**BIGGS & MATHEWS ENVIRONMENTAL**
*Consulting Engineers • Hydrogeologists*
**Mansfield • Wichita Falls**

March 1, 2013

John Carrillo, Chemist
MSW Permits Section – MC-124
Waste Permits Division
Texas Commission on Environmental Quality
P.O. Box 13087
Austin, Texas 78711-3087

Re: City of San Angelo Landfill, Tom Green County, TCEQ Permit No. MSW 79
2012 Annual Groundwater Monitoring and Corrective Action Report
CN 600251615; RN 102289576

Dear Mr. Carrillo:

On behalf of the City of San Angelo, the accompanying 2012 Annual Corrective Action Groundwater Monitoring Report is submitted pursuant to §330.415(e) and as an update to the 2006 Hydrogeologic Study for the referenced San Angelo Landfill. This report provides the required forms and documentation for the 2012 groundwater monitoring events, an overview of the corrective action monitoring results in 2012, and the status of the corrective action program.

The San Angelo Landfill is in corrective action because of statistically significant levels of volatile organic compounds (VOCs) above groundwater protection standards. The 2005 Corrective Action permit modification and the 2006 Hydrogeologic Evaluation established that the source of the VOCs in the groundwater is landfill gas migration, and the selected remedy was installation of an extensive landfill gas (LFG) collection and control system that became operational in October 2006. Since the operation of the LFG system, the groundwater quality has continued to improve. Decreases in VOC concentrations are being observed at all monitoring well locations. VOCs are now absent at 7 of the initial 11 monitoring wells that were installed prior to the LFG system. Since operation of the LFG system, total VOC concentrations at the other 4 initial monitoring wells have significantly decreased. There are no longer statistical exceedances in the VOCs at several of the monitoring well locations.

This annual corrective action monitoring report demonstrates the overall improvement in groundwater quality beneath the City of San Angelo Landfill. It is anticipated that continued improvement will be observed as LFG extraction and groundwater monitoring progress.

Please call or e-mail me or Diann Davis at 817-291-2277/dianndavis@charter.net if you have any questions.

Sincerely,

DAVIS GROUNDWATER SERVICES, INC.
TBPG NO. 50234

DiAnn Davis, P.G.
Hydrogeologist

BIGGS & MATHEWS ENVIRONMENTAL
TBPE NO. F-256 ◆ TBPG NO. 50222

Michael Snyder, P.G.
Principal Hydrogeologist

Attachment: 2012 Annual Corrective Action Monitoring Report (1 original and 2 copies)

cc: Mr. Shane Kelton, City of San Angelo (1)
Mr. Damon Sanford, San Angelo Landfill (1)
Mr. Christopher Mayben, TCEQ Region 8 (1)

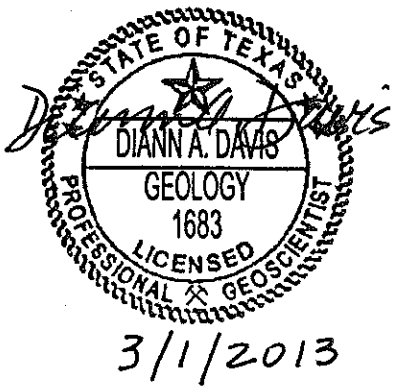
# CITY OF SAN ANGELO LANDFILL
# TOM GREEN COUNTY, TEXAS
# MSW PERMIT NO. 79

# 2012 ANNUAL CORRECTIVE ACTION GROUNDWATER MONITORING REPORT

**Prepared for:**

**City of San Angelo**

March 2013




3/1/2013

**Prepared by:**


3-1-2013

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# 1 INTRODUCTION

On behalf of the City of San Angelo, the following 2012 annual corrective action monitoring report is being submitted for the San Angelo Landfill, MSW Permit No. 79, in compliance with §330.415(e)(1-6). This report provides an overview of the groundwater monitoring results in 2012 and contains the required documentation for each monitoring event.

The San Angelo Landfill is in corrective action because of statistically significant levels of volatile organic compounds (VOCs) above groundwater protection standards at some of the site monitoring well locations. The 2005 Corrective Action permit modification and the 2006 Hydrogeologic Evaluation established that the source of the VOCs in the groundwater monitoring wells was landfill gas migration, and the selected remedy was an extensive landfill gas (LFG) collection and control system that was installed and became operational in October 2006. Since the operation of the LFG system, the groundwater quality has continued to improve, apparently in response to the successful control of LFG. In addition to the declining concentrations of LFG-related organic compounds in the groundwater, there were no LFG detections in the perimeter gas probes, other than a low-level reading of 0.3% (well below the regulatory limit of 5%) at GMP-10A in the fourth quarter. This further demonstrates the effectiveness of the LFG collection and control system.

Historically, the constituents of concern have been cis-1,2-dichloroethene, methylene chloride, tetrachloroethene (PCE), trichloroethene (TCE), and vinyl chloride. Methylene chloride and cis-1,2-dichloroethene are no longer constituents of concern. Levels of PCE and TCE have declined significantly in the past few years. The most significant improvement in groundwater quality was observed during the recent October 2012 monitoring event, where all VOC detections were below groundwater protection standards except PCE at MW-17, which was only slightly above the protection standard. Other improvements included the absence of PCE at 7 wells with historical PCE detections and no detections of TCE or vinyl chloride at any of the well locations. The improvements in groundwater quality are addressed in Section 7 and illustrated in the Time series graphs provided in Appendix E. The Time Series graphs show trends in the VOC detections and an overall decrease in the VOC concentrations since operation of the LFG system.

## 1.1 Site History

The San Angelo Landfill is an existing 257-acre, Type I Municipal Solid Waste Disposal Facility, owned by the City of San Angelo (COSA). The facility is under the regulatory jurisdiction of the Texas Commission on Environmental Quality (TCEQ) as Municipal Solid Waste (MSW) Permit No. 79. The facility is currently operated by Trashaway Waste Services, Inc., under contract to the COSA. The San Angelo Landfill provides waste disposal capacity for residences and businesses in the COSA, Tom Green County, and surrounding areas. The San Angelo Landfill is located approximately 3

miles northeast of the COSA on Old Ballinger Highway. The facility is within the city limits of San Angelo and is in Tom Green County, Texas.

The San Angelo Landfill was originally owned by Angelo Waste Services and began accepting municipal solid waste in the late 1960s. The landfill was originally permitted by the State of Texas in 1975 as the City of San Angelo Landfill, owned and operated by the COSA. Trashaway Waste Services of San Angelo began operating the facility in 1979 under contract with the City. The City expanded the landfill in 1985 with a major permit amendment that expanded the permit boundary from approximately 131 acres to the present permit boundary of approximately 257 acres. The older areas of the landfill are generally the west half of the permit boundary, with the expansion area consisting of the east half of the facility. In 1994, a Permit Modification was approved by the Texas Natural Resources Conservation Commission (TNRCC) to upgrade the landfill to comply with the Environmental Protection Agency (EPA) Subtitle D Regulations.

