2016 | | | | | |
| | | | | | | | Effective Price Level Date: | | 1 OCT 15 | | | | | |
| WBS NUMBER | Civil Works Feature & Sub-Feature Description | COST ($K) | CNTG ($K) | CNTG (%) | TOTAL ($K) | ESC (%) | COST ($K) | CNTG ($K) | **TOTAL ($K)** | Spent Thru: 10/1/2012 ($K) | | COST ($K) | CNTG ($K) | FULL ($K) |
| *A* | *B* | *C* | *D* | *E* | *F* | *G* | *H* | *I* | *J* | *K* | *L* | *M* | *N* | *O* |
| 03 | RESERVOIRS | $1,514 | $451 | 30% | $1,964.57 | 4.4% | $1,581 | $471 | $2,052 | | | $1,611 | $479 | $2,091 |
| 03 | RESERVOIRS (Post Construction Monitoring) | $1,862 | $554 | 30% | $2,416.13 | 4.4% | $1,944 | $579 | $2,523 | | | $2,106 | $627 | $2,733 |
| | | | | - | | - | | | | | | | | |
| 19 | BUILDINGS, GROUNDS & UTILITIES | $4,272 | $1,271 | 30% | $5,543.35 | 4.4% | $4,461 | $1,328 | $5,789 | | | $4,546 | $1,353 | $5,899 |
| | **CONSTRUCTION ESTIMATE TOTALS:** | $7,648 | $2,276 | | $9,924.04 | 4.4% | $7,987 | $2,377 | $10,363 | | | $8,263 | $2,459 | $10,723 |
| 01 | LANDS AND DAMAGES | $1,945 | $235 | 12% | $2,180.15 | 4.4% | $2,031 | $246 | $2,277 | | | $2,041 | $247 | $2,288 |
| 22 | FEASIBILITY STUDY (CAP studies) | | | | | | | | | $1,483 | | | | $1,483 |
| 30 | PLANNING, ENGINEERING & DESIGN | $2,061 | $436 | 21% | $2,496.70 | 6.5% | $2,196 | $464 | $2,660 | | | $2,207 | $467 | $2,674 |
| 31 | CONSTRUCTION MANAGEMENT | $690 | $131 | 19% | $821.31 | 6.5% | $735 | $140 | $875 | | | $766 | $146 | $912 |
| | **PROJECT COST TOTALS:** | $12,344 | $3,078 | 25% | $15,422.20 | | $12,949 | $3,226 | **$16,175** | $1,483 | | $13,278 | $3,318 | $18,079 |

| | |
|---|---|
| Mandatory by Regulation | CHIEF, COST ENGINEERING, Gary F. Yamauchi |
| Mandatory by Regulation | PROJECT MANAGER, Milton Yoshimoto |
| Mandatory by Regulation | CHIEF, REAL ESTATE, Craig H. Nakano |
| | CHIEF, PLANNING, Anthony J. Paresa |
| | CHIEF, ENGINEERING, Todd C. Barnes |
| | CHIEF, OPERATIONS, Michael F. Wong |
| | CHIEF, CONSTRUCTION, Louis Muzzarini |
| | CHIEF, CONTRACTING, Roger David Williams |
| | CHIEF, PM-PB, Roxanne E. Iseri |
| | CHIEF, DPM, Milton Yoshimoto |

| | | |
|---|---|---|
| ESTIMATED FEDERAL COST: | 65% | **$10,787** |
| ESTIMATED NON-FEDERAL COST: | 35% | **$5,809** |
| FEASIBILITY FEDERAL COST: | | **$792** |
| FEASIBILITY NON-FEDERAL COST: | | **$692** |
| **ESTIMATED TOTAL PROJECT COST:** | | **$18,079** |

## **** TOTAL PROJECT COST SUMMARY ****

### **** CONTRACT COST SUMMARY ****

PROJECT: Saipan Lagoon Ecosystem Restoration
LOCATION: Saipan Lagoon, Sasipan
This Estimate reflects the scope and schedule in report; CAP Feasibility STUDY - ECOSYSTEM RESTORATION REPORT

DISTRICT: NWW WALLA WALLA
PREPARED: 6/18/2013
POC: CHIEF, COST ENGINEERING, Gary F. Yamauchi

| **WBS Structure** | | **ESTIMATED COST** | | | | **PROJECT FIRST COST (Constant Dollar Basis)** | | | | **TOTAL PROJECT COST (FULLY FUNDED)** | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Estimate Prepared: | | | 3/22/2013 | Program Year (Budget EC): | | | 2016 | | | | | |
| | | Effective Price Level: | | | 10/1/2012 | Effective Price Level Date: | | | 1 OCT 15 | | | | | |
| | | | RISK BASED | | | | | | | | | | | |
| WBS NUMBER | Civil Works Feature & Sub-Feature Description | COST ($K) | CNTG ($K) | CNTG (%) | TOTAL ($K) | ESC (%) | COST ($K) | CNTG ($K) | TOTAL ($K) | Mid-Point Date | INFLATED (%) | COST ($K) | CNTG ($K) | FULL ($K) |
| *A* | *B* | *C* | *D* | *E* | *F* | *G* | *H* | *I* | *J* | *P* | *L* | *M* | *N* | *O* |
| | **PHASE 1 or CONTRACT 1** | | | | | | | | | | | | | |
| 03 | RESERVOIRS | $1,514 | $451 | 29.8% | $1,965 | 4.4% | $1,581 | $471 | $2,052 | 2016Q2 | 1.9% | $1,611 | $479 | $2,091 |
| 03 | RESERVOIRS | $1,862 | $554 | 29.8% | $2,416 | 4.4% | $1,944 | $579 | $2,523 | 2019Q3 | 8.3% | $2,106 | $627 | $2,733 |
| | (Post Construction Monitoring) | | | | | | | | | | | | | |
| 19 | BUILDINGS, GROUNDS & UTILITIES | $4,272 | $1,271 | 29.8% | $5,543 | 4.4% | $4,461 | $1,328 | $5,789 | 2016Q2 | 1.9% | $4,546 | $1,353 | $5,899 |
| | **CONSTRUCTION ESTIMATE TOTALS:** | $7,648 | $2,276 | 29.8% | **$9,924** | | $7,987 | $2,377 | $10,363 | | | $8,263 | $2,459 | $10,723 |
| 01 | LANDS AND DAMAGES | $1,945 | $235 | 12.1% | $2,180 | 4.4% | $2,031 | $246 | $2,277 | 2015Q3 | 0.5% | $2,041 | $247 | $2,288 |
| 30 | PLANNING, ENGINEERING & DESIGN | | | | | | | | | | | | | |
| *3.10%* | Project Management | $237 | $50 | 21.1% | $287 | 6.5% | $253 | $53 | $306 | 2015Q2 | | $253 | $53 | $306 |
| *14.37%* | Planning & Environmental Compliance | $1,099 | $232 | 21.1% | $1,331 | 6.5% | $1,171 | $248 | $1,419 | 2015Q2 | | $1,171 | $248 | $1,419 |
| *3.19%* | Engineering & Design | $244 | $52 | 21.1% | $296 | 6.5% | $260 | $55 | $315 | 2015Q2 | | $260 | $55 | $315 |
| *0.65%* | Engineering Tech Review ITR & VE | $50 | $11 | 21.1% | $61 | 6.5% | $53 | $11 | $65 | 2015Q2 | | $53 | $11 | $65 |
| *0.33%* | Contracting & Reprographics | $25 | $5 | 21.1% | $30 | 6.5% | $27 | $6 | $32 | 2015Q2 | | $27 | $6 | $32 |
| *1.31%* | Engineering During Construction | $100 | $21 | 21.1% | $121 | 6.5% | $107 | $23 | $129 | 2016Q2 | 4.2% | $111 | $23 | $134 |
| *2.00%* | Planning During Construction | $153 | $32 | 21.1% | $185 | 6.5% | $163 | $34 | $197 | 2016Q2 | 4.2% | $170 | $36 | $206 |
| *2.00%* | Project Operations | $153 | $32 | 21.1% | $185 | 6.5% | $163 | $34 | $197 | 2015Q2 | | $163 | $34 | $197 |
| 31 | CONSTRUCTION MANAGEMENT | | | | | | | | | | | | | |
| *4.52%* | Construction Management | $346 | $66 | 19.0% | $412 | 6.5% | $369 | $70 | $439 | 2016Q2 | 4.2% | $384 | $73 | $457 |
| *2.00%* | Project Operation: | $153 | $29 | 19.0% | $182 | 6.5% | $163 | $31 | $194 | 2016Q2 | 4.2% | $170 | $32 | $202 |
| *2.50%* | Project Management | $191 | $36 | 19.0% | $227 | 6.5% | $204 | $39 | $242 | 2016Q2 | 4.2% | $212 | $40 | $252 |
| | **CONTRACT COST TOTALS:** | $12,344 | $3,078 | | **$15,422** | | $12,949 | $3,226 | $16,175 | | | $13,278 | $3,318 | **$16,596** |

## Abbreviated Risk Analysis

Project (less than $40M): **Saipan Lagoon Ecosystem Restoration - Alt 4 (C2Q2A**
Project Development Stage: **Feasibility (Alternatives)**
Risk Category: **Moderate Risk: Typical Project or Possible Life Safety**

Total Construction Contract Cost = **$ 7,648,021**

|  | CWWBS | Feature of Work | Contract Cost |  | % Contingency | $ Contingency | Total |
|---|---|---|---|---|---|---|---|
|  | 01 LANDS AND DAMAGES | Real Estate | **$ 1,944,800** |  | **12.09%** | $ 235,099 | $ 2,179,899.09 |
| 1 | **03 RESERVOIRS** | **1 Mobilization - Demobilization** | **$ 168,851** |  | 24.92% | $ 42,075 | $ 210,926.12 |
| 2 | **03 RESERVOIRS** | **2 Chainlink Fence** | **$ 226,141** |  | 22.18% | $ 50,148 | $ 276,288.77 |
| 3 | **03 RESERVOIRS** | **3 Dewatering** | **$ 274,018** |  | 28.96% | $ 79,353 | $ 353,371.04 |
| 4 | **03 RESERVOIRS** | **4 Road Crossing** | **$ 70,708** |  | 15.14% | $ 10,706 | $ 81,413.84 |
| 5 | **03 RESERVOIRS** | **5 Grading** | **$ 773,912** |  | 44.14% | $ 341,586 | $ 1,115,498.00 |
| 6 | **03 RESERVOIRS** | **6 Post-Construction Monitoring** | **$ 1,862,012** |  | 9.04% | $ 168,255 | $ 2,030,266.53 |
| 7 | **19 BUILDINGS, GROUNDS, AND UTILITIES** | **7 Drainage** | **$ 1,185,241** |  | 41.42% | $ 490,901 | $ 1,676,142.39 |
| 8 | **19 BUILDINGS, GROUNDS, AND UTILITIES** | **8 Driveway** | **$ 65,012** |  | 17.42% | $ 11,327 | $ 76,339.09 |
| 9 | **19 BUILDINGS, GROUNDS, AND UTILITIES** | **9 Basin** | **$ 3,022,126** |  | 35.79% | $ 1,081,744 | $ 4,103,869.52 |
| 12 |  | **Remaining Construction Items** | **$ -** | *0.0%* | 0.00% | $ - | $ - |
| 13 | 30 PLANNING, ENGINEERING, AND DESIGN | **Planning, Engineering, & Design** | **$ 2,061,000** |  | 21.14% | $ 435,761 | $ 2,496,760.51 |
| 14 | 31 CONSTRUCTION MANAGEMENT | **Construction Management** | **$ 690,000** |  | 19.03% | $ 131,330 | $ 821,330.09 |

**Totals**

|  | Contract Cost | % Contingency | $ Contingency | Total |
|---|---|---|---|---|
| Real Estate | $ 1,944,800 | 12.09% | $ 235,099 | $ 2,179,899.09 |
| Total Construction Estimate | $ 7,648,021 | 29.76% | $ 2,276,094 | $ 9,924,115 |
| Total Planning, Engineering & Design | $ 2,061,000 | 21.14% | $ 435,761 | $ 2,496,761 |
| Total Construction Management | $ 690,000 | 19.03% | $ 131,330 | $ 821,330 |
| Total | $ 12,343,821 |  | $ 3,078,284 | $ 15,422,105 |

# Abbreviated Risk Analysis

## Saipan Lagoon Ecosystem Restoration - C2Q2A1
## Feasibility

Meeting Date: 22-Mar-13

**PDT Members** (Typical Recommended)

| | |
|---|---|
| Project Management: | Milton Yoshimoto |
| Cost Estimator: | Lana Murishige |
| Environmentalist: | Sonia Shjesgadt |
| Environmentalist: | Miya Akiba |
| Engineering & Design: | Anson Murayama |
| Engineering & Design: | Frank Camacho |
| Project Management: | Uyen Tran |

**Saipan Lagoon Ecosystem Restoration - Alt 4 (C2Q2A1)**
Feasibility (Alternatives)
Abbreviated Risk Analysis

**Meeting Date:** ########

**Risk Level**

| | | | | | |
|---|---|---|---|---|---|
| Very Likely | 2 | 3 | 4 | 5 | 5 |
| Likely | 1 | 2 | 3 | 4 | 5 |
| Possible | 0 | 1 | 2 | 3 | 4 |
| Unlikely | 0 | 0 | 1 | 2 | 3 |
| | Negligible | Marginal | Significant | Critical | Crisis |

| Risk Element | Feature of Work | Concerns Pull Down Tab (ENABLE MACROS THRU TRUST CENTER) (Choose ALL that apply) | Concerns | PDT Discussions & Conclusions (Include logic & justification for choice of Likelihood & Impact) | Likelihood | Impact | Risk Level |
|---|---|---|---|---|---|---|---|
| **Project Scope Growth** | | | | | | | |
| | | | | | | Max Potential Cost Growth | 75% |
| PS-1 | 1 Mobilization - Demobilization | • Project accomplish intent? | Schedule is assumed and subject to change. | A more detailed design will be required and the topo is anticipated to be out of date. | Possible | Marginal | 1 |
| PS-2 | 2 Chainlink Fence | • Potential for scope growth, added features and quantities? | Possible quantity differential if site limits change. | | Likely | Marginal | 2 |
| PS-3 | 3 Dewatering | • Investigations sufficient to support design assumptions? | Schedule is assumed and subject to change. Soil report will be needed. | A more detailed design will be required and the topo is anticipated to be out of date. | Likely | Marginal | 2 |
| PS-4 | 4 Road Crossing | • Investigations sufficient to support design assumptions? | Topo may not be most current thus affecting assumed locations of road and utilities. | | Possible | Negligible | 0 |
| PS-5 | 5 Grading | • Design confidence? | 10% conceptual design only. Existing topo may not be most current. | A more detailed design will be required and the topo is anticipated to be out of date. | Likely | Significant | 3 |
| PS-6 | 6 Post-Construction Monitoring | • Potential for scope growth, added features and quantities? | Additional monitoring may be required if performance standards aren't met. | It is unlikely that there would be any changes after construction. | Unlikely | Marginal | 0 |
| PS-7 | 7 Drainage | • Potential for scope growth, added features and quantities? | 10% conceptual design only. Condition of existing utilities may be different. | A more detailed design will be required. The condition of the existing utilities is unknown and the assumption was made that the existing utilities will convey all the runoff from the watershed to the basin. | Likely | Significant | 3 |
| PS-8 | 8 Driveway | • Potential for scope growth, added features and quantities? | Topo may not be most current thus affecting assumed locations of road and utilities. | | Possible | Negligible | 0 |
| PS-9 | 9 Basin | • Potential for scope growth, added features and quantities? | 10% conceptual design only. Condition of existing utilities may be different. | A more detailed design will be required. The condition of the existing utilities is unknown and the assumption was made that the existing utilities will convey all the runoff from the watershed to the basin. | Likely | Significant | 3 |
| PS-10 | 0 | • Potential for scope growth, added features and quantities? | | | Unlikely | Negligible | 0 |
| PS-11 | 0 | • Potential for scope growth, added features and quantities? | | | Unlikely | Negligible | 0 |
| PS-12 | Remaining Construction Items | • Potential for scope growth, added features and quantities? | None. | | Unlikely | Negligible | 0 |
| PS-13 | Planning, Engineering, & Design | • Potential for scope growth, added features and quantities? | Need to provide 100% Design. | A more detailed design will be required and the topo is anticipated to be out of date. The condition of the existing utilities is unknown and the assumption was made that the existing utilities will convey all the runoff from the watershed to the basin. | Likely | Marginal | 2 |
| PS-14 | Construction Management | • Potential for scope growth, added features and quantities? | Need to provide 100% Design. | A more detailed design will be required and the topo is anticipated to be out of date. The condition of the existing utilities is unknown and the assumption was made that the existing utilities will convey all the runoff from the watershed to the basin. | Likely | Marginal | 2 |

