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SUBJECT: DRAFT 2006 ANNUAL REPORT SITE 1 LANDFILL, FORMER NAVAL AIR STATION MOFFETT FIELD, MOFFETT FIELD, CALIFORNIA, MAY 2007

Dear Ms. Wells and Ms. Lee:

The Draft 2006 Annual Report Site 1 Landfill is enclosed for your review. This document summarizes the Site 1 monitoring and maintenance activities for 2006. Please submit comments, if any, or concurrence by June 25, 2007.

Should you have questions or need additional information, please contact Mr. Wilson Doctor, Remedial Project Manager, at (619) 532-0928 or me at (619) 532-0963.

Sincerely,

[Signature]

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BRAC Environmental Coordinator
By direction of the Director

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DRAFT 2006 ANNUAL REPORT
SITE 1 LANDFILL

Former Naval Air Station Moffett Field
Moffett Field, California

ENVIRONMENTAL MULTIPLE AWARD CONTRACT (EMAC)
Contract Number N68711-01-D-6005
Contract Task Order 0004

Prepared for:

Base Realignment and Closure
Program Management Office West
1455 Frazee Road, Suite 900
San Diego, California 92108-4310

Prepared by:

T N & Associates, Inc.
3150 Hilltop Mall Road #55
Richmond, CA 94806

May 2007
DRAFT 2006 ANNUAL REPORT
SITE 1 LANDFILL
Former Naval Air Station Moffett Field
Moffett Field, California

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Program Management Office West
1455 Frazee Road, Suite 900
San Diego, California 92108-4310

REVIEW AND APPROVAL:

TN&A Project Manager: Suman Sharma, M.Sc., M.Phil. Date: May 22, 2007

TN&A Senior Manager: William Schaal, PMP, RG #5791 Date: May 22, 2007

T N & Associates, Inc.
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EXECUTIVE SUMMARY

This document summarizes the 2006 monitoring and maintenance activities performed at the Site 1 Landfill and provides an evaluation of the post-closure groundwater and methane monitoring data collected at the Site 1 Landfill in 2006. The content of this report meets the requirements of the Moffett Federal Airfield Final Operable Unit 1 Record of Decision, (Navy, 1997) and the Title 27 California Code of Regulations, Subchapter 3. The Site 1 Landfill is located at the northern end of the former Naval Air Station Moffett Field near Mountain View, California.

Depth to groundwater measurements, groundwater sampling, and methane monitoring were performed at the Site 1 Landfill semiannually according to the Final Site 1 Landfill Post-Closure Long-Term Monitoring Plan, (Tetra Tech FW, Inc. [TtFW], 2005a) and Addendum 1 Final Sampling and Analysis Plan, (SAP) (T N & Associates, Inc., [TN&A], April 2006). The semiannual monitoring sampling events were completed in April and October 2006. Groundwater samples were collected from nine monitoring wells and from collection trench wells W1-22 and W1-23. The analytical monitoring parameters (MPs) include selected metals, volatile organic compounds (VOCs), pesticides, and semivolatile organic compounds (SVOCs).

Depth to groundwater measurements were made at twelve monitoring wells, two piezometers, and two collection trench wells at the Site 1 Landfill on April 25, 2006, and October 16, 2006. The groundwater elevations were similar to previous years. The groundwater flows from north to south at the Site 1 Landfill. A seasonal fluctuation was observed in groundwater levels in the monitoring wells. Most monitoring wells had seasonal high water levels in April 2006 and seasonal low water levels in October 2006. The seasonal water level fluctuation is approximately 1 foot. Some monitoring wells showed a slight upward or downward long-term water trend, while a flat long-term groundwater level trend was observed in the remaining monitoring wells.

MP analytical results of 2006 groundwater sampling at Site 1 were evaluated according to the procedures provided in the Final Technical Memorandum, Site 1 Groundwater Evaluation Process (Tech Memo), (TIFW, 2004). The Tech Memo provides calculated concentration limits (CCLs) for the MPs that are based on ecological screening criteria and site-specific attenuation factors for the groundwater. These CCLs are used as initial screening criteria in the groundwater evaluation.