The Subtitle D upgrade provided for a certified groundwater monitoring system and an approved LFG monitoring program. The facility began groundwater sampling and LFG monitoring consistent with TCEQ regulations upon installation of these systems. The groundwater monitoring system consisted of nine wells: two upgradient wells located on the north permit boundary, four downgradient wells located along the south permit boundary, and the three side gradient wells located along the west permit boundary. The LFG monitoring system consisted of a 14 LFG monitoring probes located adjacent to existing waste fill areas on the north, west, and south sides of the landfill. Beginning with the initial Subtitle D monitoring event in 1994, the groundwater monitoring system began detecting VOCs above National primary maximum contaminant levels (MCLs) at several groundwater monitoring wells and methane levels above the regulatory limit at several of the LFG monitoring probes.

The ongoing groundwater contamination and LFG migration were identified as alleged violations by TCEQ Region 8 (San Angelo) Enforcement Division, as a result of a site inspection conducted in December 2004. This site inspection is documented as Outstanding Alleged Violations, included in correspondence from Mr. Mark Newman, Section Manager, San Angelo Region Office, TCEQ, dated January 15, 2005, addressed to The Honorable J. W. Lown. Additional alleged violations and requested actions are documented in correspondence from Mr. Arthur Denny, Team Leader, MSW Permits Section, Waste Permits Division, TCEQ, dated March 14, 2005, addressed to the Honorable J. W. Lown. The COSA has also received a Notice of Enforcement, dated January 21, 2005 from the TCEQ Enforcement Division regarding these alleged violations and permit issues.

The COSA engaged Biggs and Mathews Environmental, Inc., (Biggs and Mathews) in mid February 2005 to assist the City in responding to the various alleged outstanding issues and formulate an approach to mitigating LFG migration and groundwater contamination. The City has continued to pursue the various enforcement actions identified in the January 21, 2005, correspondence directly with the TCEQ Enforcement Division; this coordination is ongoing. The City and Biggs and Mathews have been actively pursuing solutions and alternatives to resolve the LFG migration and groundwater contamination at the San Angelo Landfill.

A Remediation Plan for LFG Migration and Groundwater Contamination was presented to TCEQ, as permit modifications in July 2005. Based on comments from the TCEQ,

revisions were made to the plan which was declared technically complete in December 2005. Following public notice, the TCEQ issued the permit modifications on March 2, 2006.

In March and April 2006 new groundwater monitoring wells that will eventually replace the existing system were installed and developed. A groundwater monitoring well installation report dated April 17, 2006, was submitted to the TCEQ. A dedicated pump installation report and low flow purge demonstration for the newly installed wells was submitted to the TCEQ on March 31, 2006. In October 2006, the LFG collection and control system (GCCS) was started

In May 2006 the COSA submitted the required laboratory quality assurance/quality control (QA/QC) changes to the Groundwater Sampling and Analysis Plan and in February 2008 submitted a permit modification to comply with the Subchapter J requirements. That modification proposed to add eight new monitoring wells to the point of compliance monitoring system (see Figure A.3). The modification was approved by the TCEQ on March 25, 2009.

### 1.1.1 Site Characterization and Exploration

Various site exploration projects have been completed at the site that has contributed to the subsurface information used in this study.

In 1975 Trinity Engineering Testing Corporation drilled six geotechnical borings. The borings were labeled B-1 through B-6.

In April 1983, Resource Engineering Incorporated drilled five geotechnical borings. The borings were labeled TB-1 through TB-5. Groundwater monitoring wells were installed at the locations of these borings and were eventually designated MW-1 through MW-5.

In January 1985, Borings TB-6 and TB-7 were drilled by Trinity Engineering Testing Corporation. Groundwater monitoring wells were installed at these locations and were designated MW-6 and MW-7.

In March 1992, groundwater monitoring wells TB-6 and TB-7 were plugged and replaced by TB-6R and TB-7R. TB-6 and TB-7 were plugged because they were dry. TB-6R and TB-7R were eventually designated MW-6R and MW-7R. The new wells were installed by Combest Geoscience.

In May 1994, 12 gas monitoring probes were installed and designated GMP-1 through GMP-12. The probes were installed by Combest Geoscience.

In March 1995, groundwater monitoring well MW-11 was installed by Combest Geoscience.

In March 1996, offsite monitoring well MW-59 was installed south of the landfill by Combest Geoscience.

In August 1999, offsite monitoring wells MW-60 and MW-61 were installed south of the landfill by Combest Geoscience.

In January 2000, offsite monitoring wells MW-62, MW-63, MW-64, and MW-65 were installed approximately 1½ miles southeast of the landfill by Combest Geoscience. Also in January 2000, groundwater extraction well EW-1 was installed in the southwest corner of the site. It was plugged in February 2006.

In July 2000, groundwater extraction wells EW-2 and EW-3 were installed along the south boundary of the site by Combest Geoscience.

In August 2000, groundwater extraction well EW-4 was installed near MW-61, about 2500 feet west of the site by Combest Geoscience.

In March 2006, 12 groundwater monitoring wells, MW-4R, MW-5R, MW-7RR, MW-8R, MW-9R, MW-10R, MW-11R, MW-12, MW-13, MW-14, MW-15, and MW-16, were installed by Biggs and Mathews Environmental.

Historical groundwater characterization studies at the San Angelo landfill include

1. 1991 - Combest Geoscience - R*eview of hydrogeologic conditions and previous geotechnical activities at the San Angelo Municipal Landfill.*

2. 1992 - Combest Geoscience - *Improvement of the Ground-water Monitoring System and Further Review of Hydrogeology at the San Angelo Municipal Landfill (Permit 79-A).*

3. *May 3, 1995 – Phase I of Groundwater Remedial Investigation* (This was submitted as part of the 1st Quarter Sampling Report).