## Acquisition Strategy

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | **Max Potential Cost Growth** | **30%** |
| AS-1 | 1 Mobilization - Demobilization | • Contracting plan firmly established? | | | Unlikely | Negligible | **0** |
| AS-2 | 2 Chainlink Fence | • Contracting plan firmly established? | | | Unlikely | Negligible | **0** |
| AS-3 | 3 Dewatering | • Contracting plan firmly established? | | Due to unknown contract schedule, plans may be altered. | Unlikely | Marginal | **0** |
| AS-4 | 4 Road Crossing | • Contracting plan firmly established? | Topo may not be most current thus affecting assumed locations of road and utilities for easement purposes. | | Unlikely | Negligible | **0** |
| AS-5 | 5 Grading | • Contracting plan firmly established? | Contracting plan established. | Due to unknown contract schedule, plans may be altered. | Unlikely | Marginal | **0** |
| AS-6 | 6 Post-Construction Monitoring | • Contracting plan firmly established? | Contract acquisition strategy is assumed as full and open, invitation for bid. | The reasonable assumption is that the prime contractor will be performing most of the work. | Unlikely | Marginal | **0** |
| AS-7 | 7 Drainage | • Contracting plan firmly established? | Contracting plan established. | Due to unknown contract schedule, plans may be altered. | Unlikely | Marginal | **0** |
| AS-8 | 8 Driveway | • Contracting plan firmly established? | Topo may not be most current thus affecting assumed locations of road and utilities for easement purposes. | | Unlikely | Negligible | **0** |
| AS-9 | 9 Basin | • Contracting plan firmly established? | Contracting plan established. | Due to unknown contract schedule, plans may be altered. | Unlikely | Marginal | **0** |
| AS-10 | 0 | • Contracting plan firmly established? | | | Unlikely | Negligible | **0** |
| AS-11 | 0 | • Contracting plan firmly established? | | | Unlikely | Negligible | **0** |
| AS-12 | Remaining Construction Items | • Contracting plan firmly established? | None. | | Unlikely | Negligible | **0** |
| AS-13 | Planning, Engineering, & Design | • Contracting plan firmly established? | None. | | Unlikely | Negligible | **0** |
| AS-14 | Construction Management | • Contracting plan firmly established? | None. | | Unlikely | Negligible | **0** |

## Construction Elements

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | Max Potential Cost Growth | 25% |
| CE-1 | 1 Mobilization - Demobilization | • Accelerated schedule or harsh weather schedule? | Major clearing and grubbing required. Soil conditions. Location of project requires special mobilization. There is a possibility for major construction modifications if special equipment or subcontractors need to be transported to the site. Fuel for equipment. | A soils report was never performed for this study, only research was taken into account. The likelihood of the anticipated soils type to change is very unlikely, however in the case an unanticipated soil type is found the impact would have a marginal effect. Fuel costs are likely to fluctuate, however the fuel costs are a small percentage to the price of the project as a whole. | Likely | Marginal | 2 |
| CE-2 | 2 Chainlink Fence | • Accelerated schedule or harsh weather schedule? | | | Unlikely | Negligible | 0 |
| CE-3 | 3 Dewatering | • Accelerated schedule or harsh weather schedule? | Major clearing and grubbing required. Soil conditions. Location of project requires special mobilization. There is a possibility for major construction modifications if special equipment or subcontractors need to be transported to the site. Fuel for equipment. | A soils report was never performed for this study, only research was taken into account. The likelihood of the anticipated soils type to change is very unlikely, however in the case an unanticipated soil type is found the impact would have a marginal effect. Fuel costs are likely to fluctuate, however the fuel costs are a small percentage to the price of the project as a whole. | Likely | Marginal | 2 |
| CE-4 | 4 Road Crossing | • Accelerated schedule or harsh weather schedule? | Fuel for equipment. | Fuel costs are likely to fluctuate, however the fuel costs are a small percentage to the price of the project as a whole. | Likely | Negligible | 1 |
| CE-5 | 5 Grading | • Accelerated schedule or harsh weather schedule? | Major clearing and grubbing required. Soil conditions. Location of project requires special mobilization. There is a possibility for major construction modifications if special equipment or subcontractors need to be transported to the site. Fuel for equipment. | A soils report was never performed for this study, only research was taken into account. The likelihood of the anticipated soils type to change is very unlikely, however in the case an unanticipated soil type is found the impact would have a marginal effect. Fuel costs are likely to fluctuate, however the fuel costs are a small percentage to the price of the project as a whole. | Likely | Marginal | 2 |
| CE-6 | 6 Post-Construction Monitoring | • Accelerated schedule or harsh weather schedule? | Project complexity of these items may impact construction bid, site complexity, possible contract modifications. | The listed cost items are fairly simple. Any risk is likely low. | Unlikely | Negligible | 0 |
| CE-7 | 7 Drainage | • Accelerated schedule or harsh weather schedule? | Soil conditions. Location of project requires special mobilization. Fuel for equipment. | A soils report was never performed for this study, only research was taken into account. The likelihood of the anticipated soils type to change is very unlikely, however in the case an unanticipated soil type is found the impact would have a marginal effect. Fuel costs are likely to fluctuate, however the fuel costs are a small percentage to the price of the project as a whole. | Likely | Marginal | 2 |
| CE-8 | 8 Driveway | • Accelerated schedule or harsh weather schedule? | Fuel for equipment. | Fuel costs are likely to fluctuate, however the fuel costs are a small percentage to the price of the project as a whole. | Likely | Negligible | 1 |
| CE-9 | 9 Basin | • Accelerated schedule or harsh weather schedule? | Soil conditions. Location of project requires special mobilization. Fuel for equipment. | A soils report was never performed for this study, only research was taken into account. The likelihood of the anticipated soils type to change is very unlikely, however in the case an unanticipated soil type is found the impact would have a marginal effect. Fuel costs are likely to fluctuate, however the fuel costs are a small percentage to the price of the project as a whole. | Likely | Marginal | 2 |
| CE-10 | 0 | • Accelerated schedule or harsh weather schedule? | | | Unlikely | Negligible | 0 |
| CE-11 | 0 | • Accelerated schedule or harsh weather schedule? | | | Unlikely | Negligible | 0 |
| CE-12 | Remaining Construction Items | • Accelerated schedule or harsh weather schedule? | None. | | Unlikely | Negligible | 0 |
| CE-13 | Planning, Engineering, & Design | • Accelerated schedule or harsh weather schedule? | None. | | Unlikely | Negligible | 0 |
| CE-14 | Construction Management | • Accelerated schedule or harsh weather schedule? | None. | | Unlikely | Negligible | 0 |

## Quantities for Current Scope

| | | | | | | Max Potential Cost Growth | 20% |
|---|---|---|---|---|---|---|---|
| Q-1 | 1 Mobilization - Demobilization | • Level of confidence based on design and assumptions? | Topo may not be most current thus affecting the grading quantities. Design is conceptual. | The topo is anticipated to be out of date, therefore the grading quantities are likely to change but should only change to have a marginal impact to the project. | Likely | Marginal | 2 |
| Q-2 | 2 Chainlink Fence | • Level of confidence based on design and assumptions? | Location of properties on topo may not be most current affecting perimeter locations. | The topo is anticipated to be out of date, therefore the grading quantities are likely to change but should only change to have a marginal impact to the project. | Likely | Marginal | 2 |
| Q-3 | 3 Dewatering | • Level of confidence based on design and assumptions? | Topo may not be most current thus affecting the grading quantities. Design is conceptual. | The topo is anticipated to be out of date, therefore the grading quantities are likely to change but should only change to have a marginal impact to the project. | Likely | Negligible | 1 |
| Q-4 | 4 Road Crossing | • Level of confidence based on design and assumptions? | | | Unlikely | Negligible | 0 |
| Q-5 | 5 Grading | • Level of confidence based on design and assumptions? | Topo may not be most current thus affecting the grading quantities. Design is conceptual. | The topo is anticipated to be out of date, therefore the grading quantities are likely to change but should only change to have a marginal impact to the project. | Likely | Significant | 3 |
| Q-6 | 6 Post-Construction Monitoring | • Level of confidence based on design and assumptions? | As design evolves quantities on current project scope may change due to refinement. | It is unlikely that there would be any changes after construction. | Unlikely | Marginal | 0 |
| Q-7 | 7 Drainage | • Level of confidence based on design and assumptions? | Design is conceptual. | With a complete design infrastructure quantities may change slightly. | Likely | Marginal | 2 |
| Q-8 | 8 Driveway | • Level of confidence based on design and assumptions? | | | Unlikely | Negligible | 0 |
| Q-9 | 9 Basin | • Level of confidence based on design and assumptions? | Design is conceptual. | With a complete design infrastructure quantities may change slightly. | Likely | Marginal | 2 |
| Q-10 | 0 | • Level of confidence based on design and assumptions? | | | Unlikely | Negligible | 0 |
| Q-11 | 0 | • Level of confidence based on design and assumptions? | | | Unlikely | Negligible | 0 |
| Q-12 | Remaining Construction Items | • Level of confidence based on design and assumptions? | None. | | Unlikely | Negligible | 0 |
| Q-13 | Planning, Engineering, & Design | • Level of confidence based on design and assumptions? | None. | | Unlikely | Negligible | 0 |
| Q-14 | Construction Management | • Level of confidence based on design and assumptions? | None. | | Unlikely | Negligible | 0 |

## Specialty Fabrication or Equipment

| | | | | | **Max Potential Cost Growth** | | **75%** |
|---|---|---|---|---|---|---|---|
| FE-1 | 1 Mobilization - Demobilization | • Unusual parts, material or equipment manufactured or installed? | Any specialized fabrication could impact cost due to change of material costs, complex designs, sole source fabrications that are not competitive. | | Possible | Marginal | **1** |
| FE-2 | 2 Chainlink Fence | • Unusual parts, material or equipment manufactured or installed? | | | Unlikely | Marginal | **0** |
| FE-3 | 3 Dewatering | • Unusual parts, material or equipment manufactured or installed? | Installation of the basin inlet and outlet. | A more detailed design of the basin inlet and outlet will likely be needed, but the impact of the difference compared to the conceptual design should be negligible. | Possible | Marginal | **1** |
| FE-4 | 4 Road Crossing | • Unusual parts, material or equipment manufactured or installed? | | | Unlikely | Negligible | **0** |
| FE-5 | 5 Grading | • Unusual parts, material or equipment manufactured or installed? | Installation of the basin inlet and outlet. | A more detailed design of the basin inlet and outlet will likely be needed, but the impact of the difference compared to the conceptual design should be negligible. | Possible | Significant | **2** |
| FE-6 | 6 Post-Construction Monitoring | • Unusual parts, material or equipment manufactured or installed? | Any specialized fabrication could impact cost due to change of material costs, complex designs, sole source fabrications that are not competitive. | Not applicable. | Unlikely | Negligible | **0** |
| FE-7 | 7 Drainage | • Unusual parts, material or equipment manufactured or installed? | Installation of the culvert inlet and outlet. Fabrication of manholes. | A more detailed design of the culvert inlet and outlet will likely be needed, but the impact of the difference compared to the conceptual design should be negligible and the addition of the drain manholes will have a more marginal impact. | Possible | Significant | **2** |
| FE-8 | 8 Driveway | • Unusual parts, material or equipment manufactured or installed? | | | Unlikely | Negligible | **0** |
| FE-9 | 9 Basin | • Unusual parts, material or equipment manufactured or installed? | | | Unlikely | Negligible | **0** |
| FE-10 | 0 | • Unusual parts, material or equipment manufactured or installed? | | | Unlikely | Negligible | **0** |
| FE-11 | 0 | • Unusual parts, material or equipment manufactured or installed? | | | Unlikely | Negligible | **0** |
| FE-12 | Remaining Construction Items | • Unusual parts, material or equipment manufactured or installed? | None. | | Unlikely | Negligible | **0** |
| FE-13 | Planning, Engineering, & Design | • Unusual parts, material or equipment manufactured or installed? | None. | | Unlikely | Negligible | **0** |
| FE-14 | Construction Management | • Unusual parts, material or equipment manufactured or installed? | None. | | Unlikely | Negligible | **0** |

## Cost Estimate Assumptions

|  |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|
|  |  |  |  |  |  | Max Potential Cost Growth | 35% |
| CT-1 | 1 Mobilization - Demobilization | • Reliability and number of key quotes? | Assumptions based on concept design. Assumptions were used to establish costs and are relative to contractor markups and assignment, quantities, crews and productivities, quotes and historical cost data. Cost is based on current pricing. | Depending on when the construction takes place, prices could vary greatly and is dependent on the economy. Major quantities were provided by the AE and the critical cost items were adjusted to reflect reasonable cost as if this were a bid item. As further details are developed, the major line item costs will be refined which could significantly affect the cost. | Possible | Significant | 2 |
| CT-2 | 2 Chainlink Fence | • Reliability and number of key quotes? | Assumptions based on concept design. Assumptions were used to establish costs and are relative to contractor markups and assignment, quantities, crews and productivities, quotes and historical cost data. Cost is based on current pricing. | Depending on when the construction takes place, prices could vary greatly and is dependent on the economy. Major quantities were provided by the AE and the critical cost items were adjusted to reflect reasonable cost as if this were a bid item. As further details are developed, the major line item costs will be refined which could significantly affect the cost. | Possible | Significant | 2 |
| CT-3 | 3 Dewatering | • Reliability and number of key quotes? | Assumptions based on concept design. Assumptions were used to establish costs and are relative to contractor markups and assignment, quantities, crews and productivities, quotes and historical cost data. Cost is based on current pricing. | Depending on when the construction takes place, prices could vary greatly and is dependent on the economy. Major quantities were provided by the AE and the critical cost items were adjusted to reflect reasonable cost as if this were a bid item. As further details are developed, the major line item costs will be refined which could significantly affect the cost. | Possible | Significant | 2 |
| CT-4 | 4 Road Crossing | • Reliability and number of key quotes? | Assumptions based on concept design. Assumptions were used to establish costs and are relative to contractor markups and assignment, quantities, crews and productivities, quotes and historical cost data. Cost is based on current pricing. | Depending on when the construction takes place, prices could vary greatly and is dependent on the economy. Major quantities were provided by the AE and the critical cost items were adjusted to reflect reasonable cost as if this were a bid item. As further details are developed, the major line item costs will be refined which could significantly affect the cost. | Possible | Significant | 2 |
| CT-5 | 5 Grading | • Reliability and number of key quotes? | Assumptions based on concept design. Assumptions were used to establish costs and are relative to contractor markups and assignment, quantities, crews and productivities, quotes and historical cost data. Cost is based on current pricing. | Depending on when the construction takes place, prices could vary greatly and is dependent on the economy. Major quantities were provided by the AE and the critical cost items were adjusted to reflect reasonable cost as if this were a bid item. As further details are developed, the major line item costs will be refined which could significantly affect the cost. | Possible | Significant | 2 |
| CT-6 | 6 Post-Construction Monitoring | • Reliability and number of key quotes? | Assumptions based on concept design. Assumptions were used to establish costs and are relative to contractor markups and assignment, quantities, crews and productivities, quotes and historical cost data. Cost is based on current pricing. | Depending on when the construction takes place, prices could vary greatly and is dependent on the economy. Major quantities were provided by the AE and the critical cost items were adjusted to reflect reasonable cost as if this were a bid item. As further details are developed, the major line item costs will be refined which could significantly affect the cost. | Possible | Marginal | 1 |
| CT-7 | 7 Drainage | • Reliability and number of key quotes? | Assumptions based on concept design. Assumptions were used to establish costs and are relative to contractor markups and assignment, quantities, crews and productivities, quotes and historical cost data. Cost is based on current pricing. | Depending on when the construction takes place, prices could vary greatly and is dependent on the economy. Major quantities were provided by the AE and the critical cost items were adjusted to reflect reasonable cost as if this were a bid item. As further details are developed, the major line item costs will be refined which could significantly affect the cost. | Possible | Significant | 2 |
| CT-8 | 8 Driveway | • Reliability and number of key quotes? | Assumptions based on concept design. Assumptions were used to establish costs and are relative to contractor markups and assignment, quantities, crews and productivities, quotes and historical cost data. Cost is based on current pricing. | Depending on when the construction takes place, prices could vary greatly and is dependent on the economy. Major quantities were provided by the AE and the critical cost items were adjusted to reflect reasonable cost as if this were a bid item. As further details are developed, the major line item costs will be refined which could significantly affect the cost. | Possible | Significant | 2 |
| CT-9 | 9 Basin | • Reliability and number of key quotes? | Assumptions based on concept design. Assumptions were used to establish costs and are relative to contractor markups and assignment, quantities, crews and productivities, quotes and historical cost data. Cost is based on current pricing. | Depending on when the construction takes place, prices could vary greatly and is dependent on the economy. Major quantities were provided by the AE and the critical cost items were adjusted to reflect reasonable cost as if this were a bid item. As further details are developed, the major line item costs will be refined which could significantly affect the cost. | Possible | Significant | 2 |
| CT-10 | 0 | • Reliability and number of key quotes? |  |  | Unlikely | Negligible | 0 |
| CT-11 | 0 | • Reliability and number of key quotes? |  |  | Unlikely | Negligible | 0 |
| CT-12 | Remaining Construction Items | • Reliability and number of key quotes? | None. |  | Unlikely | Negligible | 0 |
| CT-13 | Planning, Engineering, & Design | • Reliability and number of key quotes? | Assumptions based on concept design. Assumptions were used to establish costs and are relative to contractor markups and assignment, quantities, crews and productivities, quotes and historical cost data. Cost is based on current pricing. |  | Possible | Significant | 2 |
| CT-14 | Construction Management | • Reliability and number of key quotes? | Assumptions based on concept design. Assumptions were used to establish costs and are relative to contractor markups and assignment, quantities, crews and productivities, quotes and historical cost data. Cost is based on current pricing. |  | Possible | Marginal | 1 |