During 2006, no reported VOC, SVOC, or pesticide MP concentrations were greater than the applicable CCLs. Barium concentrations were greater than the applicable CCL in samples from every monitoring well during the April 2006 sampling event, with the exception of W1-19, and in every monitoring well in the October 2006 sampling event. Copper was also reported at concentrations greater than the applicable CCL in samples from monitoring wells W1-19 and W1-1R during the April 2006 sampling event and in the sample from monitoring well W1-23 during the October 2006 sampling event. It is unlikely there has been any release from the landfill, however, because the exceedances of both constituents were less than historical background levels.
As part of landfill monitoring activities, methane measurements were taken at 19 passive gas vent wells within the Site 1 Landfill and 4 landfill gas monitoring wells (LGMWs) on the landfill perimeter. Surface methane monitoring was also performed at 21 surface locations along the perimeter of the site at 150-foot intervals. The percentages of methane gas concentrations measured within the landfill are lower in October 2006 than in April 2006 and are similar to historical concentrations. Methane was not measured above the Title 27 concentration limit of 5 percent by volume at LGMWs or at surface locations along the perimeter of the site in April or October 2006. All readings were zero percent by volume at these locations.

Maintenance activities were performed at the Site 1 Landfill during 2006 according to Final Site 1 Landfill Post-Closure Long-Term Maintenance Plan, (TtFW, 2005b). These activities included inspection and repair, as required, of the landfill cover (including cutting grass and weeds); raptor perches; landfill gas vents and monitoring wells; groundwater monitoring wells; piezometers; collection trench wells; and stormwater runoff controls. The Santa Clara County Department of Environmental Health (DEH) inspected Site 1 quarterly in 2006. Evidence of rodent activity was noted during DEH inspections in February and August. This problem was mitigated by backfilling rodent holes prior to the November DEH inspection. No other problems or deficiencies were noted.
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### ABBREVIATIONS AND ACRONYMS

<table>
<thead>
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<tr>
<td>μg/L</td>
<td>micrograms per liter</td>
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<td>μmhos/cm</td>
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<td>degrees Celsius</td>
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<td>CCR</td>
<td>California Code of Regulations</td>
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<td>chemical of concern</td>
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<tr>
<td>DEH</td>
<td>Santa Clara County Department of Environmental Health</td>
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<tr>
<td>DO</td>
<td>dissolved oxygen</td>
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<td>Department of Defense</td>
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<td>DON</td>
<td>Department of the Navy</td>
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<td>DUP</td>
<td>duplicate sample</td>
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<td>EPA</td>
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<td>ft</td>
<td>feet</td>
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<td>ft/ft</td>
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<td>NGVD</td>
<td>National Geodetic Vertical Datum</td>
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<tr>
<td>NTU</td>
<td>nephelometric turbidity unit</td>
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<tr>
<td>ORP</td>
<td>oxidation-reduction potential</td>
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<tr>
<td>OU1</td>
<td>Operable Unit 1</td>
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<td>pH</td>
<td>hydrogen ion concentration</td>
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<td>ROD</td>
<td>Record of Decision</td>
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<td>SAP</td>
<td>Sampling and Analysis Plan</td>
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<td>SQL</td>
<td>sample quantitation limit</td>
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<td>Abbreviation</td>
<td>Definition</td>
</tr>
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<td>--------------</td>
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<td>SVOC</td>
<td>Semivolatile organic compound</td>
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<td>United States Fish and Wildlife Service</td>
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1.0 INTRODUCTION

This document summarizes the 2006 monitoring and maintenance activities performed at the Site 1 Landfill and provides an evaluation of the post-closure groundwater and methane monitoring data collected at the Site 1 Landfill in 2006. The content of this report meets the requirements of the Moffett Federal Airfield Final Operable Unit 1 (OU1) Record of Decision (ROD), (Navy, 1997) and Title 27 California Code of Regulations (CCR), Subchapter 3. The Site 1 Landfill is located at the northern end of the former Naval Air Station (NAS) Moffett Field (Moffett) near Mountain View, California (Figures 1-1 and 1-2). This report was prepared on behalf of the Department of the Navy (DON), Base Realignment and Closure (BRAC) Program Management Office West. This work was performed under Contract Task Order Number 0004, issued under Remedial Action Contract No. N68711-01-D-6005.

The purpose of this Annual Report is to present the results of groundwater and methane monitoring performed in 2006. It also includes a description of maintenance performed at the Site 1 Landfill during 2006. Appendices A through G include general site and county landfill inspection reports; groundwater gradient calculation sheets and groundwater hydrographs; field sampling data; analytical summary and statistical evaluation tables; analytical data validation packages; groundwater monitoring point data graphs; and methane monitoring data graphs.