4. *April 22, 1996 – Phase II of the Groundwater Remedial Investigation at the San Angelo MSWLF in Tom Green County, Texas (Permit 79).*

5. *December 9, 2005 – Biggs & Mathews Environmental – Landfill Gas and Groundwater Remediation Plan.*

6. *November 27, 2006 – Biggs & Mathews Environmental – Hydrogeologic Evaluation*

7. *March 25, 2008, revised December 5, 2008, and approved by the TCEQ March 25, 2009 – Biggs & Mathews Environmental – Permit Modification to the Groundwater Monitoring Plan to comply with well spacing requirements in Chapter 330, Subchapter J.*

## 1.2 Groundwater Monitoring and Reporting

The Subchapter J permit modification for this facility was approved by the TCEQ on March 25, 2009. Groundwater monitoring and reporting in 2012 were in accordance with the approved Groundwater Sampling and Analysis Plan (GWSAP). In 2012, semiannual monitoring for Appendix I total metals was conducted in May and October. The final (8th) quarterly background monitoring event for total metals at the new monitoring wells (MW-17 through MW-24) was completed in February/March 2012. Quarterly corrective action monitoring for VOCs was conducted at all wells in

February/March, May, August, and October. During the August 2012 quarterly event, verification re-sampling for arsenic and cobalt were conducted at MW-23 (results are addressed in Section 2). The groundwater sampling and reporting dates in 2012 are shown in Table 1. The groundwater monitoring system is discussed in Section 1.3.

After each monitoring event, a detailed report, which included signed TCEQ-0312 forms, complete analytical reports, and statistical analysis tables and graphs, was placed in the Site Operating Record (SOR) and the TCEQ was notified of any statistically significant increases (SSIs) in the current data. SSIs in the 2012 groundwater data are addressed in Sections 2 and 3.3.

The original, signed TCEQ-0312 forms, complete analytical reports, and statistical analysis tables and graphs for 2012 are being submitted as part of this annual report (see Appendix B). Groundwater flow rates (Appendix C) and potentiometric surface maps (Appendix D) are also being submitted. An original and copy of this report have been submitted and a complete copy has been sent to the TCEQ Region 8 office.

**Table 1**
**2012 Groundwater Sampling and Reporting Dates**

| Monitoring Event and Sampling Date | TCEQ Forms, Lab Reports & Statistical Analysis in SOR* | Notification of SSIs to TCEQ and in SOR |
|---|---|---|
| Quarterly Corrective Action Monitoring (VOCs)<br>Final (8th) Background Monitoring (New Wells)<br>February 29 and March 1, 2012 | May 1, 2012 | May 15, 2012 |
| Semiannual Monitoring (Total Metals)<br>Quarterly Corrective Action Monitoring (VOCs)<br>May 9, 10, and 14, 2012 | July 13, 2012 | July 26, 2012 |
| Re-sample for Arsenic and Cobalt at MW-23<br>August 8, 2012 | September 14, 2012 | September 14, 2012<br>(SSIs not verified) |
| Quarterly Corrective Action Monitoring (VOCs)<br>August 8-9, 2012 | October 9, 2012 | October 23, 2012 |
| Semiannual Monitoring (Total Metals)<br>Quarterly Corrective Action Monitoring (VOCs)<br>October 29-31, 2012 | December 31, 2012 | January 14, 2013 |

*SOR is Site Operating Record.

## 1.3 Groundwater Monitoring System and Monitoring Status

The approved groundwater monitoring system currently includes 22 monitoring wells (14 older wells and 8 new wells). MW-17 through MW-24 were installed in March 2010, in accordance with the approved Subchapter J well-spacing modification. Quarterly background monitoring at the new wells began in May 2010 and was complete in February/March 2012 at all new wells, except MW-18 and MW-20. These two wells are typically dry and have not completed background. The groundwater monitoring system is shown in Table 2, along with the monitoring status and hydraulic gradient position of each well. Monitoring well locations are illustrated on Figure A (see Appendix A).

**Table 2**
**Groundwater Monitoring System**

| Monitoring Well No. | Monitoring Status | Hydraulic Gradient Position |
|---|---|---|
| MW-2 | Corrective Action | Upgradient |
| MW-4R | Corrective Action | Downgradient |
| MW-5R | Corrective Action | Downgradient |
| MW-6R | Corrective Action | Downgradient |
| MW-7RR | Corrective Action | Upgradient |
| MW-8R | Corrective Action | Downgradient |
| MW-9R | Corrective Action | Downgradient |
| MW-10R | Corrective Action | Downgradient |
| MW-11R | Corrective Action | Downgradient |
| MW-12 | Corrective Action | Downgradient |
| MW-13 | Corrective Action | Downgradient |
| MW-14 | Corrective Action | Downgradient |
| MW-15 | Corrective Action | Downgradient |
| MW-16 | Corrective Action | Downgradient |
| MW-17 | Corrective Action | Downgradient |
| MW-18 | Background | Downgradient |
| MW-19 | Corrective Action | Downgradient |
| MW-20 | Background | Downgradient |
| MW-21 | Corrective Action | Downgradient |
| MW-22 | Corrective Action | Downgradient |
| MW-23 | Corrective Action | Downgradient |
| MW-24 | Corrective Action | Downgradient |
| **Offsite Monitoring Wells** | | |
| MW-59 | n/a | ½ mi. downgradient |
| MW-60R | n/a | ½ mi. downgradient |
| MW-61 | n/a | ½ mi. downgradient |

Offsite wells MW-59, MW-60R, and MW-61 are sampled quarterly for VOCs, as part of the approved corrective action plan. MW-60R was installed in March 2010, pursuant to a permit modification approved on January 13, 2010, and has no produced sufficient water for sampling since November 2010. The offsite wells are shown in Table 2 and the monitoring results for these wells are included in this report. The 2006 Hydrogeologic Study demonstrated that it is unlikely that VOCs from the landfill could have migrated to these offsite locations, which are about ½ mile south of the landfill.

## 1.4 Groundwater Monitoring Constituents and MSW-PQLs

The 22 wells at the landfill are being monitored for the Appendix I total metals and VOCs specified in the approved GWSAP. Samples are analyzed by TestAmerica Laboratories in Austin, Texas, using EPA-approved methods and the inter-laboratory MSW-practical quantitation limits (MSW-PQLs) provided in the TCEQ letter dated May 25, 2010. Use of the inter-laboratory MSW-PQLs commenced at this facility in May 2010. PQLs are discussed further in Section 3.2.

Background for the Appendix I total metals is being re-established at the site monitoring wells using the inter-laboratory MSW-PQL benchmark concentrations. In the TCEQ letter dated May 25, 2010, the agency suggested that groundwater data collected using the new MSW-PQLs be added to the existing background population until there is a total of eight data points based on MSW-PQL benchmark concentrations. The current background for each well will be updated in accordance with the TCEQ guidelines.