## External Project Risks

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | **Max Potential Cost Growth** | | **40%** |
| EX-1 | 1 Mobilization - Demobilization | • Potential for severe adverse weather? | External risks such as failure to obtain permits in a timely manner, political risks, delays or cancellation of funding sources could impact project costs. Potential for adverse weather. | Depending on the project schedule, weather is likely to affect the project schedule. However, the construction of the basin would be part of the critical path so the impact would have a marginal effect. | Possible | Marginal | **1** |
| EX-2 | 2 Chainlink Fence | • Potential for severe adverse weather? | External risks such as failure to obtain permits in a timely manner, political risks, delays or cancellation of funding sources could impact project costs. Potential for adverse weather. | Depending on the project schedule, weather is likely to affect the project schedule. However, the construction of the basin would be part of the critical path so the impact would have a marginal effect. | Possible | Marginal | **1** |
| EX-3 | 3 Dewatering | • Potential for severe adverse weather? | External risks such as failure to obtain permits in a timely manner, political risks, delays or cancellation of funding sources could impact project costs. Potential for adverse weather. | Depending on the project schedule, weather is likely to affect the project schedule. However, the construction of the basin would be part of the critical path so the impact would have a marginal effect. | Possible | Significant | **2** |
| EX-4 | 4 Road Crossing | • Potential for severe adverse weather? | External risks such as failure to obtain permits in a timely manner, political risks, delays or cancellation of funding sources could impact project costs. Potential for adverse weather. | Depending on the project schedule, weather is likely to affect the project schedule. However, the construction of the basin would be part of the critical path so the impact would have a marginal effect. | Possible | Marginal | **1** |
| EX-5 | 5 Grading | • Potential for severe adverse weather? | External risks such as failure to obtain permits in a timely manner, political risks, delays or cancellation of funding sources could impact project costs. Potential for adverse weather. | Depending on the project schedule, weather is likely to affect the project schedule. However, the construction of the basin would be part of the critical path so the impact would have a marginal effect. | Possible | Significant | **2** |
| EX-6 | 6 Post-Construction Monitoring | • Potential for severe adverse weather? | External risks such as failure to obtain permits in a timely manner, political risks, delays or cancellation of funding sources could impact project costs. Potential for adverse weather. | Depending on the project schedule, weather is likely to affect the project schedule. However, the construction of the basin would be part of the critical path so the impact would have a marginal effect. | Possible | Negligible | **0** |
| EX-7 | 7 Drainage | • Potential for severe adverse weather? | External risks such as failure to obtain permits in a timely manner, political risks, delays or cancellation of funding sources could impact project costs. Ability to establish easement agreements. Potential for adverse weather. | Depending on the project schedule, weather is likely to affect the project schedule. However, the construction of the basin would be part of the critical path so the impact would have a marginal effect. The ability to establish easements which may be needed to convey the discharge to the lagoon may have a marginal effect on the project. | Possible | Significant | **2** |
| EX-8 | 8 Driveway | • Potential for severe adverse weather? | External risks such as failure to obtain permits in a timely manner, political risks, delays or cancellation of funding sources could impact project costs. Ability to establish easement agreements. Potential for adverse weather. | Depending on the project schedule, weather is likely to affect the project schedule. However, the construction of the basin would be part of the critical path so the impact would have a marginal effect. The ability to establish easements which may be needed to convey the discharge to the lagoon may have a marginal effect on the project. | Possible | Significant | **2** |
| EX-9 | 9 Basin | • Potential for severe adverse weather? | External risks such as failure to obtain permits in a timely manner, political risks, delays or cancellation of funding sources could impact project costs. Ability to establish easement agreements. Potential for adverse weather. | Depending on the project schedule, weather is likely to affect the project schedule. However, the construction of the basin would be part of the critical path so the impact would have a marginal effect. The ability to establish easements which may be needed to convey the discharge to the lagoon may have a marginal effect on the project. | Possible | Significant | **2** |
| EX-10 | 0 | • Potential for severe adverse weather? | | | Unlikely | Negligible | **0** |
| EX-11 | 0 | • Potential for severe adverse weather? | | | Unlikely | Negligible | **0** |
| EX-12 | Remaining Construction Items | • Potential for severe adverse weather? | None. | | Unlikely | Negligible | **0** |
| EX-13 | Planning, Engineering, & Design | • Potential for severe adverse weather? | External risks such as political, funding sources could impact project costs over time. | Changes to permitting and other requirements could result in added coordination and design efforts. | Possible | Significant | **2** |
| EX-14 | Construction Management | • Potential for severe adverse weather? | Potential for adverse weather. | Severe weather could impact the grading of the site and impact the schedule. | Possible | Significant | **2** |

## Saipan Lagoon Ecosystem Restoration - Alt 4 (C2Q2A1)

Feasibility (Alternatives)
Abbreviated Risk Analysis

| Typical Risk Elements | Potential Risk Areas | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 Mobilization - Demobilization | 2 Chainlink Fence | 3 Dewatering | 4 Road Crossing | 5 Grading | 6 Post-Construction Monitoring | 7 Drainage | 8 Driveway | 9 Basin | 0 | 0 | Remaining Construction Ite | Planning, Engineering, & Design | Construction Management |
| **Project Scope Growth** | 1 | 2 | 2 | - | 3 | - | 3 | - | 3 | - | - | - | 2 | 2 |
| **Acquisition Strategy** | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **Construction Elements** | 2 | - | 2 | 1 | 2 | - | 2 | 1 | 2 | - | - | - | - | - |
| **Quantities for Current Scope** | 2 | 2 | 1 | - | 3 | - | 2 | - | 2 | - | - | - | - | - |
| **Specialty Fabrication or Equipment** | 1 | - | 1 | - | 2 | - | 2 | - | - | - | - | - | - | - |
| **Cost Estimate Assumptions** | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | - | - | - | 2 | 1 |
| **External Project Risks** | 1 | 1 | 2 | 1 | 2 | - | 2 | 2 | 2 | - | - | - | 2 | 2 |

# *Appendix I*
# *CE/ICA Variable Calculations*

## Average Annual Runoff Reduction Calculations for Each Drainage Basin Design

| Drainage Basin Design | Storage Capacity (ac-ft) | Runoff Reduction at Each Probablity (ac-ft) | | | | | Average Annual Runoff Reduction (ac-ft) | Reduction Factor "Y" |
|---|---|---|---|---|---|---|---|---|
| | | 1 | 0.5 | 0.2 | 0.1 | 0.04 | | |
| China House 2-yr | 4.765 | 0 | 4.765 | 4.765 | 4.765 | 4.765 | 3.38315 | 0.532 |
| China House 5-yr | 13.54 | 0 | 4.765 | 13.54 | 13.54 | 13.54 | 6.1034 | 0.960 |
| China House 10-yr | 15.839 | 0 | 4.765 | 13.54 | 15.839 | 15.839 | 6.35629 | 1.000 |
| Quartermaster 2-yr | 1.52 | 0 | 1.52 | 1.52 | 1.52 | 1.52 | 1.0792 | 0.460 |
| Quartermaster 5-yr | 4.885 | 0 | 1.52 | 4.885 | 4.885 | 4.885 | 2.12235 | 0.905 |
| Quartermaster 10-yr | 6.92 | 0 | 1.52 | 4.885 | 6.92 | 6.92 | 2.3462 | 1.000 |
| Cock Fight Arena 2-yr | 11.845 | 0 | 11.845 | 11.845 | 11.845 | 11.845 | 8.40995 | 0.970 |
| Cock Fight Arena 5-yr | 11.845 | 0 | 11.845 | 11.845 | 11.845 | 11.845 | 8.40995 | 0.970 |
| Cock Fight Arena 10-yr | 14.23 | 0 | 11.845 | 11.845 | 14.23 | 14.23 | 8.6723 | 1.000 |

### Sample Calculation for China House

**10-year**

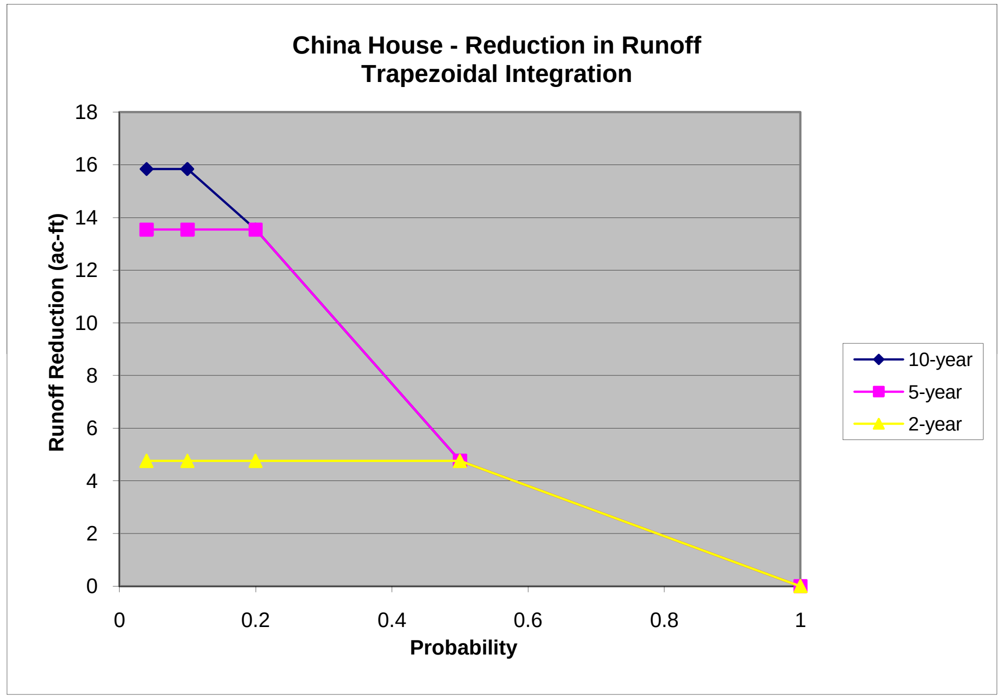
| Return Period | Probability | Runoff Reduction (ac-ft) | Average Annual Runoff Reduction (ac-ft) |
|---|---|---|---|
| 1 | 1 | 0 | 0 |
| 2 | 0.5 | 4.765 | 1.191 |
| 5 | 0.2 | 13.540 | 2.746 |
| 10 | 0.1 | 15.839 | 1.469 |
| 25 | 0.04 | 15.839 | 0.950 |
| Average Annual Reduction in Runoff (Total) = | | | 6.356 |

**5-year**

| Return Period | Probability | Runoff Reduction (ac-ft) | Average Annual Runoff Reduction (ac-ft) |
|---|---|---|---|
| 1 | 1 | 0 | 0 |
| 2 | 0.5 | 4.765 | 1.191 |
| 5 | 0.2 | 13.54 | 2.746 |
| 10 | 0.1 | 13.54 | 1.354 |
| 25 | 0.04 | 13.54 | 0.812 |
| Average Annual Reduction in Runoff (Total) = | | | 6.103 |

**2-year**

| Return Period | Probability | Runoff Reduction (ac-ft) | Average Annual Runoff Reduction (ac-ft) |
|---|---|---|---|
| 1 | 1 | 0 | 0 |
| 2 | 0.5 | 4.765 | 1.191 |
| 5 | 0.2 | 4.765 | 1.430 |
| 10 | 0.1 | 4.765 | 0.477 |
| 25 | 0.04 | 4.765 | 0.286 |
| Average Annual Reduction in Runoff (Total) = | | | 3.383 |



Notes:

1. The total average annual reduction in runoff for each drinage basin design is the area under the curve. As can be easily seen from the graph, the effect of less frequent (<25-years) storms would be negligable.
2. The reduction factor "Y" is calculated as the proportion of average annual runoff reduction for each design level compared with the average annual runoff reduction from the 10-year design.