1.1 SITE LOCATION

Moffett is located about 1 mile south of the San Francisco Bay in Santa Clara County, California (Figure 1-1). Moffett is bounded by United States Fish and Wildlife Service (USFWS) property to the north; by Stevens Creek to the west; by U.S. Highway 101 to the south; and by Macon Road and E. Patrol Road to the east (Figure 1-2).

The Site 1 Landfill is located in the northernmost portion of Moffett and encompasses approximately 12 acres (Final Site 1 Landfill Post-Closure Long-Term Monitoring Plan (LTMP) (Tetra Tech FW, Inc. [TtFW], 2005a). The Site 1 Landfill (historically referred to as the Runway Landfill) lies at the north end of the runways between North Perimeter Road, the USFWS property, and the Stormwater Retention Basin (Figure 1-2).

1.2 2006 MONITORING AND MAINTENANCE ACTIVITIES

Monitoring activities performed in 2006 at Site 1 included depth to groundwater measurements, groundwater sampling, and methane monitoring. Groundwater monitoring at Site 1 was performed semiannually during 2006 according to the Addendum 1 Final Sampling and Analysis Plan (SAP) (T N & Associates, Inc. [TN&A], April 2006) and LTMP (TtFW, 2005a). The groundwater evaluation process was performed according to the Technical Memorandum, Site 1 Groundwater Evaluation Process (Tech Memo) (TtFW, 2004). Maintenance activities in 2006 at Site 1 were performed according to the Final Site 1 Landfill Post-Closure Long-Term Maintenance Plan (Maintenance Plan) (TtFW, 2005b).

As approved by the regulatory agencies, the sampling frequency and analyses were performed according to the Tech Memo and the LTMP. Groundwater samples were collected semiannually and analyzed for the Site 1 monitoring parameters (MPs). Methane monitoring was performed according to Section 4 of the LTMP (TtFW, 2005a).

Depth to groundwater measurements, groundwater sampling, and methane monitoring were performed at the Site 1 Landfill in April and October 2006. Groundwater samples were collected
from nine monitoring wells and two collection trench wells. Table 1-1 provides well construction information for Site 1 monitoring wells. The analytical MPs include selected metals, volatile organic compounds (VOCs), pesticides, and semivolatile organic compounds (SVOCs).

Maintenance activities were performed at the Site 1 Landfill during 2006 according to the Maintenance Plan. These activities included inspection and repair, as required, of the landfill cover (including cutting grass and weeds); raptor perches; landfill gas vents and monitoring wells; groundwater monitoring wells; piezometers; collection trench wells; and stormwater runoff controls. Site 1 inspections were performed in February, April, July, and October 2006. Inspection checklists and maintenance activities are provided in Appendix A.

The Santa Clara County Department of Environmental Health (DEH) also inspected the Site 1 Landfill quarterly in February, May, August, and November 2006. Evidence of rodent activity was noted during DEH inspections in February and August. This problem was mitigated by backfilling rodent holes prior to the November DEH inspection. No other problems or deficiencies were noted. The DEH inspection reports are provided in Appendix A.

1.3 BASIS OF DATA EVALUATION

Remedial activities at Moffett are performed as part of the Installation Restoration Program (IRP) established by the United States Department of Defense (DOD) to identify, evaluate, and control the spread of contaminants from historical hazardous waste sites. The Site 1 Landfill is in OU1. The content of this report meets the requirements stated in the ROD (Navy, 1997) for OU1 and Title 27 CCR, Subchapter 3.

The ROD (Navy, 1997) for OU1 summarizes site characteristics and risks; describes and evaluates the remedial alternatives; identifies the selected remedy; and identifies statutory determinations (including compliance with applicable or relevant and appropriate requirements). The major elements of the selected remedy for the Site 1 Landfill are a landfill cap; landfill gas venting trench; subsurface collection trench; groundwater and methane monitoring; institutional controls; and post-closure maintenance. Remedial actions were completed in November 1998 and monitoring of methane and groundwater began in 1999.