# 2 STATISTICALLY SIGNIFICANT LEVELS

The following is provided in compliance with §330.415(e)(1), which states that the annual corrective action report shall include *a statement regarding whether a statistically significant level above a groundwater protection standard established in §330.409(h), (i), or (j) of this title in any well during the previous calendar year period has occurred and the status of any statistically significant level events.*

## February/March 2012 Quarterly Corrective Action Monitoring for VOCs

Statistical analysis of Appendix I total metal data was not required at the February/March 2012 quarterly monitoring event. The VOCs that were at statistically significant levels above National primary maximum contaminant levels (MCLs) for drinking water or groundwater protection standards are shown in Table 3. The February/March 2012 results were reported to the TCEQ on May 15, 2012 (see Table 1). Statistical analysis of the VOC data is addressed in Section 3.3.2.

**Table 3**
**Feb/March 2012 Statistically Significant Levels of VOCs above MCLs**
**(95% Upper Confidence Limits)**

| Well No. | Tetrachloroethene MCL 5 µg/L | Trichloroethene MCL 5 µg/L | Vinyl chloride MCL 2 µg/L |
|---|---|---|---|
| MW-4R | 6.33 | | |
| MW-5R | 8.62 | 5.96 | |
| MW-9R | 13.6 | 6.28 | |
| MW-10R | | 8.55 | |
| MW-13 | 6.84 | 6.73 | 3.10 |
| MW-15 | 8.50 | | |
| MW-17 | 8.65 | | |
| MW-19 | 5.61 | | |
| MW-21 | | 8.65 | |
| MW-22 | 6.25 | | |
| MW-23 | 6.77 | | |
| MW-61 (offsite) | 10.7 | | |

Note: Concentrations are in µg/L. A blank cell indicates no statistical exceedance.

## May 2012 Semiannual and Quarterly Corrective Action Monitoring

Statistical analysis of the Appendix I total metal compliance data at the new monitoring wells commenced in May 2012. The May 2012 statistical analysis identified *unverified* SSIs in arsenic and cobalt at MW-23. The unverified SSIs in the total metal data are shown in Table 4. There were no other SSIs in the May 2012 data. Verification re-sampling for arsenic and cobalt was conducted at MW-23 in August 2012 and the initial SSIs were not verified. The re-sampling results are discussed in the following section. Statistical analysis of the Appendix I total metals is addressed in Section 3.3.1.

**Table 4**
**Unverified SSIs in the May 2012 Appendix I Total Metals**

| Well No. | Appendix I Total Metal | May 2012 Detection (µg/L) | Prediction Limit (µg/L) | Status |
|---|---|---|---|---|
| MW-23 | Arsenic | 23.1 | 6.48 | Re-sampled August 8, 2012 Not verified (see Table 6) |
| MW-23 | Cobalt | 5.15 | 5.0 | Re-sampled August 8, 2012 Not verified (see Table 6) |

The May 2012 VOCs that were at statistically significant levels above MCLs or groundwater protection standards are shown in Table 5. The May 2012 results were reported to the TCEQ on July 26, 2012 (see Table 1).

**Table 5**
**May 2012 Statistically Significant Levels of VOCs above MCLs (95% Upper Confidence Limits)**

| Well No. | Tetrachloroethene MCL 5 µg/L | Trichloroethene MCL 5 µg/L | Vinyl chloride MCL 2 µg/L |
|---|---|---|---|
| MW-4R | 5.63 | | |
| MW-5R | 7.14 | 5.96 | |
| MW-9R | 12.8 | | |
| MW-10R | | 8.55 | |
| MW-13 | 5.69 | 6.78 | 3.07 |
| MW-15 | 8.63 | | |
| MW-17 | 8.28 | | |
| MW-19 | 5.54 | | |
| MW-21 | | 9.15 | |
| MW-22 | 6.25 | | |
| MW-23 | 6.65 | | |
| MW-61 (offsite) | 8.48 | | |

Note: Concentrations are in µg/L. A blank cell indicates no statistical exceedance.

## August 2012 Verification Re-sampling for Arsenic and Cobalt at MW-23

Verification re-sampling for arsenic and cobalt was conducted at MW-23 on August 8, 2012. As shown in Table 6, the initial SSIs in arsenic and cobalt were *not* verified in the August 2012 re-sampling results and no further action was required. The verification re-sampling report was submitted to the TCEQ on September 14, 2012 (see Table 1).

**Table 6**
**August 2012 Verification Re-sampling Results at MW-23**

| Well No. | Appendix I Total Metal | August 2012 Detection (µg/L) | Prediction Limit (µg/L) | Status |
|---|---|---|---|---|
| MW-23 | Arsenic | 5.38 | 6.48 | Not verified (No further action required) |
| MW-23 | Cobalt | <5 | 5.0 | Not verified (No further action required) |

## August 2012 Quarterly Corrective Action Monitoring for VOCs

The August 2012 VOCs that were at statistically significant levels above MCLs or groundwater protection standards are shown in Table 7. The August 2012 results were reported to the TCEQ on October 23, 2012 (see Table 1).

**Table 7**
**August 2012 Statistically Significant Levels of VOCs above MCLs**
**(95% Upper Confidence Limits)**

| Well No. | Tetrachloroethene MCL 5 µg/L | Trichloroethene MCL 5 µg/L | Vinyl chloride MCL 2 µg/L |
|---|---|---|---|
| MW-4R | 5.63 | | |
| MW-5R | 7.17 | 5.96 | |
| MW-9R | 11.9 | | |
| MW-10R | | 8.39 | |
| MW-13 | 5.82 | 7.48 | 2.43 |
| MW-15 | 8.29 | | |
| MW-17 | 7.98 | | |
| MW-19 | 6.01 | | |
| MW-21 | | 8.54 | |
| MW-22 | 5.17 | | |
| MW-23 | 7.12 | | |
| MW-61 (offsite) | 8.12 | | |

Note: Concentrations are in µg/L. A blank cell indicates no statistical exceedance.

## October 2012 Semiannual and Quarterly Corrective Action Monitoring

There were *no* SSIs identified in the statistical analysis of the October 2012 Appendix I total metals (see Section 3.3.1).

The VOCs that were at statistically significant levels above MCLs or groundwater protection standards are shown in Table 8. The October 2012 results were reported to the TCEQ on January 14, 2013 (see Table 1).

**Table 8**
**October 2012 Statistically Significant Levels of VOCs above MCLs**
**(95% Upper Confidence Limits)**

| Well No. | Tetrachloroethene MCL 5 µg/L | Trichloroethene MCL 5 µg/L | Vinyl chloride MCL 2 µg/L |
|---|---|---|---|
| MW-4R | 6.24 | | |
| MW-5R | 7.89 | 5.04 | |
| MW-9R | 7.59 | | |
| MW-10R | | 7.51 | |
| MW-13 | 6.54 | 6.49 | 2.14 |
| MW-15 | 7.19 | | |
| MW-17 | 7.90 | | |
| MW-19 | 5.65 | | |
| MW-21 | | 5.01 | |
| MW-23 | 5.80 | | |
| MW-61 (offsite) | 7.27 | | |

Note: Concentrations are in µg/L. A blank cell indicates no statistical exceedance.