### Lagoon Habitat Units (LGHUs) Restored by Reducing Freshwater Runoff (FW)

| Drainage Basin Design | FW (acres) | Drainage Area (acres) | Total Watershed Area (acres) | % Total Watershed | Total Lagoon Area (acres) | Linear Application (acres) | Reduction Factor (Y) |
|---|---|---|---|---|---|---|---|
| China House 2-yr | 33.964 | 344 | 2000 | 17.20% | 371 | 63.812 | 0.53225 |
| China House 5-yr | 61.273 | 344 | 2000 | 17.20% | 371 | 63.812 | 0.96021 |
| China House 10-yr | 63.812 | 344 | 2000 | 17.20% | 371 | 63.812 | 1.00000 |
| Quartermaster 2-yr | 9.301 | 109 | 2000 | 5.45% | 371 | 20.2195 | 0.45998 |
| Quartermaster 5-yr | 18.290 | 109 | 2000 | 5.45% | 371 | 20.2195 | 0.90459 |
| Quartermaster 10-yr | 20.220 | 109 | 2000 | 5.45% | 371 | 20.2195 | 1.00000 |
| Cock Fight Arena 2-yr | 74.294 | 413 | 2000 | 20.65% | 371 | 76.6115 | 0.96975 |
| Cock Fight Arena 5-yr | 74.294 | 413 | 2000 | 20.65% | 371 | 76.6115 | 0.96975 |
| Cock Fight Arena 10-yr | 76.612 | 413 | 2000 | 20.65% | 371 | 76.6115 | 1.00000 |

### Lagoon Habitat Units (LGHUs) Restored by Reducing Runoff from Runoff Potentially Contaminating Activities (PCAs) (R)

| Drainage Basin Design | R (acres) | PCAs/ Total PCAs*Y | Runoff PCAs | Total Runoff PCAs | Total Lagoon Area (acres) | Reduction Factor (Y) |
|---|---|---|---|---|---|---|
| China House 2-yr | 60.75865 | 0.16376994 | 8 | 26 | 371 | 0.53225 |
| China House 5-yr | 109.6121 | 0.295450527 | 8 | 26 | 371 | 5.65549 |
| China House 10-yr | 114.1538 | 0.307692308 | 8 | 26 | 371 | 2.99493 |
| Quartermaster 2-yr | 13.12706 | 0.035382911 | 2 | 26 | 371 | 0.45998 |
| Quartermaster 5-yr | 25.81562 | 0.069583877 | 2 | 26 | 371 | 0.25236 |
| Quartermaster 10-yr | 28.53846 | 0.076923077 | 2 | 26 | 371 | 0.27898 |
| Cock Fight Arena 2-yr | 27.67513 | 0.074596039 | 2 | 26 | 371 | 0.96975 |
| Cock Fight Arena 5-yr | 27.67513 | 0.074596039 | 2 | 26 | 371 | 0.96975 |
| Cock Fight Arena 10-yr | 28.53846 | 0.076923077 | 2 | 26 | 371 | 1.00000 |

### Lagoon Habitat Units (LGHUs) Restored by Reducing Runoff from Hazardous Waste Potentially Contaminating Activities (PCAs) (H)

| Drainage Basin Design | H (acres) | PCAs/ Total PCAs*Y | Hazardous Waste PCAs | Total Hazardous Waste PCAs | Total Lagoon Area (acres) | Reduction Factor (Y) |
|---|---|---|---|---|---|---|
| China House 2-yr | 43.1956 | 0.116430192 | 7 | 32 | 371 | 0.53225 |
| China House 5-yr | 77.92738 | 0.210046859 | 7 | 32 | 371 | 5.65549 |
| China House 10-yr | 81.15625 | 0.21875 | 7 | 32 | 371 | 2.99493 |
| Quartermaster 2-yr | 10.66574 | 0.028748615 | 2 | 32 | 371 | 0.45998 |
| Quartermaster 5-yr | 20.97519 | 0.0565369 | 2 | 32 | 371 | 0.25236 |
| Quartermaster 10-yr | 23.1875 | 0.0625 | 2 | 32 | 371 | 0.27898 |
| Cock Fight Arena 2-yr | 44.97209 | 0.121218564 | 4 | 32 | 371 | 0.96975 |
| Cock Fight Arena 5-yr | 44.97209 | 0.121218564 | 4 | 32 | 371 | 0.96975 |
| Cock Fight Arena 10-yr | 46.375 | 0.125 | 4 | 32 | 371 | 1.00000 |

### Lagoon Habitat Units (LGHUs) Restored by Reducing Sedimentation (S)

| Drainage Basin Design | S (acres) | Acres Drainage Area/ Acres Watershed*Y | Unvegetated/ Unpaved Land within Drainage Area (acres) | Unvegetated/ Unpaved Land within Project Area (acres) | Total Lagoon Area (acres) | Reduction Factor (Y) |
|---|---|---|---|---|---|---|
| China House 2-yr | 83.24925 | 0.224391501 | 20.7 | 49.1 | 371 | 0.53225 |
| China House 5-yr | 150.1865 | 0.404815361 | 20.7 | 49.1 | 371 | 5.65549 |
| China House 10-yr | 156.4094 | 0.421588595 | 20.7 | 49.1 | 371 | 2.99493 |
| Quartermaster 2-yr | 24.32917 | 0.065577288 | 7 | 49.1 | 371 | 0.45998 |
| Quartermaster 5-yr | 47.84565 | 0.128964008 | 7 | 49.1 | 371 | 0.25236 |
| Quartermaster 10-yr | 52.89206 | 0.142566191 | 7 | 49.1 | 371 | 0.27898 |
| Cock Fight Arena 2-yr | 110.6442 | 0.29823223 | 15.1 | 49.1 | 371 | 0.96975 |
| Cock Fight Arena 5-yr | 110.6442 | 0.29823223 | 15.1 | 49.1 | 371 | 0.96975 |
| Cock Fight Arena 10-yr | 114.0957 | 0.307535642 | 15.1 | 49.1 | 371 | 1.00000 |

# *Appendix J*
# *IWR-PLAN Tables and Graphs*

# Total and Average Cost

3/22/2013 11:34:07AM

## All Plan Alternatives

**Planning Set:** Saipan Lagoon REV03

| Counter | Name | LGHU (Output) equivalent acre | Cost $1000 | Average Cost |
|---|---|---|---|---|
| 1 | No Action Plan | 0.00 | 0.00 | |
| 2 | C0Q1A0 | 11.32 | 1,485.80 | 131.22 |
| 3 | C0Q2A0 | 22.27 | 2,118.00 | 95.11 |
| 4 | C0Q3A0 | 24.62 | 2,757.50 | 112.02 |
| 5 | C1Q0A0 | 42.49 | 2,164.90 | 50.95 |
| 6 | C1Q1A0 | 53.82 | 3,650.70 | 67.84 |
| 7 | C1Q2A0 | 64.76 | 4,282.90 | 66.13 |
| 8 | C1Q3A0 | 67.11 | 4,922.40 | 73.35 |
| 9 | C0Q0A1 | 70.33 | 2,747.80 | 39.07 |
| 10 | C0Q0A2 | 70.33 | 5,231.50 | 74.38 |
| 11 | C0Q0A3 | 72.53 | 5,686.30 | 78.40 |
| 12 | C2Q0A0 | 76.66 | 3,376.00 | 44.04 |
| 13 | C3Q0A0 | 79.84 | 4,810.80 | 60.26 |
| 14 | C0Q1A2 | 81.66 | 6,717.30 | 82.26 |
| 15 | C0Q1A1 | 81.66 | 4,233.60 | 51.85 |
| 16 | C0Q1A3 | 83.85 | 7,172.10 | 85.53 |
| 17 | C2Q1A0 | 87.99 | 4,861.80 | 55.26 |
| 18 | C3Q1A0 | 91.16 | 6,296.60 | 69.07 |
| 19 | C0Q2A1 | 92.60 | 4,865.80 | 52.55 |
| 20 | C0Q2A2 | 92.60 | 7,349.50 | 79.37 |
| 21 | C0Q2A3 | 94.80 | 7,804.30 | 82.33 |
| 22 | C0Q3A2 | 94.95 | 7,989.00 | 84.14 |
| 23 | C0Q3A1 | 94.95 | 5,505.30 | 57.98 |
| 24 | C0Q3A3 | 97.15 | 8,443.80 | 86.92 |
| 25 | C2Q2A0 | 98.93 | 5,494.00 | 55.53 |
| 26 | C2Q3A0 | 101.28 | 6,133.50 | 60.56 |
| 27 | C3Q2A0 | 102.11 | 6,928.80 | 67.86 |
| 28 | C3Q3A0 | 104.46 | 7,568.30 | 72.46 |
| 29 | C1Q0A2 | 112.83 | 7,396.40 | 65.56 |
| 30 | C1Q0A1 | 112.83 | 4,912.70 | 43.54 |
| 31 | C1Q0A3 | 115.02 | 7,851.20 | 68.26 |
| 32 | C1Q1A1 | 124.15 | 6,398.50 | 51.54 |
| 33 | C1Q1A2 | 124.15 | 8,882.20 | 71.55 |
| 34 | C1Q1A3 | 126.35 | 9,337.00 | 73.90 |
| 35 | C1Q2A1 | 135.09 | 7,030.70 | 52.04 |
| 36 | C1Q2A2 | 135.09 | 9,514.40 | 70.43 |
| 37 | C1Q2A3 | 137.29 | 9,969.20 | 72.61 |
| 38 | C1Q3A1 | 137.44 | 7,670.20 | 55.81 |
| 39 | C1Q3A2 | 137.44 | 10,153.90 | 73.88 |
| 40 | C1Q3A3 | 139.64 | 10,608.70 | 75.97 |
| 41 | C2Q0A1 | 146.99 | 6,123.80 | 41.66 |
| 42 | C2Q0A2 | 146.99 | 8,607.50 | 58.56 |
| 43 | C2Q0A3 | 149.19 | 9,062.30 | 60.74 |
| 44 | C3Q0A2 | 150.17 | 10,042.30 | 66.87 |
| 45 | C3Q0A1 | 150.17 | 7,558.60 | 50.33 |
| 46 | C3Q0A3 | 152.37 | 10,497.10 | 68.89 |
| 47 | C2Q1A1 | 158.32 | 7,609.60 | 48.07 |
| 48 | C2Q1A2 | 158.32 | 10,093.30 | 63.75 |
| 49 | C2Q1A3 | 160.51 | 10,548.10 | 65.71 |
| 50 | C3Q1A2 | 161.49 | 11,528.10 | 71.38 |
| 51 | C3Q1A1 | 161.49 | 9,044.40 | 56.00 |
| 52 | C3Q1A3 | 163.69 | 11,982.90 | 73.20 |
| 53 | C2Q2A2 | 169.26 | 10,725.50 | 63.37 |
| 54 | C2Q2A1 | 169.26 | 8,241.80 | 48.69 |
| 55 | C2Q2A3 | 171.46 | 11,180.30 | 65.21 |

* Plan Of Interest

# Total and Average Cost

3/22/2013 11:34:07AM

**All Plan Alternatives** **Planning Set:** Saipan Lagoon REV03

| Counter | Name | LGHU (Output) equivalent acre | Cost $1000 | Average Cost |
|---|---|---|---|---|
| 56 | C2Q3A1 | 171.61 | 8,881.30 | 51.75 |
| 57 | C2Q3A2 | 171.61 | 11,365.00 | 66.23 |
| 58 | C3Q2A2 | 172.44 | 12,160.30 | 70.52 |
| 59 | C3Q2A1 | 172.44 | 9,676.60 | 56.12 |
| 60 | C2Q3A3 | 173.81 | 11,819.80 | 68.01 |
| 61 | C3Q2A3 | 174.64 | 12,615.10 | 72.24 |
| 62 | C3Q3A2 | 174.79 | 12,799.80 | 73.23 |
| 63 | C3Q3A1 | 174.79 | 10,316.10 | 59.02 |
| 64 | C3Q3A3 | 176.98 | 13,254.60 | 74.89 |

# Multiple Variable Report

**Planning Set:** Saipan Lagoon REV03

3/22/2013 11:35:44AM

## Cost Effective Plan Alternatives

| Counter | Name | Cost | FW | H | LGHU | R | S |
|---|---|---|---|---|---|---|---|
| 1 | No Action Plan | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2 | C0Q1A0 | 1485.80 | 9.30 | 10.67 | 11.32 | 13.13 | 24.33 |
| 3 | C0Q2A0 | 2118.00 | 18.29 | 20.98 | 22.27 | 25.82 | 47.85 |
| 4 | C1Q0A0 | 2164.90 | 33.96 | 43.20 | 42.49 | 60.76 | 83.25 |
| 5 | C0Q0A1 | 2747.80 | 74.29 | 44.97 | 70.33 | 27.68 | 110.64 |
| 6 | C2Q0A0 | 3376.00 | 61.27 | 77.93 | 76.66 | 109.61 | 150.19 |
| 7 | C0Q1A1 | 4233.60 | 83.59 | 55.64 | 81.66 | 40.81 | 134.97 |
| 8 | C2Q1A0 | 4861.80 | 70.57 | 88.60 | 87.99 | 122.74 | 174.52 |
| 9 | C0Q2A1 | 4865.80 | 92.58 | 65.95 | 92.60 | 53.50 | 158.49 |
| 10 | C1Q0A1 | 4912.70 | 108.25 | 88.17 | 112.83 | 88.44 | 193.89 |
| 11 | C2Q0A1 | 6123.80 | 135.56 | 122.90 | 146.99 | 137.29 | 260.83 |
| 12 | C3Q0A1 | 7558.60 | 138.10 | 126.13 | 150.17 | 141.83 | 267.05 |
| 13 | C2Q1A1 | 7609.60 | 144.86 | 133.57 | 158.32 | 150.42 | 285.16 |
| 14 | C2Q2A1 | 8241.80 | 153.85 | 143.88 | 169.26 | 163.11 | 308.68 |
| 15 | C2Q3A1 | 8881.30 | 155.78 | 146.09 | 171.61 | 165.83 | 313.72 |
| 16 | C3Q2A1 | 9676.60 | 156.39 | 147.11 | 172.44 | 167.65 | 314.90 |
| 17 | C3Q3A1 | 10316.10 | 158.32 | 149.32 | 174.79 | 170.37 | 319.94 |
| 18 | C3Q3A3 | 13254.60 | 160.64 | 150.73 | 176.98 | 171.23 | 323.40 |

* Plan Of Interest

# Incremental Cost of Best Buy Plan Combinations (Ordered By Output)

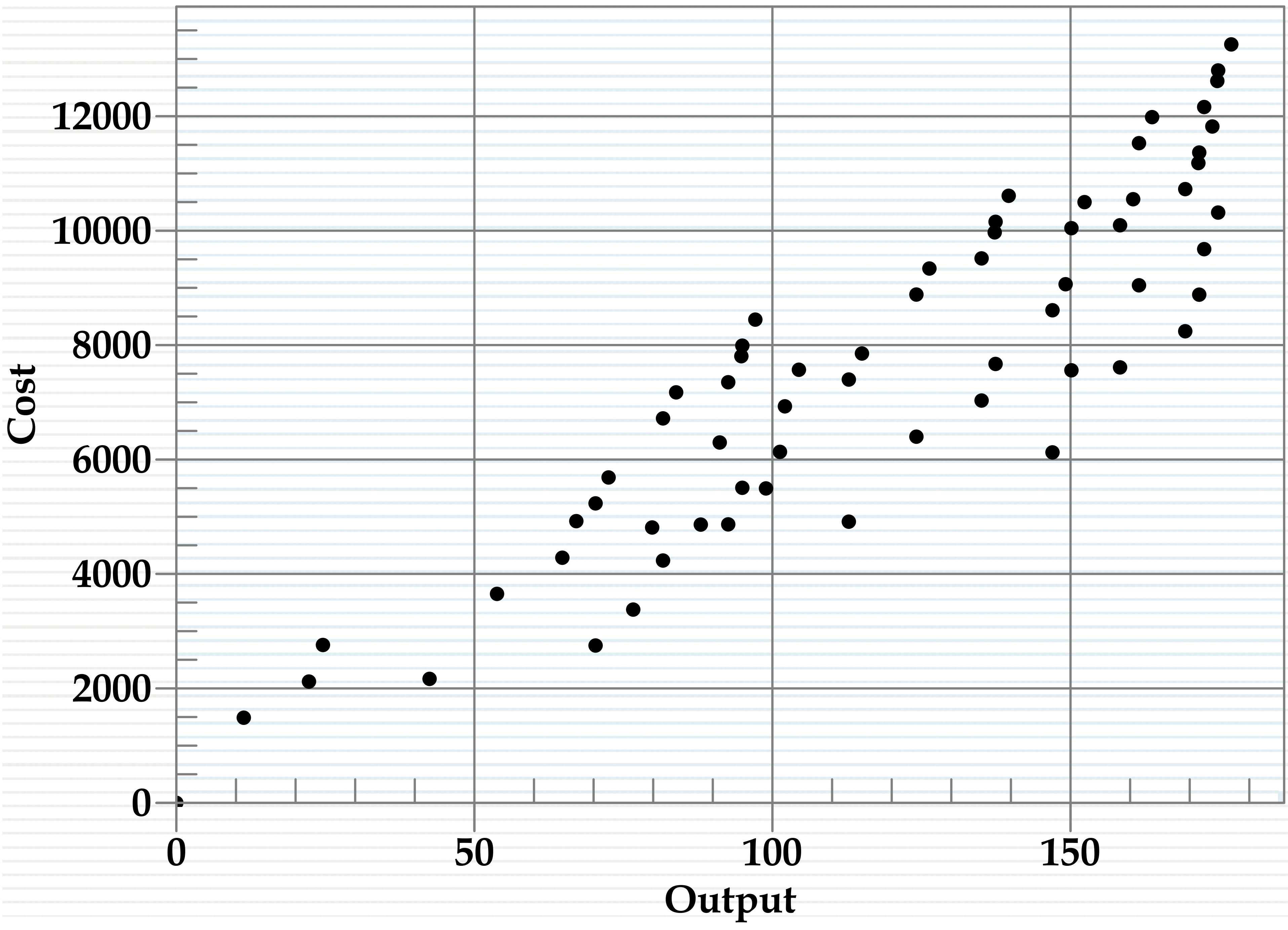
3/22/2013 11:36:25AM

**Planning Set:** Saipan Lagoon REV03

| Counter | Plan Alternative | LGHU (Output) (equivalent acre) | Cost ($1000) | Average Cost ($1000 / equivalent acre) | Incremental Cost ($1000) | Inc. Output (equivalent acre) | Inc. Cost Per Output |
|---|---|---|---|---|---|---|---|
| 1 | No Action Plan | 0.00 | 0.00 | | | | |
| 2 | C0Q0A1 | 70.33 | 2,747.80 | 39.0690 | 2,747.8000 | 70.3320 | 39.0690 |
| 3 | C2Q0A1 | 146.99 | 6,123.80 | 41.6602 | 3,376.0000 | 76.6620 | 44.0375 |
| 4 | C2Q2A1 | 169.26 | 8,241.80 | 48.6926 | 2,118.0000 | 22.2680 | 95.1141 |
| 5 | C2Q3A1 | 171.61 | 8,881.30 | 51.7528 | 639.5000 | 2.3480 | 272.3595 |
| 6 | C3Q3A1 | 174.79 | 10,316.10 | 59.0210 | 1,434.8000 | 3.1770 | 451.6210 |
| 7 | C3Q3A3 | 176.98 | 13,254.60 | 74.8915 | 2,938.5000 | 2.1970 | 1,337.5057 |