The evaluation of Site 1 groundwater analytical results presented in this report was performed according to the Tech Memo (TtFW, 2004). The Tech Memo documents the groundwater detection monitoring program MPs and calculated concentration limits (CCLs) and describes the statistical evaluation process for the Site 1 Landfill post-closure monitoring. The MPs are a set of parameters that provide a reliable indication of a contaminant release from a landfill. The MPs include physical and analytical parameters that are a subset of the chemicals of concern (COCs). Sampling of groundwater for the complete list of COCs, as specified in the Tech Memo (TtFW, 2004), was conducted in May and November 2004 per the LTMP (TtFW, 2005a). Semiannual groundwater monitoring has been performed at the Installation Restoration (IR) Site 1 since April 2005. Following two years of semiannual monitoring, trend analysis of the entire data set, as required, will be evaluated to optimize the monitoring frequency according to the Navy’s optimization policy (Navy, 2004) and the Guide to Optimal Groundwater Monitoring (Navy, 2000). Results will be used to decide whether to continue semiannual monitoring or to reduce the monitoring frequency to annual. Groundwater sampling for the complete list of COCs will be performed every five years (from the year of previous COC sampling event). The CCLs were developed based on ecological screening criteria and site-specific attenuation factors for the groundwater. These CCLs are used as initial screening criteria in the groundwater evaluation. If analytical results are less than the CCLs, then no release from the
landfill is presumed and no additional evaluation is required. If CCLs are exceeded, then additional evaluation of upgradient (background) and downgradient data is necessary to determine whether there has been a release from the landfill.

1.4 REPORT ORGANIZATION
This report is divided into the following sections.

- **Section 1.0: Introduction** provides the site location; monitoring and maintenance activities; the basis of the data evaluation; and the report organization.

- **Section 2.0: Groundwater Hydraulics** provides the Site 1 groundwater gradient, flow direction, and water level trends.

- **Section 3.0: Groundwater Sampling** summarizes the Site 1 groundwater analytical data and presents the results of the evaluation of the groundwater data.

- **Section 4.0: Methane Monitoring** summarizes the Site 1 methane monitoring data in the landfill gas monitoring wells, the landfill gas vents, and the perimeter gas monitoring points.

- **Section 5.0: Conclusions** provides the conclusions and recommendations.

- **Section 6.0: References** provides the references for this report.

- **Tables and figures** are incorporated into the text.

- **Appendix A** provides the 2006 general site inspection reports and the 2006 Santa Clara County landfill inspection reports.

- **Appendix B** provides groundwater gradient calculation sheets and groundwater hydrographs.

- **Appendix C** provides field sample data (CD-ROM).

- **Appendix D** contains a summary of the analytical tables and statistical evaluation tables.

- **Appendix E** provides analytical data validation packages (CD-ROM).

- **Appendix F** provides groundwater monitoring point data graphs.

- **Appendix G** provides methane monitoring data graphs.
2.0 GROUNDWATER HYDRAULICS

This section describes the Site 1 hydrogeology groundwater gradient, flow direction, and water level trends.

2.1 HYDROGEOLOGY

The stratigraphy of the Site 1 Landfill is a complex interfingering of fine-grained units representing the boundary between alluvial and estuarine environments and fluctuations of the boundary caused by changes in sea level (TtFW, 2005a). Lithologic logs from shallow well borings indicate that the uppermost materials (zero to 60 feet below ground surface) are comprised of silts to silty clays, which are brown to black and moderately plastic in nature. Intermittent throughout the upper 60 feet are interfingered silty sands and clayey gravels, which are medium gray to black or brown. These materials are present as lenses or stringers and are not laterally or vertically continuous throughout the site.

Most of the groundwater elevations in the Site 1 Landfill groundwater monitoring wells are below mean sea level (msl). The vadose zone (subsurface between the saturated zone and the land surface) consists of imported fill material and clayey soils. Shallow subsurface soil samples collected from within the Site 1 Landfill and adjacent area at depths between landfill cover and above the permeable lenses within the upper portion of the shallow aquifer were tested for porosity and permeability. Test results indicate that soils below the landfill and above the shallow aquifer are generally clays having hydraulic conductivity values in the 10^-8 centimeters-per-second range (TtFW, 2005a).