# 3 GROUNDWATER MONITORING RESULTS IN 2012

The following is provided in compliance with §330.415(e)(2), which states that the annual corrective action report shall include *the results of all groundwater monitoring, testing, and analytical work obtained or prepared in accordance with the requirements of this chapter, including a summary of background groundwater quality values, groundwater monitoring analyses, statistical calculations, graphs, and drawings.*

## 3.1 Groundwater Sampling Procedures

Groundwater sampling details for the 2012 monitoring events are discussed in the following sections and provided on page 1 of the TCEQ-0312 forms in Appendix B.

### 3.1.1 February/March 2012 Quarterly Sampling Event

Sampling was conducted on February 29 and March 1, 2012, by Biggs and Mathews Environmental, in accordance with the GWSAP. Water levels were measured in each well, prior to purging. New wells MW-18 and MW-20 and offsite well MW-60R were dry when water levels were measured. The site monitoring wells were sampled using dedicated Well Wizard™ pumps and low-flow sampling methods. MW-7RR and MW-16 produce insufficient water to support low-flow sampling and both wells were purged dry, allowed to recover overnight, and sampled within 24 hours of purging, using dedicated pumps. The offsite wells (MW-59 and MW-61) were purged of three well volumes of groundwater and sampled using new disposable bailers. All wells produced sufficient water for sampling, except MW-18, MW-20, and MW-60R, which were dry.

Field quality control (QC) samples included a blind duplicate sample collected at MW-24 (identified as MW-1A), a field blank prepared each day of sampling, and a trip blank prepared by the laboratory. The field QC samples were analyzed for VOCs and total metals. There were no detections in the field QC blanks. The analytical results for the duplicate sample were consistent with the results for MW-24.

### 3.1.2 May 2012 Semiannual Sampling Event

Sampling was conducted on May 9, 10, and 14, 2012, by Biggs and Mathews Environmental, in accordance with the GWSAP. Water levels were measured in all wells, prior to purging. New wells MW-18 and MW-20 and offsite well MW-60R were dry when water levels were measured. The site monitoring wells were sampled using dedicated Well Wizard™ pumps and low-flow sampling methods. MW-7RR and MW-16, which produce insufficient water for low-flow sampling, were purged dry, allowed to recover overnight, and sampled within 24 hours of purging, using dedicated pumps.

The offsite monitoring wells were purged of three well volumes of groundwater and sampled using new disposable bailers. All wells produced sufficient water for sampling, except MW-18, MW-20, and MW-60R, which were dry.

Field QC samples included a blind duplicate sample collected at MW-2 (identified as MW-1A), a field blank prepared each day of sampling, and two trip blanks prepared by the laboratory. Field QC samples were analyzed for VOCs and total metals. There were no detections in the field QC blanks.

### 3.1.3 August 2012 Quarterly Sampling Event

Sampling was conducted August 8-9, 2012, by Biggs and Mathews Environmental, in accordance with the GWSAP. Water levels were measured in all monitoring wells, prior to purging. New wells MW-18 and MW-20 and offsite well MW-60R were dry when water levels were measured. The site monitoring wells were sampled using dedicated Well Wizard™ pumps and low-flow sampling methods. MW-7RR and MW-16 were purged dry, allowed to recover overnight, and sampled within 24 hours, using dedicated pumps. The offsite wells were purged of three well volumes of groundwater and sampled using new disposable bailers. All wells produced sufficient water for sampling, except MW-18, MW-20, and MW-60R, which were dry.

Field QC samples included a blind duplicate sample collected at MW-2 (identified as MW-1A), a field blank prepared each day of sampling, and a trip blank prepared by the laboratory. Field QC samples were analyzed for VOCs. There were no VOC detections in the field QC blanks. The analytical results for the duplicate were consistent with the results for MW-2.

### 3.1.4 October 2012 Semiannual Sampling Event

Sampling was conducted October 29-31, 2012, by Biggs and Mathews Environmental, in accordance with the GWSAP. Water levels were measured in all monitoring wells, prior to purging. New wells MW-18 and MW-20 and offsite well MW-60R were dry when water levels were measured. The site monitoring wells were sampled using dedicated Well Wizard™ pumps and low-flow sampling methods. MW-7RR and MW-16 were purged dry, allowed to recover overnight, and sampled within 24 hours of purging, using dedicated pumps. The offsite monitoring wells were purged of three well volumes of groundwater and sampled using new disposable bailers. All wells produced sufficient water for sampling, except MW-18, MW-20, and MW-60R, which were dry.

Field QC samples included a blind duplicate sample collected at MW-2 (identified as MW-1A), a field blank prepared each day of sampling, and a trip blank prepared by the laboratory. Field QC samples were analyzed for VOCs and total metals. There were no detections in the field QC blanks. The analytical results for the duplicate were consistent with the results for MW-2.

## 3.2 Laboratory Analysis

Laboratory analyses were conducted by TestAmerica Laboratories in Austin, Texas. TestAmerica Austin is an accredited environmental testing laboratory, in accordance

with standards established by the National Environmental Laboratory Accreditation Conference (NELAC), and the lab has been accredited by the Texas Laboratory Accreditation Program. In 2012, all samples arrived at the laboratory in acceptable condition and all analyses were performed within holding times.

Samples were analyzed for Appendix I total metals and VOCs using EPA Methods 6010B, 6020, and 8260B and inter-laboratory MSW-PQLs. Samples were analyzed by method 6020 at a dilution to overcome matrix interference of non-target analytes. Dilution factors were applied to laboratory method detection limits (MDLs) and evaluated versus the MSW-PQLs (see laboratory case narratives). There were no elevated PQLs in the 2012 analyses and all laboratory results in 2012 were reported at MSW-PQL benchmark concentrations.

The analytical results have been reviewed for compliance with the laboratory QA/QC plan and meet all requirements of the NELAC standards. All data have been found to be compliant with laboratory protocol, except where noted in the case narratives and flagged on the result pages. Complete analytical reports and signed TCEQ-0312 forms for all 2012 monitoring events are provided in Appendix B. These reports were placed in the Site Operating Record, following each groundwater monitoring event (see Table 1).

## 3.3 Statistical Analysis

Statistical exceedances in the 2012 groundwater data are addressed in Section 2 of this report. Statistical analysis of the Appendix I total metals was conducted at the May and October 2012 semiannual events. Statistical analysis of the VOCs was conducted at each quarterly monitoring event (February/March, May, August, and October 2012). The statistical analysis results for each event were submitted to the TCEQ on the dates shown in Table 1. The following provides an overview of the statistical analysis.