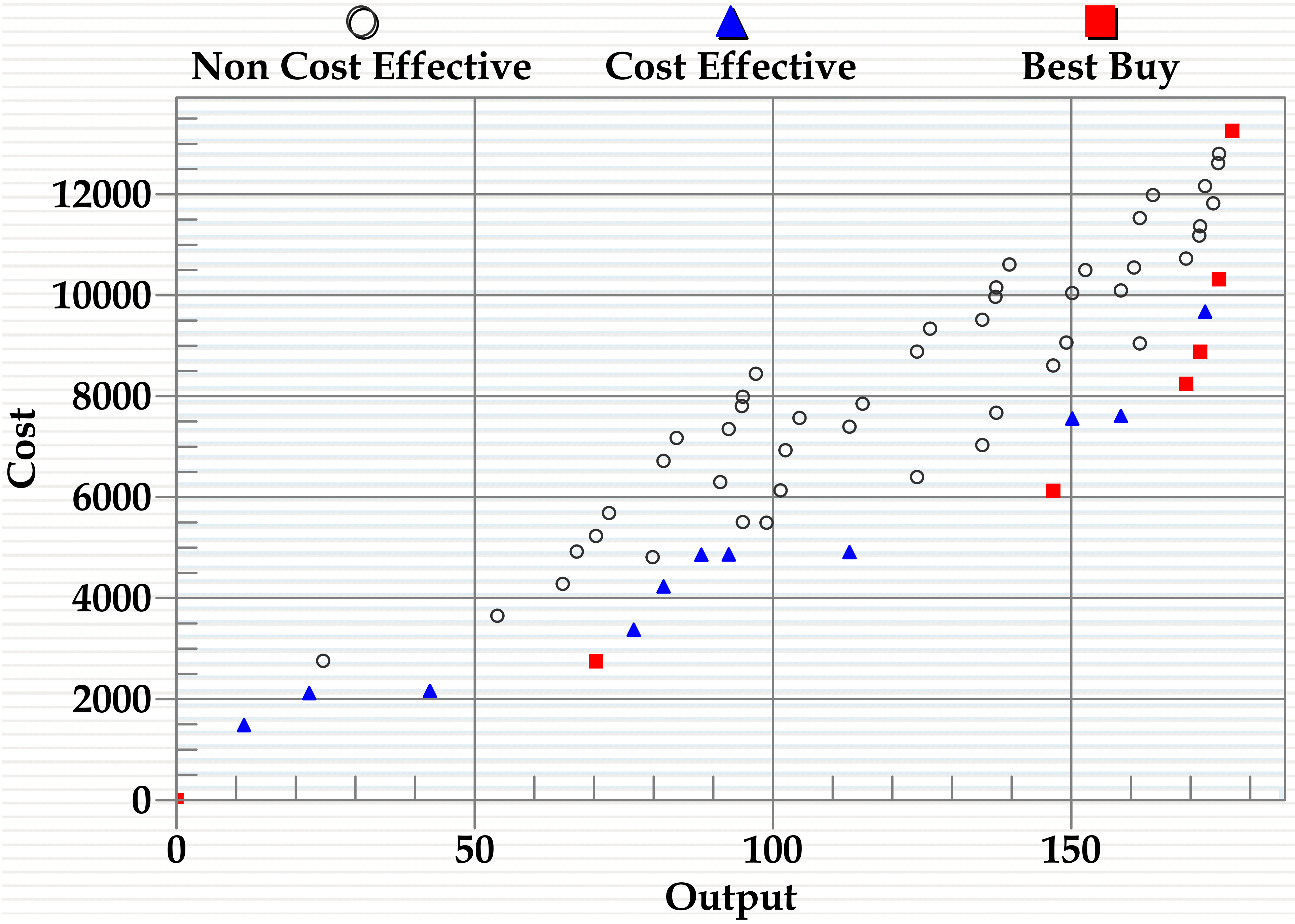
# Planning Set "Saipan Lagoon REV03" Cost and Output

All Plan Alternatives



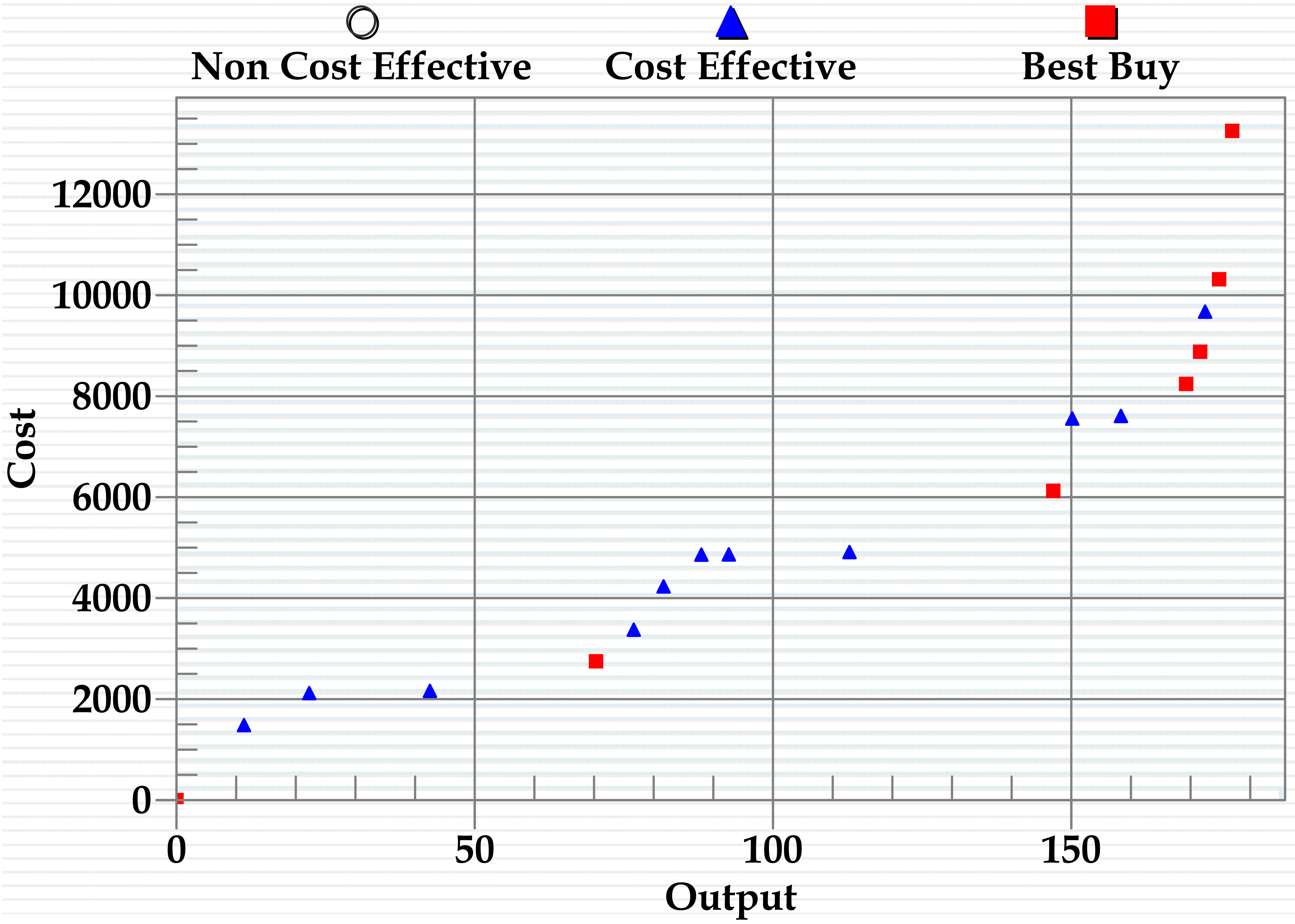
# Planning Set "Saipan Lagoon REV03" Cost and Output

All Plan Alternatives Differentiated by Cost Effectiveness



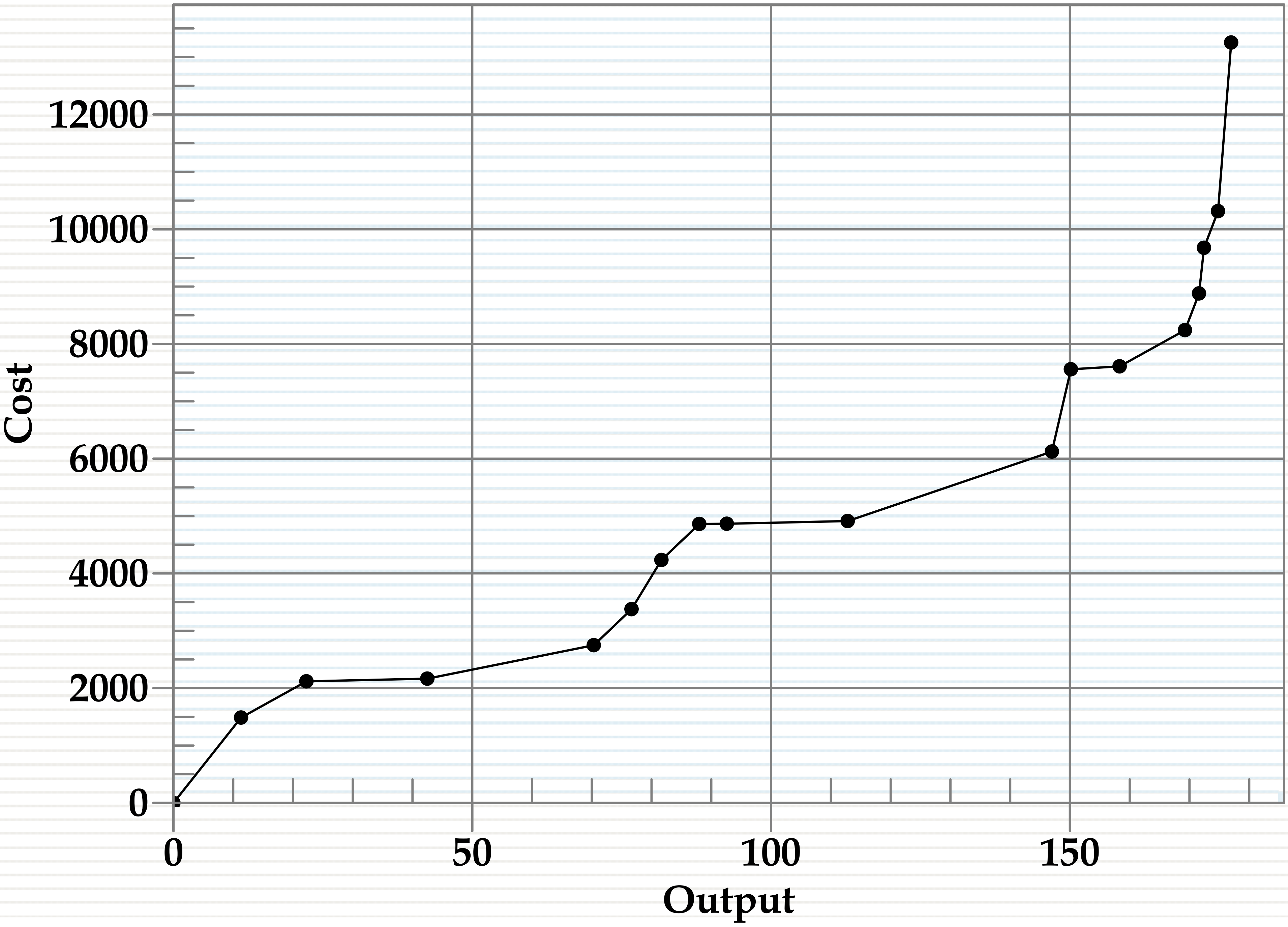
# Planning Set "Saipan Lagoon REV03" Cost and Output

Cost Effective Plan Alternatives Differentiated by Cost Effectiveness



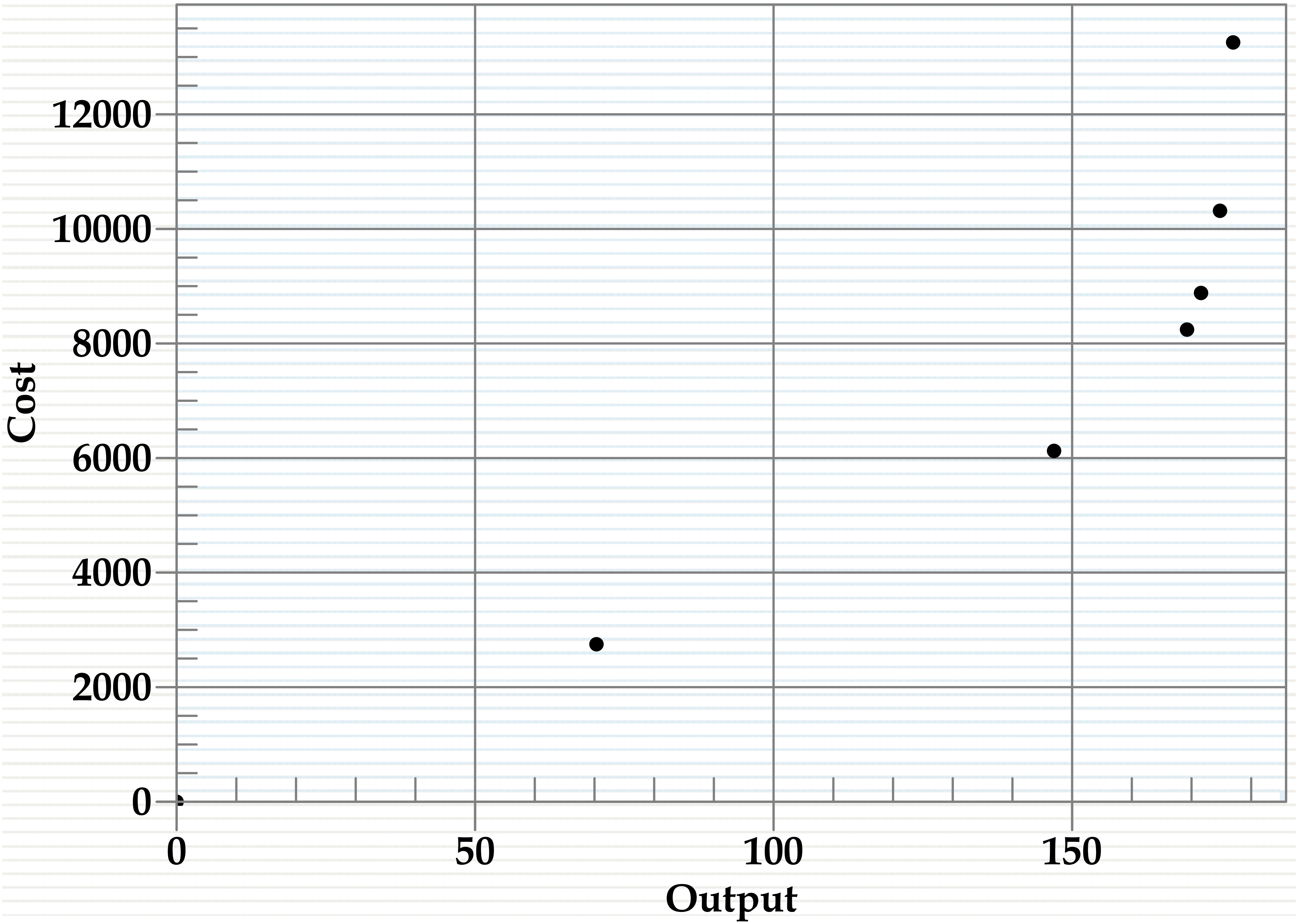
# Planning Set "Saipan Lagoon REV03" Cost and Output