Groundwater in the upper portion of the shallow aquifer beneath the landfill generally flows north to south (TtFW, 2004). The regional groundwater flow direction is south to north toward San Francisco Bay. The southward gradient underlying the Site 1 Landfill is opposite from the regional gradient due to active pumping of the Moffett storm drainage system (TtFW, 2005a). Pumping occurs at Building 191 located south of the Site 1 Landfill (Figure 1-2). Building 191 began operating in the early 1950s. It consists of a subsurface concrete-lined vault equipped with a passive pump and receives water from nearby ditches and a French drain system underneath the runways (Tetra Tech EM, Inc. [TtEMI], 2000). The pump station influences local groundwater gradients and reverses the local natural groundwater flow direction because the drainage system that feeds the pump station is below the water table in some areas.

Three surface water bodies are proximal to the Site 1 Landfill: 1) the man-made ephemeral Stormwater Retention Basin to the north, 2) former Jagel Slough to the southeast, and 3) United States Fish and Wildlife Service property to the east (Figure 2-1). It appears that low-permeability barriers exist between the water bodies and the Site 1 Landfill, limiting subsurface water movement (Navy, 1997). As a result, head differences are maintained between each water body (International Technology Corporation, 1993). Potential for flow from the landfill to the other bodies exists, but these restrictive barriers impede flow. Low-hydraulic conductivity, high-organic contents associated with the clays, and low-contaminant source concentrations combine to restrict flow and limit potential contaminant migration (Navy, 1997).

2.2 GROUNDWATER GRADIENT AND FLOW DIRECTION

This section describes the collection of 2006 water level measurements and summarizes groundwater flow direction beneath the Site 1 Landfill. Field activities performed at the Site 1 Landfill in 2006 include two water level gauging events involving monitoring wells, piezometers,
and collection trench wells (Table 2-1). Figure 2-1 shows the locations for the Site 1 water level measurements.

Depth to groundwater measurements were collected from twelve monitoring wells, two piezometers, and two collection trench wells at the Site 1 Landfill on April 25, 2006, and October 16, 2006. Depth to groundwater measurements were made using an electronic measuring tape having markings every hundredth of a foot. All water levels were measured within a 24-hour period. Measurements were subtracted from surveyed measuring point elevations to calculate the groundwater level elevations.

Groundwater elevations were similar to previous years. Determined groundwater elevations for all Site 1 Landfill groundwater wells were below msl during 2006. The potentiometric surfaces of the upper portion of the shallow aquifer are shown in Figures 2-2 and 2-3. The shallow aquifer is also known as A aquifer. These figures are based on groundwater elevations in monitoring wells having similar construction (i.e., screened in the upper portion of the shallow aquifer). For example, piezometers PZ1-18 and PZ1-21 and groundwater wells W1-6 and W1-7 are screened at greater depths than the other wells. They are not considered in the contouring because they are not representative of the groundwater elevations in the upper portion of the shallow aquifer. In addition, collection trench wells W1-22 and W1-23 are not included because they are screened within the collection trench north of the landfill.

Groundwater flows from north to south at the Site 1 Landfill. The approximate gradient from north to south (W1-5 to W1-1R) is as follows.

- April 2006: 0.0007 feet per foot (ft/ft)
- October 2006: 0.0008 ft/ft

The hydraulic gradient is calculated as \( hL / L \), where \( hL \) is the head loss between two monitoring wells and \( L \) is the horizontal distance between them (Basic Groundwater Hydrology, U.S. Geological Survey Water-Supply Paper 2220). Determined gradients are summarized below (Appendix B).

### 2.3 Water Level Trends

Appendix B provides groundwater hydrographs for the 12 monitoring wells at the Site 1 Landfill. Some monitoring wells (W1-1 [replaced in August 2004 by well W1-1R], W1-12R, W1-19, W1-20) show a slight upward long-term water level trend. Monitoring wells (W1-5, W1-8, W1-16, W1-23) show a slight downward long-term water level trend. The remainder of the monitoring wells shows a flat long-term trend. All monitoring wells show a seasonal water level variation: high water level elevations near the end of the precipitation season (March) and a low water level elevation near the end of the dry season (October). During 2006, monitoring wells had seasonal high water levels in March and seasonal low water levels in October. The seasonal water level fluctuation is approximately one foot.
3.0 GROUNDWATER SAMPLING

Groundwater monitoring at Site 1 was performed during 2006 according to the Addendum 1 Final SAP (TN&A, April 2006), LTMP (TtFW, 2005a) and the Tech Memo (TtFW, 2004). Groundwater monitoring was performed semiannually.