### 3.3.1 Appendix I Total Metals

The Appendix I total metals were evaluated using the Sanitas™ statistical software program. The Sanitas program follows current EPA guidance for the statistical analysis of groundwater monitoring data (EPA Unified Guidance, Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, March 2009).

The May 2012 and October 2012 semiannual compliance data were compared to the current background at each well using intra-well parametric and non-parametric prediction limits. The current background data for the Appendix I total metals are listed in Table 9. As addressed in Section 1.3, background for total metals is being re-established at all wells using inter-laboratory MSW-PQL benchmark concentrations, and the background will be updated in accordance with the TCEQ guidelines.

As previously stated in Section 2, statistical analysis of the May 2012 semiannual compliance data identified unverified SSIs in arsenic and cobalt at MW-23. There were no other SSIs in the May 2012 data. MW-23 was re-sampled for arsenic and cobalt on August 8, 2012, and the initial SSIs in arsenic and cobalt were *not* verified in the re-sampling results. No further action was required.

There were *no* SSIs identified in the October 2012 semiannual compliance data. The intra-well prediction limits and summary tables for the May and October 2012 semiannual monitoring events are provided in Appendix B. Time Series graphs for each event, which illustrate the historical total metal data at all wells, are also provided in Appendix B.

### 3.3.2 Appendix I VOCs

The quarterly VOC data were evaluated using the Sanitas™ statistical software program. Statistical analysis of the VOC data was conducted using 95% upper confidence limits and comparisons to MCLs or groundwater protection standards. The confidence limits were calculated using VOC data from the most recent four sampling events (n=4). Tables 3, 5, 7, and 8 in Section 2 show the VOCs that were at statistically significant levels above groundwater protection standards at each quarterly event in 2012. The confidence limits and summary tables for all events (February/March, May, August, and October 2012) are provided in Appendix B. Trends in the VOC data and the status of corrective action are addressed in Section 7.

## Table 9
## Appendix I Total Metal Data

| Sampling Date | Antimony (µg/L) | Arsenic (µg/L) | Barium (µg/L) | Beryllium (µg/L) | Cadmium (µg/L) | Chromium (µg/L) | Cobalt (µg/L) | Copper (µg/L) | Lead (µg/L) | Nickel (µg/L) | Selenium (µg/L) | Silver (µg/L) | Thallium (µg/L) | Vanadium (µg/L) | Zinc (µg/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **MW-2** | | | | | | | | | | | | | | | |
| 07/06/06 | | <10 | <200 | | <2 | <5 | | <25 | <3 | | 15.3 | | | | |
| 11/07/06 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 16.0 | <5 | <2 | <50 | <20 |
| 05/22/07 | | <10 | <200 | | <2 | <5 | | <25 | <3 | | 15.4 | | | | |
| 10/30/07 | | <10 | <200 | | <2 | <5 | | <25 | <3 | | 12.1 | | | | |
| 05/21/08 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 14.2 | <5 | <2 | <50 | <20 |
| 08/25/08 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 12.4 | <5 | <2 | <50 | <20 |
| 11/04/08 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 17.6 | <5 | <2 | <50 | <20 |
| 02/10/09 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 14.3 | <5 | <2 | <50 | <20 |
| 05/05/09 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 15.2 | <5 | <2 | <50 | <20 |
| 08/11/09 | <1 | | | <1 | | | <50 | | | <40 | | <5 | <1 | <50 | <20 |
| 10/27/09 | <1 | <10 | <200 | <1 | <2 | <5 | <50 | <25 | <3 | <40 | 16.2 | <5 | <1 | <50 | <20 |
| 03/03/10 | 1.58 | <10 | <200 | <1 | <2 | <5 | <50 | <25 | <3 | <40 | 13.5 | <5 | <1 | <50 | <20 |
| 05/25/10 | <5 | <5 | 44.4 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 14.6 | <100 |
| 11/15/10 | <5 | <5 | 44.7 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 17.6 | <100 |
| 05/10/11 | <5 | <5 | 52.0 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 13.0 | <100 |
| 11/15/11 | <5 | <5 | 51.1 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | <10 | <100 |
| 11/15/11 | 9.68 | <5 | 51.3 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | <10 | <100 |
| **MW-4R** | | | | | | | | | | | | | | | |
| 05/16/06 | | <10 | <200 | | <2 | <5 | | <25 | <3 | | 19.4 | | | | |
| 05/16/06 | | <10 | <200 | | <2 | <5 | | <25 | <3 | | 20.4 | | | | |
| 07/11/06 | | <10 | <200 | | <2 | 6 | | <25 | <3 | | 17.6 | | | | |
| 11/07/06 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 13.3 | <5 | <2 | <50 | <20 |
| 02/22/07 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 12.9 | <5 | <2 | <50 | <20 |
| 04/26/07 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 14.0 | <5 | <2 | <50 | <20 |
| 09/13/07 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 10.8 | <5 | <2 | <50 | <20 |
| 11/01/07 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 10.4 | <5 | <2 | <50 | <20 |
| 02/21/08 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 17.1 | <5 | <2 | <50 | <20 |
| 02/21/08 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 16.7 | <5 | <2 | <50 | <20 |
| 04/30/08 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 10.7 | <5 | <2 | <50 | <20 |
| 08/27/08 | <6 | | | <4 | | | <50 | | | <40 | | <5 | <2 | <50 | <20 |
| 11/06/08 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 10.2 | <5 | <2 | <50 | <20 |
| 05/06/09 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 16.6 | <5 | <2 | <50 | <20 |
| 10/27/09 | <1 | <10 | <200 | <1 | <2 | <5 | <50 | <25 | <3 | <40 | 6.70 | <5 | <1 | <50 | <20 |
| 05/25/10 | <5 | <5 | 46.3 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 20.6 | <100 |
| 11/18/10 | <5 | <5 | 51.1 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 24.2 | <100 |
| 05/10/11 | <5 | <5 | 53.9 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 21.8 | <100 |
| 11/15/11 | <5 | <5 | 51.4 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 20.5 | <100 |

Note: Duplicate dates indicate blind duplicate samples.