## Cost Effective Plan Alternatives



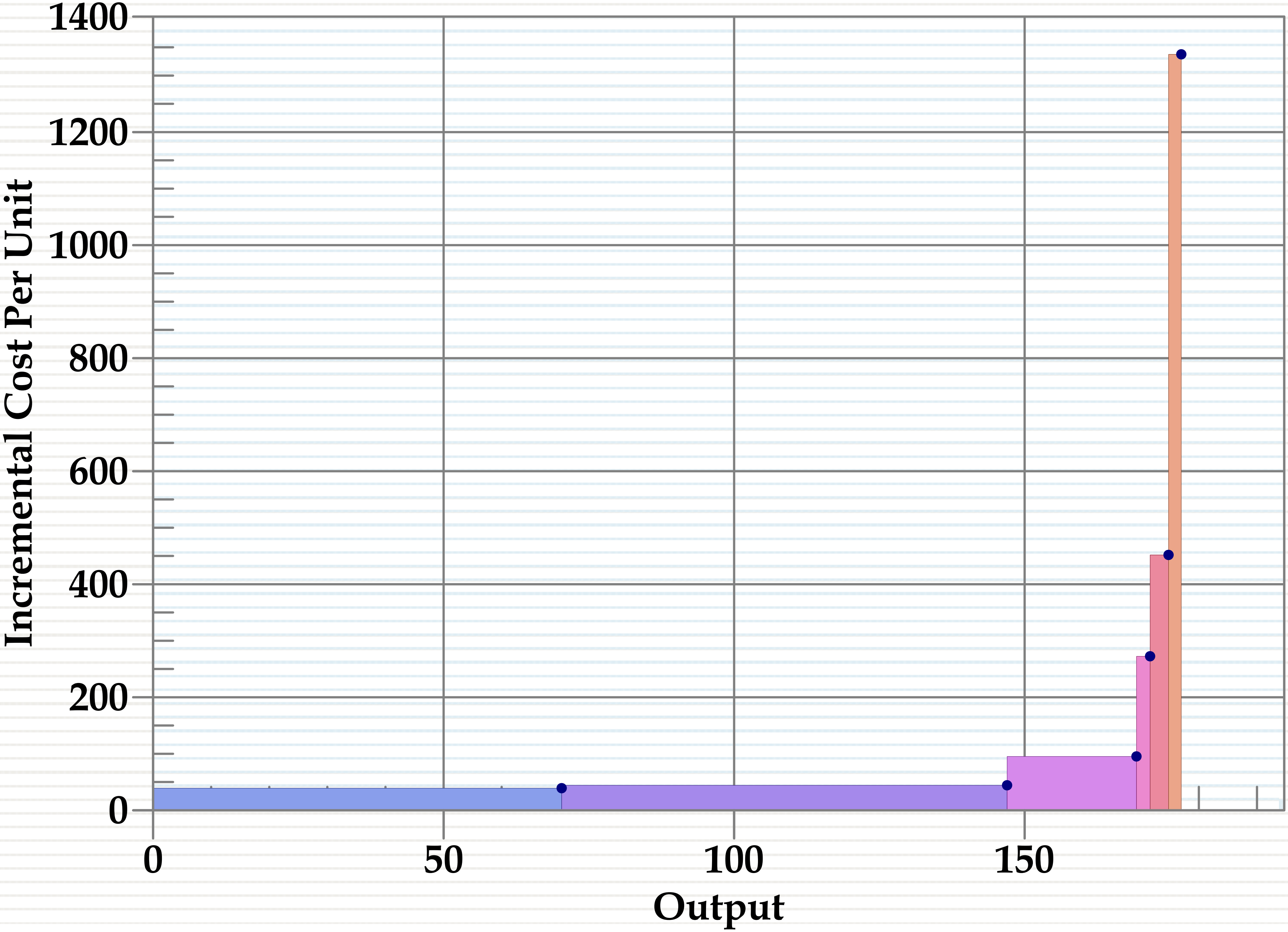
# Planning Set "Saipan Lagoon REV03" Cost and Output

Best Buy Plan Alternatives



# Planning Set "Saipan Lagoon REV03" Incremental Cost and Output

Best Buy Plan Alternatives



# Annualized Cost for "C0 Q0 A1"

8/30/2013

**Initial terms:**
Discount rate %: 3.75 Period of analysis: 50 Capital recovery factor: 0.044574218 Avg annual cost: $300,375.15

**Total initial cost:**
Construction $1,959,420.0 + Real Estate $1,012,000.0 + Monitoring $796,620.00 + Other $518,440.00 = $4,286,480.00

**Total Investment cost:**
Total Initial Cost $4,286,480.00 + PED $2,193,370.00 + IDC $133,281.00 = $6,613,131.00

**Initial investment:**
Total Investment Cost $6,613,131.0 PV Factor 1.000000 Present Value = $6,613,131.00

| Year | Cost | PV Factor | Present Value |
|---|---|---|---|
| 0 | $6,613,131.00 | 1.0000 | $6,613,131.00 |
| 1 | $5,600.00 | 0.9639 | $5,397.59 |
| 2 | $5,600.00 | 0.9290 | $5,202.50 |
| 3 | $5,600.00 | 0.8954 | $5,014.45 |
| 4 | $5,600.00 | 0.8631 | $4,833.21 |
| 5 | $5,600.00 | 0.8319 | $4,658.52 |
| 6 | $5,600.00 | 0.8018 | $4,490.13 |
| 7 | $5,600.00 | 0.7728 | $4,327.84 |
| 8 | $5,600.00 | 0.7449 | $4,171.41 |
| 9 | $5,600.00 | 0.7180 | $4,020.64 |
| 10 | $5,600.00 | 0.6920 | $3,875.31 |
| 11 | $5,600.00 | 0.6670 | $3,735.24 |
| 12 | $5,600.00 | 0.6429 | $3,600.23 |
| 13 | $5,600.00 | 0.6197 | $3,470.11 |
| 14 | $5,600.00 | 0.5973 | $3,344.68 |
| 15 | $5,600.00 | 0.5757 | $3,223.79 |
| 16 | $5,600.00 | 0.5549 | $3,107.27 |
| 17 | $5,600.00 | 0.5348 | $2,994.95 |
| 18 | $5,600.00 | 0.5155 | $2,886.70 |
| 19 | $5,600.00 | 0.4969 | $2,782.36 |
| 20 | $5,600.00 | 0.4789 | $2,681.80 |
| 21 | $5,600.00 | 0.4616 | $2,584.86 |
| 22 | $5,600.00 | 0.4449 | $2,491.44 |
| 23 | $5,600.00 | 0.4288 | $2,401.38 |
| 24 | $5,600.00 | 0.4133 | $2,314.59 |
| 25 | $5,600.00 | 0.3984 | $2,230.93 |
| 26 | $5,600.00 | 0.3840 | $2,150.29 |
| 27 | $5,600.00 | 0.3701 | $2,072.57 |
| 28 | $5,600.00 | 0.3567 | $1,997.66 |
| 29 | $5,600.00 | 0.3438 | $1,925.45 |
| 30 | $5,600.00 | 0.3314 | $1,855.86 |
| 31 | $5,600.00 | 0.3194 | $1,788.78 |
| 32 | $5,600.00 | 0.3079 | $1,724.12 |
| 33 | $5,600.00 | 0.2968 | $1,661.81 |
| 34 | $5,600.00 | 0.2860 | $1,601.74 |
| 35 | $5,600.00 | 0.2757 | $1,543.85 |
| 36 | $5,600.00 | 0.2657 | $1,488.05 |
| 37 | $5,600.00 | 0.2561 | $1,434.26 |
| 38 | $5,600.00 | 0.2469 | $1,382.42 |
| 39 | $5,600.00 | 0.2379 | $1,332.45 |
| 40 | $5,600.00 | 0.2293 | $1,284.29 |
| 41 | $5,600.00 | 0.2210 | $1,237.87 |
| 42 | $5,600.00 | 0.2131 | $1,193.13 |
| 43 | $5,600.00 | 0.2054 | $1,150.00 |
| 44 | $5,600.00 | 0.1979 | $1,108.44 |
| 45 | $5,600.00 | 0.1908 | $1,068.37 |
| 46 | $5,600.00 | 0.1839 | $1,029.76 |
| 47 | $5,600.00 | 0.1772 | $992.54 |
| 48 | $5,600.00 | 0.1708 | $956.66 |
| 49 | $5,600.00 | 0.1647 | $922.08 |
| 50 | $5,600.00 | 0.1587 | $888.76 |

**Net Totals:** Cost: $6,893,131.00 Present Value: $6,738,764.16 Avg Annual Cost: $300,375.15

# Annualized Cost for "C2 Q0 A1"

8/30/2013

**Initial terms:**
Discount rate %: 3.75 Period of analysis: 50 Capital recovery factor: 0.044574218 Avg annual cost: $458,532.13

**Total initial cost:**
Construction $5,576,550.0 + Real Estate $1,600,980.0 + Monitoring $1,621,860.0 + Other $707,040.00 = $9,506,430.00

**Total Investment cost:**
Total Initial Cost $9,506,430.00 + PED $239,252.00 + IDC $321,396.00 = $10,067,078.00

**Initial investment:**
Total Investment Cost $10,067,078. PV Factor 1.000000 Present Value = $10,067,078.00

| Year | Cost | PV Factor | Present Value |
|---|---|---|---|
| 0 | $10,067,078.00 | 1.0000 | $10,067,078.00 |
| 1 | $9,800.00 | 0.9639 | $9,445.78 |
| 2 | $9,800.00 | 0.9290 | $9,104.37 |
| 3 | $9,800.00 | 0.8954 | $8,775.30 |
| 4 | $9,800.00 | 0.8631 | $8,458.12 |
| 5 | $9,800.00 | 0.8319 | $8,152.40 |
| 6 | $9,800.00 | 0.8018 | $7,857.74 |
| 7 | $9,800.00 | 0.7728 | $7,573.72 |
| 8 | $9,800.00 | 0.7449 | $7,299.97 |
| 9 | $9,800.00 | 0.7180 | $7,036.12 |
| 10 | $9,800.00 | 0.6920 | $6,781.80 |
| 11 | $9,800.00 | 0.6670 | $6,536.68 |
| 12 | $9,800.00 | 0.6429 | $6,300.41 |
| 13 | $9,800.00 | 0.6197 | $6,072.68 |
| 14 | $9,800.00 | 0.5973 | $5,853.19 |
| 15 | $9,800.00 | 0.5757 | $5,641.63 |
| 16 | $9,800.00 | 0.5549 | $5,437.71 |
| 17 | $9,800.00 | 0.5348 | $5,241.17 |
| 18 | $9,800.00 | 0.5155 | $5,051.73 |
| 19 | $9,800.00 | 0.4969 | $4,869.14 |
| 20 | $9,800.00 | 0.4789 | $4,693.14 |
| 21 | $9,800.00 | 0.4616 | $4,523.51 |
| 22 | $9,800.00 | 0.4449 | $4,360.01 |
| 23 | $9,800.00 | 0.4288 | $4,202.42 |
| 24 | $9,800.00 | 0.4133 | $4,050.53 |
| 25 | $9,800.00 | 0.3984 | $3,904.12 |
| 26 | $9,800.00 | 0.3840 | $3,763.01 |
| 27 | $9,800.00 | 0.3701 | $3,627.00 |
| 28 | $9,800.00 | 0.3567 | $3,495.90 |
| 29 | $9,800.00 | 0.3438 | $3,369.54 |
| 30 | $9,800.00 | 0.3314 | $3,247.75 |
| 31 | $9,800.00 | 0.3194 | $3,130.36 |
| 32 | $9,800.00 | 0.3079 | $3,017.22 |
| 33 | $9,800.00 | 0.2968 | $2,908.16 |
| 34 | $9,800.00 | 0.2860 | $2,803.05 |
| 35 | $9,800.00 | 0.2757 | $2,701.73 |
| 36 | $9,800.00 | 0.2657 | $2,604.08 |
| 37 | $9,800.00 | 0.2561 | $2,509.96 |
| 38 | $9,800.00 | 0.2469 | $2,419.24 |
| 39 | $9,800.00 | 0.2379 | $2,331.79 |
| 40 | $9,800.00 | 0.2293 | $2,247.51 |
| 41 | $9,800.00 | 0.2210 | $2,166.28 |
| 42 | $9,800.00 | 0.2131 | $2,087.98 |
| 43 | $9,800.00 | 0.2054 | $2,012.51 |
| 44 | $9,800.00 | 0.1979 | $1,939.77 |
| 45 | $9,800.00 | 0.1908 | $1,869.65 |
| 46 | $9,800.00 | 0.1839 | $1,802.08 |
| 47 | $9,800.00 | 0.1772 | $1,736.94 |
| 48 | $9,800.00 | 0.1708 | $1,674.16 |
| 49 | $9,800.00 | 0.1647 | $1,613.65 |
| 50 | $9,800.00 | 0.1587 | $1,555.32 |

**Net Totals:** Cost: $10,557,078.00 Present Value: $10,286,936.03 Avg Annual Cost: $458,532.13

# Annualized Cost for "C2 Q2 A1"

8/30/2013

**Initial terms:**
Discount rate %: 3.75 Period of analysis: 50 Capital recovery factor: 0.044574218 Avg annual cost: $723,888.53

**Total initial cost:**
Construction $7,507,920.0 + Real Estate $2,180,150.0 + Monitoring $2,416,130.0 + Other $821,310.00 = $12,925,510.00

**Total Investment cost:**
Total Initial Cost $12,925,510.00 + PED $2,496,700.00 + IDC $541,918.00 = $15,964,128.00

**Initial investment:**
Total Investment Cost $15,964,128. PV Factor 1.000000 Present Value = $15,964,128.00

| Year | Cost | PV Factor | Present Value |
|---|---|---|---|
| 0 | $15,964,128.00 | 1.0000 | $15,964,128.00 |
| 1 | $12,300.00 | 0.9639 | $11,855.42 |
| 2 | $12,300.00 | 0.9290 | $11,426.91 |
| 3 | $12,300.00 | 0.8954 | $11,013.89 |
| 4 | $12,300.00 | 0.8631 | $10,615.80 |
| 5 | $12,300.00 | 0.8319 | $10,232.10 |
| 6 | $12,300.00 | 0.8018 | $9,862.26 |
| 7 | $12,300.00 | 0.7728 | $9,505.79 |
| 8 | $12,300.00 | 0.7449 | $9,162.21 |
| 9 | $12,300.00 | 0.7180 | $8,831.05 |
| 10 | $12,300.00 | 0.6920 | $8,511.85 |
| 11 | $12,300.00 | 0.6670 | $8,204.19 |
| 12 | $12,300.00 | 0.6429 | $7,907.66 |
| 13 | $12,300.00 | 0.6197 | $7,621.84 |
| 14 | $12,300.00 | 0.5973 | $7,346.35 |
| 15 | $12,300.00 | 0.5757 | $7,080.82 |
| 16 | $12,300.00 | 0.5549 | $6,824.89 |
| 17 | $12,300.00 | 0.5348 | $6,578.20 |
| 18 | $12,300.00 | 0.5155 | $6,340.44 |
| 19 | $12,300.00 | 0.4969 | $6,111.26 |
| 20 | $12,300.00 | 0.4789 | $5,890.38 |
| 21 | $12,300.00 | 0.4616 | $5,677.47 |
| 22 | $12,300.00 | 0.4449 | $5,472.26 |
| 23 | $12,300.00 | 0.4288 | $5,274.47 |
| 24 | $12,300.00 | 0.4133 | $5,083.82 |
| 25 | $12,300.00 | 0.3984 | $4,900.07 |
| 26 | $12,300.00 | 0.3840 | $4,722.96 |
| 27 | $12,300.00 | 0.3701 | $4,552.25 |
| 28 | $12,300.00 | 0.3567 | $4,387.71 |
| 29 | $12,300.00 | 0.3438 | $4,229.12 |
| 30 | $12,300.00 | 0.3314 | $4,076.26 |
| 31 | $12,300.00 | 0.3194 | $3,928.93 |
| 32 | $12,300.00 | 0.3079 | $3,786.92 |
| 33 | $12,300.00 | 0.2968 | $3,650.04 |
| 34 | $12,300.00 | 0.2860 | $3,518.11 |
| 35 | $12,300.00 | 0.2757 | $3,390.95 |
| 36 | $12,300.00 | 0.2657 | $3,268.39 |
| 37 | $12,300.00 | 0.2561 | $3,150.25 |
| 38 | $12,300.00 | 0.2469 | $3,036.39 |
| 39 | $12,300.00 | 0.2379 | $2,926.64 |
| 40 | $12,300.00 | 0.2293 | $2,820.86 |
| 41 | $12,300.00 | 0.2210 | $2,718.90 |
| 42 | $12,300.00 | 0.2131 | $2,620.62 |
| 43 | $12,300.00 | 0.2054 | $2,525.90 |
| 44 | $12,300.00 | 0.1979 | $2,434.60 |
| 45 | $12,300.00 | 0.1908 | $2,346.61 |
| 46 | $12,300.00 | 0.1839 | $2,261.79 |
| 47 | $12,300.00 | 0.1772 | $2,180.04 |
| 48 | $12,300.00 | 0.1708 | $2,101.24 |
| 49 | $12,300.00 | 0.1647 | $2,025.29 |
| 50 | $12,300.00 | 0.1587 | $1,952.09 |