Groundwater samples were collected from nine monitoring wells and two collection trench wells. Samples were analyzed for physical and analytical MPs. The physical MPs are temperature, conductivity, dissolved oxygen (DO), oxidation-reduction potential (ORP), hydrogen ion concentration (pH), and turbidity. The analytical MPs selection is based on Title 27 CCR criteria and is described below (TtFW, 2004). Locations for Site 1 groundwater and collection trench sampling are shown in Figure 3-1. Field sampling data sheets for the April and October 2006 groundwater sampling events are included in Appendix C.

No supplemental groundwater sampling events were performed in 2006.

3.1 ANALYTICAL RESULTS

Tables D-1 through D-4 in Appendix D of this document provide the analytical summary tables and statistical evaluation tables for semiannual samples collected in 2006. Appendix E of this document provides the validated analytical data. Analytical testing for 2006 was performed according to the Tech Memo (TtFW, 2004) as described in the following section.

3.1.1 Analytical Testing

Groundwater samples collected in April and October 2006 at the Site 1 Landfill were analyzed for the following analytical MPs.

- VOCs using United States Environmental Protection Agency (EPA) Method 8260B:
  - M,p-xylene
  - Trichloroethene
  - Vinyl chloride

- Pesticides using EPA Method 8081A:
  - Beta-benzene hexachloride
  - Heptachlor

- Dissolved metals using EPA Method 200.8:
  - Arsenic
  - Barium
  - Cobalt
  - Copper

- SVOCs using EPA Method 8270C:
  - 2,4,6-trichlorophenol
  - 2-methylphenol

Thirteen samples, including two duplicate samples, were collected from nine groundwater monitoring wells and two collection trench wells at the Site 1 Landfill for each semiannual sampling event. Analytical results from collection trench well W1-22 are not considered
representative of chemical concentrations for the shallow aquifer because the trench wells were not designed to monitor groundwater. The collection trench wells are screened in a collection trench located on the north side of the landfill. They were installed to protect the adjacent Stormwater Retention Basin. The collection trench wells are shallow and screened in permeable fill material placed in the trench. Due to well construction relative to the collection trench and the shallow aquifer, the collection trench wells are not considered to be useful monitoring points for collecting representative samples of groundwater conditions. The collection trench wells, however, are sampled according to the ROD requirements (Navy, 1997) at the same frequency as the monitoring wells.

3.1.2 Statistical Evaluation

Table 3-1 provides the MPs and the CCLs as detailed in the Tech Memo (TiFW, 2004). CCLs are based on ecological screening criteria and site-specific attenuation factors for groundwater. These CCLs are used as initial screening criteria in the groundwater data evaluation. If analytical results are less than the CCLs, then no additional evaluation is required and the assumption that no release from the landfill occurred is supported. If CCLs are exceeded, then additional evaluation of the upgradient (background) and downgradient data is performed to determine whether there has been a release from the landfill. If upgradient concentrations are higher than downgradient concentrations, then most likely there was no release from the landfill. Conversely, if downgradient concentrations are higher than upgradient concentrations, additional sampling events are performed and results are evaluated to determine whether there has been a release from the landfill. Tables 3-2 and 3-3 provide the analytical MPs detected in groundwater samples from monitoring wells and the collection trench at Site 1 during April and October 2006 sampling events. Tables D-3 and D-4 provide the statistical evaluation summary.

3.1.3 Visual Trends

Appendix F provides groundwater monitoring point data graphs for sampled monitoring wells that have at least one detection concentration in 2006 and a total of at least three historical detected concentrations (2000 through 2006), except trench well W1-23. Groundwater monitoring point data graphs are required according to Title 27 CCR, Section 20415(e)(14). Trends were determined by visually evaluating the graphs for increasing concentration trends, decreasing concentration trends, or relatively consistent (flat) concentration trends.

Arsenic, barium, cobalt, and copper were all detected at least once in all groundwater samples collected in 2006 at the Site 1 Landfill, with two exceptions. Each reported dissolved metal has at least three historical detected concentrations (2001 through 2006) in samples from every Site 1 groundwater monitoring well. Arsenic was not detected in groundwater samples collected from wells W1-5 and W1-22 in 2006. Arsenic and copper concentrations show a decreasing trend. Barium concentrations show a flat trend. Cobalt concentrations show a flat to decreasing trend. All of these metals are found in seawater (Study and Interpretation of the Chemical Characteristics of Natural Water, U.S. Geological Survey Water Supply Paper 1473, 2nd Edition [Hem, 1971]) and are considered part of the composition of natural groundwater at the Site 1 Landfill due to the proximity of natural salt water (Final Site 1 Landfill 2005 Annual Report Revision1, TiFW, 2006).