# Table 9
## Appendix I Total Metal Data

| Sampling Date | Antimony (µg/L) | Arsenic (µg/L) | Barium (µg/L) | Beryllium (µg/L) | Cadmium (µg/L) | Chromium (µg/L) | Cobalt (µg/L) | Copper (µg/L) | Lead (µg/L) | Nickel (µg/L) | Selenium (µg/L) | Silver (µg/L) | Thallium (µg/L) | Vanadium (µg/L) | Zinc (µg/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **MW-5R** | | | | | | | | | | | | | | | |
| 05/16/06 | | <10 | <200 | | <2 | <5 | | <25 | <3 | | <5 | | | | |
| 07/10/06 | | <10 | <200 | | <2 | <5 | | <25 | <3 | | <5 | | | | |
| 11/09/06 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 02/22/07 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 04/25/07 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 09/12/07 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 11/01/07 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 02/20/08 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 04/30/08 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 08/27/08 | <6 | | | <4 | | | <50 | | | <40 | | <5 | <2 | <50 | <20 |
| 11/06/08 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 05/06/09 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 10/27/09 | <1 | <10 | <200 | <1 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 05/26/10 | <5 | <5 | 37.6 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 24.3 | <100 |
| 11/18/10 | <5 | <5 | 39.7 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 23.6 | <100 |
| 05/11/11 | <5 | <5 | 40.3 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 23.8 | <100 |
| 11/16/11 | <5 | <5 | 39.6 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 22.9 | <100 |
| **MW-6R** | | | | | | | | | | | | | | | |
| 07/10/06 | | <10 | <200 | | <2 | <5 | | <25 | <3 | | <5 | | | | |
| 11/08/06 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 05/23/07 | | <10 | <200 | | <2 | <5 | | <25 | <3 | | <5 | | | | |
| 10/31/07 | | <10 | <200 | | <2 | <5 | | <25 | <3 | | <5 | | | | |
| 05/22/08 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 08/26/08 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 11/06/08 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 02/11/09 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 05/06/09 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 08/12/09 | <1 | | | <1 | | | <50 | | | <40 | 5.70 | <5 | <2 | <50 | <20 |
| 10/28/09 | <1 | <10 | <200 | <1 | <2 | <5 | <50 | <25 | <3 | <40 | | <5 | <1 | <50 | <20 |
| 03/03/10 | <1 | <10 | <200 | <1 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <1 | <50 | <20 |
| 05/27/10 | <5 | <5 | 85.1 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 29.2 | <100 |
| 11/19/10 | <5 | <5 | 105 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 29.8 | <100 |
| 05/11/11 | <5 | <5 | 108 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 33.3 | <100 |
| 11/16/11 | <5 | <5 | 105 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 32.1 | <100 |

Note: Duplicate dates indicate blind duplicate samples.

## Table 9
## Appendix I Total Metal Data

| Sampling Date | Antimony (µg/L) | Arsenic (µg/L) | Barium (µg/L) | Beryllium (µg/L) | Cadmium (µg/L) | Chromium (µg/L) | Cobalt (µg/L) | Copper (µg/L) | Lead (µg/L) | Nickel (µg/L) | Selenium (µg/L) | Silver (µg/L) | Thallium (µg/L) | Vanadium (µg/L) | Zinc (µg/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **MW-7RR** | | | | | | | | | | | | | | | |
| 05/16/06 | | <10 | <200 | | <2 | <5 | | <25 | <3 | | 18.8 | | | | |
| 07/07/06 | | <10 | <200 | | <2 | <5 | | <25 | <3 | | 17.5 | | | | |
| 11/08/06 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 16.1 | <5 | <2 | <50 | 20.4 |
| 02/21/07 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 14.3 | <5 | <2 | <50 | <20 |
| 04/25/07 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 14.1 | <5 | <2 | <50 | <20 |
| 09/12/07 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 15.9 | <5 | <2 | <50 | <20 |
| 10/30/07 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 13.1 | <5 | <2 | <50 | <20 |
| 02/20/08 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 12.2 | <5 | <2 | <50 | <20 |
| 04/29/08 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 11.6 | <5 | <2 | <50 | <20 |
| 08/26/08 | <6 | | | <4 | | | <50 | | | <40 | | <5 | <2 | <50 | <20 |
| 11/05/08 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 14.3 | <5 | <2 | <50 | <20 |
| 05/05/09 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 15.3 | <5 | <2 | <50 | <20 |
| 10/28/09 | <1 | <10 | <200 | <1 | <2 | <5 | <50 | <25 | <3 | <40 | 15.2 | <5 | <1 | <50 | <20 |
| 05/26/10 | <5 | <5 | 34.6 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 14.3 | <100 |
| 11/17/10 | <5 | <5 | 34.1 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 14.7 | <100 |
| 05/11/11 | <5 | <5 | 34.4 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 15.4 | <100 |
| 11/16/11 | <5 | <5 | 30.7 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 13.4 | <100 |
| **MW-8R** | | | | | | | | | | | | | | | |
| 05/15/06 | | <10 | <200 | | <2 | <5 | | <25 | <3 | | 8.9 | | | | |
| 07/06/06 | | <10 | <200 | | <2 | <5 | | <25 | <3 | | 9.3 | | | | |
| 11/08/06 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 5.8 | <5 | <2 | <50 | <20 |
| 02/21/07 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | 44.6 | 10.1 | <5 | <2 | <50 | 20.9 |
| 04/24/07 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 09/11/07 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 7.4 | <5 | <2 | <50 | <20 |
| 10/31/07 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 13 | <5 | <2 | <50 | <20 |
| 02/19/08 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 15.0 | <5 | <2 | <50 | <20 |
| 04/29/08 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 16.7 | <5 | <2 | <50 | <20 |
| 08/26/08 | <6 | | | <4 | | | <50 | | | <40 | | <5 | <2 | <50 | <20 |
| 11/04/08 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 15.0 | <5 | <2 | <50 | <20 |
| 05/05/09 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 8.72 | <5 | <2 | <50 | <20 |
| 10/27/09 | <1 | <10 | <200 | <1 | <2 | <5 | <50 | <25 | <3 | <40 | 9.70 | <5 | <1 | <50 | <20 |
| 05/25/10 | <5 | <5 | 63.7 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | <10 | <100 |
| 11/15/10 | <5 | <5 | 140 | <4 | <2 | <20 | <5 | <10 | <15 | 20.9 | <50 | <10 | <1 | 11.4 | <100 |
| 05/10/11 | <5 | <5 | 74.1 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 12.4 | <100 |
| 11/15/11 | <5 | 8.10 | 166 | <4 | <2 | <20 | <5 | <10 | <15 | 23.3 | <50 | <10 | <1 | <10 | <100 |

Note: Duplicate dates indicate blind duplicate samples.