**Net Totals:** Cost: $16,579,128.00 Present Value: $16,240,072.27 Avg Annual Cost: $723,888.53

# Annualized NER Outputs for "C0 Q0 A1"

8/26/2013 10:54:53AM

**Initial Terms**

**Max Output:** 70.33 units

**Period of Analysis:** 50 years

**Calculation Method:** Linear Interpolation

**Average Annual Output =** 4.2198

| Year | Output Units |
|---|---|
| 0 | 0.00 |
| 1 | 14.07 |
| 2 | 28.13 |
| 3 | 42.20 |
| 4 | 56.26 |
| 5 | 70.33 |
| 6 | 0.00 |
| 7 | 0.00 |
| 8 | 0.00 |
| 9 | 0.00 |
| 10 | 0.00 |
| 11 | 0.00 |
| 12 | 0.00 |
| 13 | 0.00 |
| 14 | 0.00 |
| 15 | 0.00 |
| 16 | 0.00 |
| 17 | 0.00 |
| 18 | 0.00 |
| 19 | 0.00 |
| 20 | 0.00 |
| 21 | 0.00 |
| 22 | 0.00 |
| 23 | 0.00 |
| 24 | 0.00 |
| 25 | 0.00 |
| 26 | 0.00 |
| 27 | 0.00 |
| 28 | 0.00 |
| 29 | 0.00 |
| 30 | 0.00 |
| 31 | 0.00 |
| 32 | 0.00 |
| 33 | 0.00 |
| 34 | 0.00 |
| 35 | 0.00 |
| 36 | 0.00 |
| 37 | 0.00 |
| 38 | 0.00 |
| 39 | 0.00 |
| 40 | 0.00 |
| 41 | 0.00 |
| 42 | 0.00 |
| 43 | 0.00 |
| 44 | 0.00 |
| 45 | 0.00 |
| 46 | 0.00 |
| 47 | 0.00 |
| 48 | 0.00 |
| 49 | 0.00 |
| 50 | 0.00 |

# Annualized NER Outputs for "C2 Q0 A1"

8/26/2013 11:05:29AM

## Initial Terms

**Max Output:** 146.99 units

**Period of Analysis:** 50 years

**Calculation Method:** Linear Interpolation

**Average Annual Output =** 8.8194

| Year | Output Units |
|---|---|
| 0 | 0.00 |
| 1 | 29.40 |
| 2 | 58.80 |
| 3 | 88.19 |
| 4 | 117.59 |
| 5 | 146.99 |
| 6 | 0.00 |
| 7 | 0.00 |
| 8 | 0.00 |
| 9 | 0.00 |
| 10 | 0.00 |
| 11 | 0.00 |
| 12 | 0.00 |
| 13 | 0.00 |
| 14 | 0.00 |
| 15 | 0.00 |
| 16 | 0.00 |
| 17 | 0.00 |
| 18 | 0.00 |
| 19 | 0.00 |
| 20 | 0.00 |
| 21 | 0.00 |
| 22 | 0.00 |
| 23 | 0.00 |
| 24 | 0.00 |
| 25 | 0.00 |
| 26 | 0.00 |
| 27 | 0.00 |
| 28 | 0.00 |
| 29 | 0.00 |
| 30 | 0.00 |
| 31 | 0.00 |
| 32 | 0.00 |
| 33 | 0.00 |
| 34 | 0.00 |
| 35 | 0.00 |
| 36 | 0.00 |
| 37 | 0.00 |
| 38 | 0.00 |
| 39 | 0.00 |
| 40 | 0.00 |
| 41 | 0.00 |
| 42 | 0.00 |
| 43 | 0.00 |
| 44 | 0.00 |
| 45 | 0.00 |
| 46 | 0.00 |
| 47 | 0.00 |
| 48 | 0.00 |
| 49 | 0.00 |
| 50 | 0.00 |

# Annualized NER Outputs for "C2 Q2 A1"

8/26/2013 11:09:37AM

## Initial Terms

**Max Output:** 169.26 units

**Period of Analysis:** 50 years

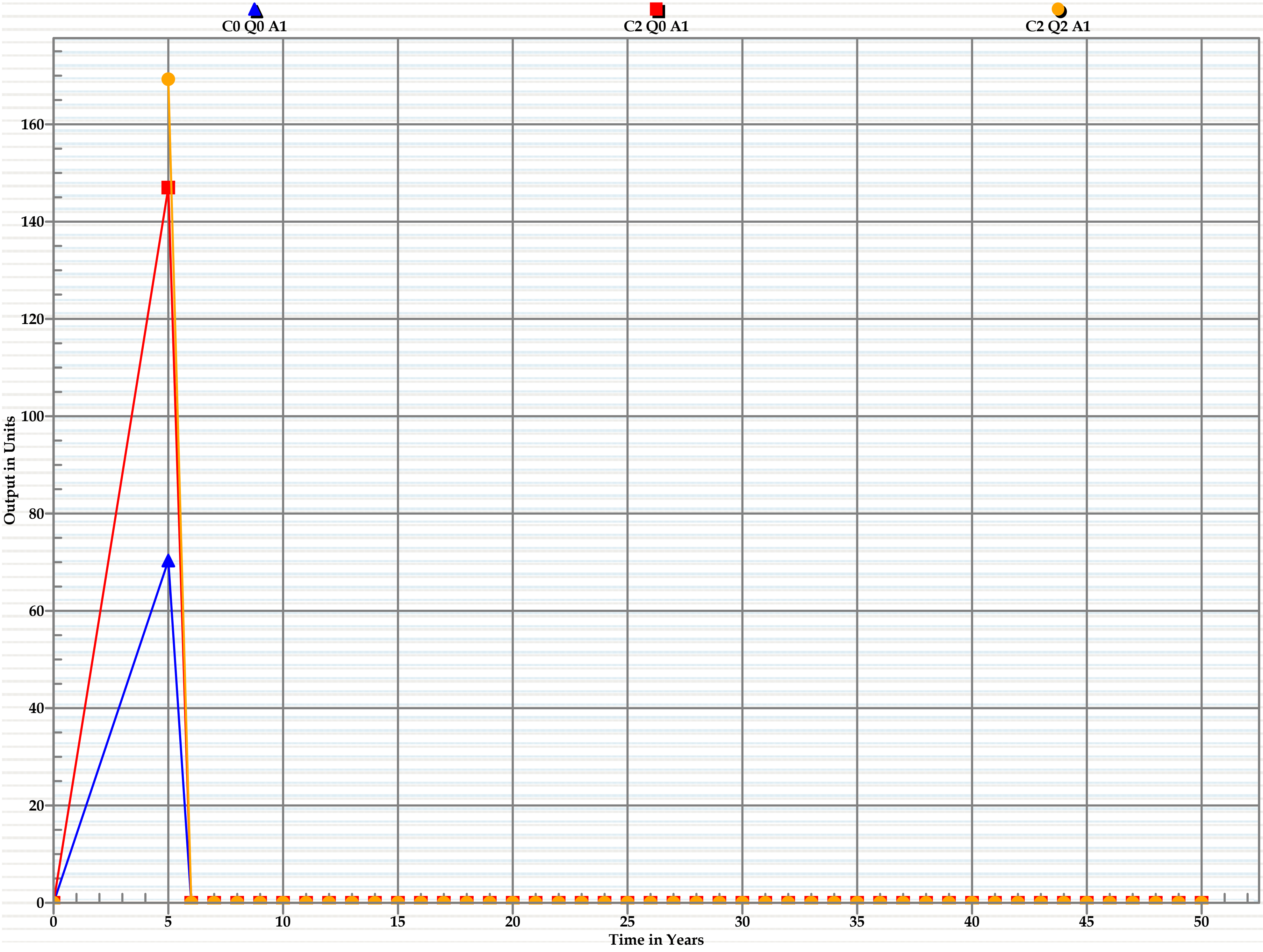
**Calculation Method:** Linear Interpolation

**Average Annual Output =** 10.1556

| Year | Output Units |
|---|---|
| 0 | 0.00 |
| 1 | 33.85 |
| 2 | 67.70 |
| 3 | 101.56 |
| 4 | 135.41 |
| 5 | 169.26 |
| 6 | 0.00 |
| 7 | 0.00 |
| 8 | 0.00 |
| 9 | 0.00 |
| 10 | 0.00 |
| 11 | 0.00 |
| 12 | 0.00 |
| 13 | 0.00 |
| 14 | 0.00 |
| 15 | 0.00 |
| 16 | 0.00 |
| 17 | 0.00 |
| 18 | 0.00 |
| 19 | 0.00 |
| 20 | 0.00 |
| 21 | 0.00 |
| 22 | 0.00 |
| 23 | 0.00 |
| 24 | 0.00 |
| 25 | 0.00 |
| 26 | 0.00 |
| 27 | 0.00 |
| 28 | 0.00 |
| 29 | 0.00 |
| 30 | 0.00 |
| 31 | 0.00 |
| 32 | 0.00 |
| 33 | 0.00 |
| 34 | 0.00 |
| 35 | 0.00 |
| 36 | 0.00 |
| 37 | 0.00 |
| 38 | 0.00 |
| 39 | 0.00 |
| 40 | 0.00 |
| 41 | 0.00 |
| 42 | 0.00 |
| 43 | 0.00 |
| 44 | 0.00 |
| 45 | 0.00 |
| 46 | 0.00 |
| 47 | 0.00 |
| 48 | 0.00 |
| 49 | 0.00 |
| 50 | 0.00 |

## Annual Output

(Time is in years and output is in units)



# *Appendix K*
# *Post-Construction Monitoring Plan*

# APPENDIX K

# POST-CONSTRUCTION MONITORING PLAN

This monitoring plan is developed with the explicit intent to address the monitoring components and measures of success listed below. The project could be deemed a success if at least five of the following benchmarks were achieved:

1. Reduction in the frequency and abundance of nearshore, fast growth nuisance macroalgae (at least a 20 percent [%] reduction in percent cover or 25% reduction in days of occurrence).
2. Decrease in the abundance of seasonal macroalgae in the nearshore and mid-lagoon regions (at least a 20% reduction in percent cover).
3. Decrease in turbidity of nearshore waters, particularly following storm events (at least a 25% reduction in number of violations of Commonwealth of the Northern Marian Islands [CNMI] Division of Environmental Quality [DEQ] water quality standards for turbidity).
4. Decrease in microbial contamination in nearshore waters (at least a 25% reduction in number of violations of DEQ water quality standards for microbial contamination).
5. Decrease in nutrient levels in nearshore waters (at least a 25% reduction in number of violations of DEQ water quality standards for nutrients).
6. Decrease in contaminant (i.e., turbidity, microbial, and nutrient) concentrations in stormwater exiting the detention basins (at least a 25% reduction in number of violations of DEQ water quality standards for turbidity, microbial contamination, and nutrients).
7. Decrease in sediment load entering the Saipan Lagoon at mitigated drainages (at least a 10% reduction in sediment delta area).

Achievement of the first two benchmarks is less certain than the remaining five benchmarks because factors that are not directly linked to the proposed detention basins such as groundwater or other drainages may also affect the outcomes. The last five benchmarks are directly linked to the proposed detention basins and should be achieved by the project.

Site selection recommendations are based on an assumption of prevailing southerly, coast parallel current flows as provided by a three-dimensional current model created by the Secretariat of the Pacific Community (SPC) Applied Geoscience and Technology Division (SOPAC) (Damlamian and Kruger, 2010). Although current reversal is possible, dominant flow patterns suggest that the effects of discharge from restoration activities would be to the south and control sites would appropriately be located north of the mitigated drainage discharge. This plan further assumes that monitoring activities begin prior to construction and continue through five years post-construction. The following protocol provides direction on methods, site selection, frequency of sampling, and the benchmarks addressed by each component.

## I. PRESENCE AND ABUNDANCE OF NEARSHORE NUISANCE MACROAGLAE

**Methods:** Two primary 'nuisance' algae are found along the shoreline in Saipan Lagoon: hair-like green algae, primarily growing during periods of increased freshwater input into the lagoon, and a wide variety of seasonal macroalgae. Both are addressed here. A permanent sampling area of 3 meters (m) by 50 m should be set up for each sampling series. A 0.5 m by 0.5 m quadrant will be haphazardly tossed inside the sampling area 25 times, moving away from the starting station. A series of tosses will be thrown on the beach and a second series of tosses thrown in the water just adjacent to the shore (Habitat 10). For each toss, the quadrant will be scored for the presence or absence of either the hairlike, green "Enteromorpha-form" algae, other seasonal macroalgae, or both.

**Site Selection:** One site, starting 30 m south of the mitigation drainage and continuing south, and a second control site, starting 30 m north of the mitigation drainage and continuing north.

**Frequency of sampling:** Weekly

**Benchmark addressed and Criterion for Success:** 1

1. Reduction in the frequency and abundance of nearshore, fast growth nuisance macroalgae (at least a 20% reduction in percent cover or 25% reduction in days of occurrence).

## II. REASSESSMENT OF THE INSHORE LAGOON AREA

**Methods:** This survey provides an evaluation of the dominant benthic cover, including seasonal macroalgae. Each survey site will be made up of five 50 m transects with each transect separated by 3 m gaps. These methods are based on standard protocols used by the CNMI Marine Monitoring Team (MMT) (Starmer and Houk, 2008).

A 0.5 m by 0.5 m quadrant with a six-point grid will be placed at 1 m intervals along the 50 m transects. Surveyors will score benthic substrate under each point. Averages, variances, and statistical power will be calculated based on the 50 m replicates. The benthic categories used for analysis will include corals (to genus level), turf algae (less than 2 centimeters [cm]), macroalgae (greater than 2 cm, genus level if abundant), coralline algae, branching coralline algae, invertebrates with more than 10% benthic coverage (grouped by genus), all other are invertebrates grouped together, and sand/bare substrate.

**Site Selection:** Sites should be located 100 m south (test) and north (control) in the middle portions (heading offshore) of Habitats 12, 14, and 16.

**Frequency of sampling:** Sampling frequency should be two times a year, in June and December. These dates coincide with the times of greatest and least abundance of seasonal macroalgae in the lagoon (Houk and Camacho, 2010).

**Benchmarks addressed and Criteria for Success:** 1 and 2

1. Reduction in the frequency and abundance of nearshore, fast growth nuisance macroalgae (at least a 20% reduction in percent cover or 25% reduction in days of occurrence).

2. Decrease in the abundance of seasonal macroalgae in the nearshore and mid-lagoon regions (at least a 20% reduction in percent cover).