No VOCs or SVOCs were detected in groundwater samples collected in 2006. In addition, VOCs or SVOCs have not been detected three or more times historically between 1999 and 2006 in samples from the Site 1 groundwater monitoring wells.
3.2 GROUNDWATER QUALITY EVALUATION

Results from the 2006 groundwater sampling events are tabulated in Appendix D of this document and summarized below.

3.2.1 April 2006 Sampling Event

During the April 2006 sampling event, the dissolved metal MPs (arsenic, barium, cobalt, and copper) were detected in samples from monitoring wells at concentrations greater than their respective project reporting limits (Table 3-2). No pesticide, VOC, and SVOC MPs were detected in the April 2006 sampling event. Reported arsenic and cobalt concentrations do not exceed their respective CCLs. The following discussion summarizes how barium and copper exceeded their respective CCLs.

- The barium CCL was exceeded in samples from every monitoring well, except W1-19. All CCL exceedances, however, occurred in samples from a background well or are less than historical background values, thus, are removed from further consideration.

- The copper CCL was exceeded in samples from monitoring wells W1-1R and W1-19. Copper is removed from further consideration the exceedances were below historical background values.

Also during the April 2006 sampling event, the dissolved metal MPs were detected in a sample from trench well W1-22 at concentrations greater than their respective project reporting limits (Table 3-2). The analytical results from the collection trench well, however, are not considered representative of chemical concentrations of the shallow aquifer as described in Section 3.1.1.

3.2.2 October 2006 Sampling Event

During the October 2006 sampling event, the dissolved metal MPs (arsenic, barium, cobalt, and copper) and one pesticide MP (beta-benzene hexachloride) were detected in samples from monitoring wells at concentrations greater than their respective project reporting limits (Table 3-3). No VOC or SVOC MPs were detected in the October 2006 sampling event. Reported arsenic and cobalt concentrations do not exceed their respective CCLs. The following discussion summarizes how barium and copper exceeded their respective CCLs.

- The barium CCL was exceeded in samples from every monitoring well. All CCL exceedances, however, occurred in samples from a background well or are less than historical background values and, thus, are removed from further consideration.

- The copper CCL was exceeded in samples from monitoring well W1-23. Copper is removed from further consideration because the reported copper concentration is below historical background values.

Also during the October 2006 sampling event, the dissolved metal MPs were detected in samples from trench well W1-22 at concentrations greater than their respective project reporting limits (Table 3-3). The analytical results from the collection trench well, however, are not considered representative of chemical concentrations in the shallow aquifer as described in Section 3.1.1.
4.0 METHANE MONITORING

As part of landfill monitoring activities, methane monitoring was performed using 19 passive gas vent (GV) wells within the Site 1 Landfill and 4 landfill gas monitoring wells (LGMWs) on the perimeter of the landfill. Surface methane monitoring was also performed at the perimeter of the site at 150-foot intervals at 21 surface locations. The monitoring program was performed according to Section 4 of the LTMP (TtFW, 2005a). Monitoring was performed in April and October 2006 using a Landtec GA 90 portable methane monitor. Methane monitoring locations are shown in Figure 4-1.

4.1 LANDFILL GAS MONITORING WELL AND GAS EVENT RESULTS

The results of LGMWs and GV monitoring are shown in Table 4-1. The percentages of methane gas concentrations within the landfill were slightly lower in October 2006 than in April 2006. These results are similar to historical concentrations. Measured methane concentrations were highest in April 2006 near the northern portion of the landfill (GV-7 at 62.5 percent by volume, GV-8 at 59.8 percent by volume, and GV-5 at 53.9 percent by volume). A measured concentration of 7.5 percent by volume was observed in GV-1, which is located near the southern portion of the landfill. A measured concentration of 16.8 percent by volume in GV-10 was observed near the center of the landfill. None of the gas monitoring wells (LGMW1-1 through LGMW1-4) showed concentrations of methane above the concentration limit of 5 percent by volume specified in Title 27 California Code of Regulations, Section 20921(a)(2) and as identified in the ROD (Navy, 1997). All readings were zero percent by volume. Appendix G provides methane monitoring data graphs for the nineteen GV wells and the four LGMWs.

4.2 PERIMETER GAS MONITORING RESULTS

Perimeter surface monitoring points (P-1 through P-21) are located at ground surface along the perimeter fence line at approximate 150-foot intervals. Methane was not detected at any of the perimeter surface monitoring locations above the concentration limit of 5 percent by volume specified in Title 27 California Code of Regulations, Section 20921(a)(2) and as identified in the ROD (Navy, 1997) in April or October 2006. All readings were zero percent by volume.
5.0 CONCLUSIONS

Depth to groundwater measurements were collected from the Site 1 Landfill monitoring wells, piezometers, and collection trench wells on April 25, 2006, and October 16, 2006.

Groundwater elevations determined for all Site 1 Landfill wells using measurements made on April 25, 2006, and October 16, 2006, are below sea level. The groundwater elevations were similar to previous years. Groundwater flows from north to south at the Site 1 Landfill. The gradient from north to south was approximately 0.0007 ft/ft in April 2006 and 0.0009 ft/ft in October 2006.

During 2006, monitoring wells had seasonal high water levels in March and seasonal low water levels in October. The seasonal water level fluctuation is approximately 1 foot. Some monitoring wells show a slight upward (W1-1/1R, W1-12R, W1-19, W1-20) or slight downward (W1-5, W1-8, W1-16, W1-23) long-term water level trend, while the remainder of the monitoring wells showed a flat long-term trend.

Dissolved metal MPs were detected in groundwater samples at least once in 2006. Historically, detected concentrations since 1999 show a decreasing trend for arsenic and copper; a flat trend for barium; and a flat to decreasing trend for cobalt. All of these metals are found in seawater (Hem, 1971) and are considered part of the composition of natural groundwater at the Site 1 Landfill due to the proximity of natural salt water (TtFW, 2006).

No trends exist relative to VOCs and SVOCs because none were detected in 2006. In addition, VOCs or SVOCs have not been detected three or more times historically between 1999 and 2006 in samples from Site 1 groundwater monitoring wells.

During the April 2006 sampling event the dissolved metal MPs were detected in samples from monitoring wells at concentrations greater than their respective project reporting limits. Only concentrations of barium and copper exceeded their respective CCLs. Barium is removed from further consideration due to the CCL exceedances occurring in samples from a background well or exceedances were less than historical background values. Copper is also removed from further consideration because the CCL exceedances were less than historical background values. Pesticides, VOC and SVOC MPs were not detected in the April 2006 sampling event.

During the October 2006 sampling event the dissolved metal MPs were detected in groundwater samples at concentrations greater than their respective project reporting limits. Concentrations of barium and copper exceeded their respective CCL. Barium is removed from further consideration due to the CCL exceedances occurring in samples from a background well or exceedances were less than historical background values. Copper is removed from further consideration because the CCL exceedances were less than historical background values. Pesticides, VOC and SVOC MPs were not detected in the April 2006 sampling event. Analytical results obtained throughout 2006 indicate that there has not been a release from the landfill to groundwater.

As part of landfill monitoring activities, methane monitoring was performed at the Site 1 Landfill. The percentages of methane gas concentrations within the landfill were slightly lower in October 2006 than in April 2006 and were similar to historical concentrations. Methane was not detected at any of the perimeter surface monitoring locations in April or October 2006. Title 27 California Code of Regulations requires that for all solid waste landfills the concentrations of methane gas
generated from the landfill do not exceed the limit of 5 percent by volume. None of the measured percentages of methane gas concentrations by volume were above the Title 27 concentration limit of 5 percent by volume in perimeter surface monitoring locations and LGMWs. The percentages of methane gas concentrations by volume were above the Title 27 concentration limit of 5 percent by volume at five gas vent locations. Methane landfill gas is not migrating off site.

As part of landfill maintenance activities, the landfill cover is routinely inspected and repaired, as necessary. The landfill cover is intact and functional.

The DEH inspected Site 1 quarterly in 2006. Evidence of rodent activity was noted during DEH inspections in February and August. This problem was mitigated by backfilling rodent holes prior to the November DEH inspection. No other problems or deficiencies were noted.
6.0 REFERENCES