## III. NEARSHORE LAGOON WATER SAMPLING AND RAINFALL DATA

**Methods:** The DEQ has an ongoing United States Environmental Protection Agency (EPA) approved nearshore water quality monitoring program that evaluates basic water quality parameters (salinity, dissolved oxygen [DO], temperature, hydrogen activity [pH], turbidity, and enterococci bacteria) on a weekly basis (Bearden et al., 2012). The DEQ lab is equipped to include orthophosphate and nitrate to this suite of parameters. The recommendation here is to utilize the existing program methodology with the addition of nutrients. Because of the potential of reversed nearshore currents affecting the results, a note regarding prevailing current at the time of sampling should be added.

**Site Selection:** If necessary, add a new test site 30 m southward of the mitigated drainage and use an existing, equivalently distanced DEQ site or create a novel site north of the drainage, as a control. At least one data logging rain gauge should be located in the watershed above and drain into the constructed mitigation measures.

**Frequency of sampling:** Parameters that are part of the current DEQ protocol should be measured weekly. Ideally, nutrients will be included in this, but if they are a novel monitoring parameter, a minimally monthly sampling frequency is recommended. The rain gauge should be set to log hourly rainfall. The data should be downloaded and the gauge maintained at least monthly.

**Benchmarks addressed and Criteria for Success:** 3, 4, and 5

3. Decrease in turbidity of nearshore waters, particularly following storm events (at least a 25% reduction in number of violations of CNMI water quality criteria for Class AA marine waters for turbidity).
4. Decrease in microbial contamination in nearshore waters (at least a 25% reduction in number of violations of CNMI water quality criteria for Class AA marine waters for microbial contamination).
5. Decrease in nutrient levels in nearshore waters (at least a 25% reduction in number of violations of CNMI water quality criteria for Class AA marine waters for nutrients).

## IV. STORMWATER SAMPLING

**Methods:** The methods used for nearshore water sampling above may be applied to this monitoring effort and, again, nutrient sampling should be included. In addition, an effort should be made to capture the “first flow” of any given rainfall event and a second sample taken 15 minutes following the first sample. Sampling efforts for rainfall events that do not produce sufficient flow to allow sampling should still be noted.

**Site Selection:** A sampling site should be established at the inflow and at the discharge of each constructed detention basin.

**Frequency of sampling:** Frequency of stormwater sampling will be sporadic and dependent on storm/rainfall events. Given the uncertainty of any given rainfall event producing sufficient flow, effort should be made to capture all storm events possible, with a minimal number of 15 events over the course of the year.

**Benchmark addressed and Criterion for Success:** 6

6. Decrease in contaminant (i.e., turbidity, microbial, and nutrient) concentrations in stormwater exiting the detention basins (at least a 25% reduction in number of violations of CNMI water quality criteria for Class AA marine waters for turbidity, microbial contamination, and nutrients).

## V. RESURVEY OF SEDIMENT DELTAS

**Methods:** The sediment deltas in Saipan Lagoon are formed by sediment build up originating from the drainage watershed. They are the areas where the shoreline deviates away seaward, compared to the prevailing coastline in front of the drainage. A transect line laid parallel to the shoreline along the beach moat and across the delta can be used to define the landward extent of the delta. Once this is done, the seaward extent of the delta can be measured at 1 m intervals to define the outer perimeter of the delta and calculate the delta's area.

**Site Selection:** Drains 4, 6, and 11

**Frequency of sampling:** Annually

**Benchmark addressed and Criterion for Success:** 7

7. Decrease in sediment load entering the Saipan Lagoon at mitigated drainages (at least a 10% reduction in sediment delta area).

## VI. RISKS AND ADAPTIVE MANAGEMENT

The results from this monitoring plan will be continuously assessed to closely monitor and evaluate the effectiveness of the project. Since the project goal is to restore a diverse natural system in which unpredicted events may occur during the course of the monitoring period or unknown/unpredicted factors may influence the outcome of the project, it is prudent to allow for adaptive management to be implemented if it becomes necessary. For example, if a large storm event takes place during construction of the project, it may be necessary to reevaluate the baseline conditions or to adjust the monitoring parameters and benchmark goals. If, in the event the project benchmarks are not reached at the end of the monitoring period, extensive post-construction may be warranted. New knowledge, inventories, research, and technologies, as it becomes available, will be considered during the process of adaptive management to best manage and evaluate the outcome of the project.

## REFERENCES

Bearden, C., D. Chambers, and R. Okano, 2012. May 2012 Draft Commonwealth of the Northern Mariana Islands Integrated 305(b) and 303(d) Water Quality Assessment Report. Saipan, Division of Environmental Quality. 115pp.

Damlamian, H. and J. Kruger, 2010. Three dimensional wave-current hydrodynamic model for the management of Saipan Lagoon, Saipan , Commonwealth of the Northern Mariana Islands. Suva, SOPAC 73pp.

Houk, P. and R. Camacho, 2010. Dynamics of seagrass and macroalgal assemblages in Saipan Lagoon, Western Pacific Ocean: disturbances, pollution, and seasonal cycles. Botanica Marina 53: 205-212.

Starmer, J. and P. Houk, 2008. Marine and Water Quality Monitoring Plan for the Commonwealth of the Northern Mariana Islands. Division of Environmental Quality and Coastal Resources Management Office, Saipan, CNMI. 37 pp.

# *Appendix L*
# *Non-Federal Coordination*

# *Appendix M*
# *DQC/ATR Certifications*

# STATEMENT OF TECHNICAL REVIEW

## COMPLETION OF DISTRICT QUALITY CONTROL/QUALITY ASSURANCE

The District has completed the Saipan Lagoon Aquatic Ecosystem Restoration Study, Island of Saipan, Commonwealth of the Northern Mariana Islands. Notice is hereby given that District Quality Control/Quality Assurance (DQC) has been conducted. During the DQC, compliance with established policy principles and procedures, utilizing justified and valid assumptions, was verified. This included review of: assumptions, methods, procedures, and material used in analyses, alternatives evaluated, the appropriateness of data used and level obtained, and reasonableness of the result, including whether the product meets the customer's needs consistent with law and existing Corps policy. All comments resulting from DQC have been resolved.

Prepared by:

5/10/13

Milton T. Yoshimoto — Date
Project Manager/CEPOH-PP-C

Approved by:

5/10/13

Michael F. Wong — Date
Chief, Civil Works Technical Branch

Review Team:

H&H/Design

for James Pennaz
SDD Quality Manager
CEPOH-EC

10 MAY 13
Date

Cost Estimating

Tracy Y. Kazunaga
Cost Estimating Branch
CEPOH-EC-S

10 May 13
Date

Real Estate

Stephen Cayetano
Chief, Real Estate Branch
CEPOH-PP-R

9 May 13
Date

Environmental

Dan A. Nakamura
Chief, Environmental Programs Branch
CEPOH-PP-E

10 May 13
Date

**Project Title: Saipan Lagoon Aquatic Ecosystem Restoration Study**
**Document: Draft Ecosystem Restoration Report/Environmental Assessment, Dated 10 Mat 2013**
**Review: District Quality Control Review**

| Comment No | Page Number | Line Figure, or Table No. | Reviewer | Comment | Response | Status |
|---|---|---|---|---|---|---|
| Env-1 (EA) | i-iii | | D. Nakamura | Check line spacing between topics for uniformity | Concur. Line spacing will be checked and revised for uniformity. | Closed |
| Env-2 (EA) | ES | General | D. Nakamura | Should include the section of WRDA that authorizes this project in the ES | Concur-The ES will be revised to specify that this project is a Continuing Authorities Program (CAP) section 206-Aquatic Ecosystem Restoration of WRDA. | Closed |
| Env-3 (EA) | v | 29 | D. Nakamura | Need to mention that the short-term impacts would be mitigated to less than significant | Concur. Line 29 will be revised to read:" Project related construction may result in significant short-term environment impacts which could be mitigated to less than significant." | Closed |
| Env-4 (EA) | 1 | 19 | D. Nakamura | See comment 2 | Concur-Line 19 will be revised to specify that this project is authorized under Continuing Authorities Program (CAP) section 206-Aquatic Ecosystem Restoration of WRDA. | Closed |
| Env-5 (EA) | 2 | 18 | D. Nakamura | Delete (adverse and beneficial) | Concur. | Closed |
| Env-6 (EA) | 17 | 14 | D. Nakamura | Add "Environmentally" to title | Concur. | Closed |
| Env-7 (EA) | 18 | 16 | D. Nakamura | The No Action also serves as the baseline for comparative analysis of impacts. This should be added. | Concur. | Closed |
| Env-8 (EA) | 23 | 18 | D. Nakamura | Place cumulative impacts after indirect impacts | Concur. Will include discussion on "Cumulative Impacts" after "Indirect Impacts". | Closed |
| Env-9 (EA) | 27 | 36 | D. Nakamura | Mention erosion control BMPs as mitigation | Concur. BMP relating to soil erosion controls will be added to section 3.1.2. | Closed |
| Env-10 (EA) | 38 | 4 | D. Nakamura | Under FWCA, the proponent is to give natural resources equal consideration not strong consideration to the views of FWS, etc. | Concur. Section 3.7-*Biological Resources* will be revised to include clearer definition of FWCA, and will be moved to section 4.6 Fish and Wildlife Coordination Act. | Closed |
| Env-11 (EA) | 39 | 28 | D. Nakamura | Section 7 doesn't call for evaluation of impacts but consultation to determine effects of an action on T&E species and critical habitats. | Concur. Discussion of Section 7 ESA will be revised to include the comment, and will be moved to section 4.5 Endangered Species Act. | Closed |
| Env-12 (EA) | 41 | 18 | D. Nakamura | Section 106 consultation also involves cultural and archaeological resources not just historic properties | Concur. Discussion of Section 106 NHPA will be revised to include the comment, and will be moved to section 4.11 Section 106 NHPA. | Closed |
| Env-13 (ERR) | 49 | 32 | D. Nakamura | If the restoration outcomes are dependent upon implementation of LUCs/BMPs by the local sponsor, then how are restoration outcomes attributed to the project alone. If this is not the case, then suggest changing "also depend on" to "will be augmented by". | Concur. Page 51, line 16: "It is also important to note that success of the detention basins also depends on local implementation of land use controls and other BMPs for contaminant reduction in the West Takpochao watershed." has been revised to read:<br>"It is also important to note that success of the detention basins will be augmented by local implementation of land use controls and other BMPs for contaminant reduction in the West Takpochao watershed." | Closed |

| | | | | | | |
|---|---|---|---|---|---|---|
| Env-14 (ERR) | 50/51 | | D. Nakamura | For, the LGHU calculation, please explain why identification of PCAs in Appendix B.5 included nutrient and sediment PCAs but the calculation of nutrient runoff is not considered and the sediment portion of the calculation is based on a Google Earth approximation and not on the identified sediment PCAs. This should be explained here. | sedimentation PCAs. Becuase of the limited number of nutrient PCAs identified, they were not included in the LGHU calculation considering that they would have a negligent effect on the outcome. The sediment portion of the LGHU calculation was based on Google Earth to include unvegetated/bare land in the upper watershed within the study area that were not necessarily counted as PCAs, considering that these areas would contribute a majority of sediments that is washed into the lagoon. The following explanation has been added in Page 57, line 25:<br>"In addition to the runoff and hazardous waste PCAs, the PCA inventory identified several sedimentation and nutrient PCAs within the study area (Appendix B.5). Because of the limited number of nutrient PCAs that were identified within the study area, the calculation of nutrient runoff was not considered in the LGHU calculation. The small number of nutrient PCAs was considered to have a negligent impact on the outcome. The sedimentation factor calculation was based on Google Earth and not on the number of sedimentation PCAs to include unvegetated/bare land in the upper watershed within the study area that were not identified during the PCA inventory. This method was considered to result in a more accurate estimate of sedimentation that occurs within the study area." | Closed |
| Env-15 (ERR) | 60 | 6 | D. Nakamura | Change bullet to read, "remove accumulated sediment from the basin bottom to maintain designed capacity" | Page 49, Section 5.6, bullet items have been revised as follows:<br>"The following maintenance activities should be conducted on an annual basis before the rainy season:<br>• cutting of grass and weed removal in and around the basin and within the outlet swales;<br>• removal of accumulated sediment from the basin bottom to maintain designed capacity; and<br>• clearing of the basin inlet of debris, leafs, and any sediment." | Closed |
| Env-16 (ERR) | General | | D. Nakamura | Should the FEA/FONSI be an appendix to the ERR? | Concur. The EA has been included as an appendix to the ERR. | Closed |
| H&H/Design-1 | General Comment | Appendix A | Jim Pennaz | The loss rate such as infiltration, evaporation, transpiration, etc from storms is very high, sometimes exceeding 95% of rainfall. Please provide justification for this high loss rate. | Response provided by separate attachment. Reviewer concurred. No report revision required. | Closed |
| CE-1 | | MII Estimate | T. Kazunaga | Verify Sales Tax Rate, Electricity, gas, & fuel rates. | Complied. | Closed |
| CE-2 | | MII Estimate | T. Kazunaga | 18” RCP: Missing cost for bedding? | In Estimate. | Closed |
| CE-3 | | MII Estimate | T. Kazunaga | Dewatering cost line item may not be appropriate. Should use a dewatering pump, laborer & diesel generator. Also, did you consider where the water is going to be disposed of? | Complied. | Closed |
| CE-4 | | MII Estimate | T. Kazunaga | Appears to not include any disposal cost or assumption where the excavated, cleared & grubbed material will be taken. | No disposal necessary on TSP. | Closed |
| CE-5 | | MII Estimate | T. Kazunaga | Is the assumption the prime will do all the work with no subcontractors? | Yes. | Closed |
| CE-6 | | MII Estimate | T. Kazunaga | Where is the assumption the prime will be from? | Saipan. | Closed |
| CE-7 | | MII Estimate | T. Kazunaga | Estimate does not appear to include cost for any permits or BMPs. | Overhead Item. | Closed |
| CE-8 | | MII Estimate | T. Kazunaga | Estimate does not appear to include mob/demob. | Complied. | Closed |

| | | | | | | |
|---|---|---|---|---|---|---|
| CE-9 | | MII Estimate | T. Kazunaga | Verify if any testing (such as water quality) will be required during construction | Overhead Item. | Closed |
| CE-10 | | MII Estimate | T. Kazunaga | Verify Prime Contractor Markup of 4.71% Excise Tax. | Complied. | Closed |
| CE-11 | | MII Estimate | T. Kazunaga | Please include Gov't Field office in the JOOH. | Complied. | Closed |
| CE-12 | | CPM | T. Kazunaga | Submittals: Generally, FSRO requires at least 4 months submittal period. Please revise | Total of 4 months included. | Closed |
| CE-13 | | CPM | T. Kazunaga | Does the schedule consider any rain delays? | Added. | Closed |
| CE-14 | | CPM | T. Kazunaga | Please indicate how the midpoint of construction for escalation was calculated. | Changed. | Closed |
| CE-15 | | CPM | T. Kazunaga | Please indicate when the PPA, real estate acquisition, will be obtained. | Complied. | Closed |
| CE-16 | | TPCS | T. Kazunaga | Verify if EPL is 1 Oct 2015 or Oct 2012. | Oct 2012 | Closed |
| CE-17 | | TPCS | T. Kazunaga | TPCS does not include any escalation. | Complied. | Closed |
| CE-18 | | TPCS | T. Kazunaga | How was 30% Contingency optained for Real Estate? It is not on the CSRA. | Used it from a previous project, will change. | Closed |
| CE-19 | | TPCS | T. Kazunaga | Cont. for PED & CM does not match CSRA. | Changed. | Closed |
| RE-1 | 5 | Line 5 | McDonald | Will the COE RE ID the owners and by what means | No, the local sponsor will identify the owners and acquire the lands | Closed |
| RE-2 | 5 | Line 28 | McDonald | No cost est. for demolishing of min. func. BLDG | The local sponsor is responsible for the acquisition of lands and buildings | Closed |
| RE-3 | 5 | Line 47 | McDonald | Who will conduct the tile search and is the est. cost included | The local sponsor will conduct the title search and costs of that effort. | Closed |
| RE-4 | 10 | Line 31 | McDonald | Who or what is "fully capable" finding based on | An assessment of the sponsor's acquisition capabilities to acquire the land necessary for this project has not been done. However, CNMI is considered fully capable | Closed |