## Table 9
## Appendix I Total Metal Data

| Sampling Date | Antimony (µg/L) | Arsenic (µg/L) | Barium (µg/L) | Beryllium (µg/L) | Cadmium (µg/L) | Chromium (µg/L) | Cobalt (µg/L) | Copper (µg/L) | Lead (µg/L) | Nickel (µg/L) | Selenium (µg/L) | Silver (µg/L) | Thallium (µg/L) | Vanadium (µg/L) | Zinc (µg/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **MW-9R** | | | | | | | | | | | | | | | |
| 05/15/06 | | <10 | <200 | | <2 | <5 | | <25 | <3 | | 5.1 | | | | |
| 07/06/06 | | <10 | <200 | | <2 | <5 | | <25 | <3 | | <5 | | | | |
| 11/07/06 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 11.9 | <5 | <2 | <50 | <20 |
| 02/21/07 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 13.8 | <5 | <2 | <50 | <20 |
| 04/24/07 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 6.2 | <5 | <2 | <50 | <20 |
| 09/11/07 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 10/31/07 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 02/19/08 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 7.7 | <5 | <2 | <50 | <20 |
| 04/29/08 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 13.1 | <5 | <2 | <50 | <20 |
| 08/26/08 | <6 | | | <4 | | | <50 | | | <40 | | <5 | <2 | <50 | <20 |
| 11/04/08 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 7.7 | <5 | <2 | <50 | <20 |
| 05/05/09 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 11.9 | <5 | <2 | <50 | <20 |
| 10/27/09 | <1 | <10 | <200 | <1 | <2 | <5 | <50 | <25 | <3 | <40 | 11.9 | <5 | <1 | <50 | <20 |
| 05/25/10 | <5 | <5 | 162 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 14.8 | <100 |
| 11/17/10 | <5 | <5 | 45.5 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | <10 | <100 |
| 05/10/11 | <5 | <5 | 39.8 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | <10 | <100 |
| 11/15/11 | <5 | <5 | 39.2 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | <10 | <100 |
| **MW-10R** | | | | | | | | | | | | | | | |
| 05/15/06 | | <10 | <200 | | <2 | <5 | | <25 | <3 | | 7.3 | | | | |
| 07/07/06 | | <10 | <200 | | <2 | <5 | | <25 | <3 | | <5 | | | | |
| 11/08/06 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 02/21/07 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 04/24/07 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 09/11/07 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 5.2 | <5 | <2 | <50 | <20 |
| 10/31/07 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 6.2 | <5 | <2 | <50 | <20 |
| 02/19/08 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 04/29/08 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 6.6 | <5 | <2 | <50 | <20 |
| 05/21/08 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 6.2 | <5 | <2 | <50 | <20 |
| 08/26/08 | <6 | | | <4 | | | <50 | | | <40 | | <5 | <2 | <50 | <20 |
| 11/05/08 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 05/05/09 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 10/27/09 | <1 | <10 | <200 | <1 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <1 | <50 | <20 |
| 05/25/10 | <5 | <5 | 46.7 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 30.6 | <100 |
| 11/19/10 | <5 | <5 | 44.7 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 28.2 | <100 |
| 05/10/11 | <5 | <5 | 40.3 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 30.8 | <100 |
| 11/15/11 | <5 | <5 | 37.3 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 29.5 | <100 |

Note: Duplicate dates indicate blind duplicate samples.

# Table 9
## Appendix I Total Metal Data

| Sampling Date | Antimony (µg/L) | Arsenic (µg/L) | Barium (µg/L) | Beryllium (µg/L) | Cadmium (µg/L) | Chromium (µg/L) | Cobalt (µg/L) | Copper (µg/L) | Lead (µg/L) | Nickel (µg/L) | Selenium (µg/L) | Silver (µg/L) | Thallium (µg/L) | Vanadium (µg/L) | Zinc (µg/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **MW-11R** | | | | | | | | | | | | | | | |
| 05/15/06 | | <10 | <200 | | <2 | <5 | | <25 | <3 | | <5 | | | | |
| 07/07/06 | | <10 | <200 | | <2 | <5 | | <25 | <3 | | <5 | | | | |
| 11/08/06 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 02/21/07 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 04/25/07 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 09/12/07 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 10/31/07 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 02/20/08 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 04/29/08 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 08/26/08 | <6 | | | <4 | | | <50 | | | <40 | | <5 | <2 | <50 | <20 |
| 11/05/08 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 05/05/09 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 5.01 | <5 | <2 | <50 | <20 |
| 10/27/09 | <1 | <10 | <200 | <1 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <1 | <50 | <20 |
| 05/25/10 | <5 | 5.47 | 160 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 61.7 | <100 |
| 11/19/10 | <5 | <5 | 90.4 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 38.0 | <100 |
| 05/10/11 | <5 | <5 | 136 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 37.2 | <100 |
| 11/15/11 | <5 | 5.50 | 117 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 40.7 | <100 |
| **MW-12** | | | | | | | | | | | | | | | |
| 05/15/06 | | <10 | <200 | | <2 | <5 | | <25 | <3 | | <5 | | | | |
| 07/07/06 | | <10 | <200 | | <2 | <5 | | <25 | <3 | | <5 | | | | |
| 11/08/06 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 02/21/07 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 04/25/07 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 09/12/07 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 10/31/07 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 02/20/08 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 04/29/08 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 08/26/08 | <6 | | | <4 | | | <50 | | | <40 | | <5 | <2 | <50 | <20 |
| 11/05/08 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 05/06/09 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 10/27/09 | <1 | <10 | <200 | <1 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <1 | <50 | <20 |
| 05/25/10 | <5 | <5 | 59.9 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 34.4 | <100 |
| 11/19/10 | <5 | <5 | 67.4 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 31.1 | <100 |
| 05/11/11 | <5 | <5 | 81.3 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 32.1 | <100 |
| 11/16/11 | <5 | <5 | 63.4 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 31.9 | <100 |

Note: Duplicate dates indicate blind duplicate samples.

## Table 9
## Appendix I Total Metal Data

| Sampling Date | Antimony (µg/L) | Arsenic (µg/L) | Barium (µg/L) | Beryllium (µg/L) | Cadmium (µg/L) | Chromium (µg/L) | Cobalt (µg/L) | Copper (µg/L) | Lead (µg/L) | Nickel (µg/L) | Selenium (µg/L) | Silver (µg/L) | Thallium (µg/L) | Vanadium (µg/L) | Zinc (µg/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **MW-13** | | | | | | | | | | | | | | | |
| 05/16/06 | | <10 | <200 | | <2 | <5 | | <25 | <3 | | <5 | | | | |
| 07/10/06 | | <10 | <200 | | <2 | <5 | | <25 | <3 | | <5 | | | | |
| 11/08/06 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 02/21/07 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 04/25/07 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 09/12/07 | <6 | 12.1 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 11/01/07 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 02/20/08 | <6 | 14.1 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 04/29/08 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 08/27/08 | <6 | | | <4 | | | <50 | | | <40 | | <5 | <2 | <50 | <20 |
| 11/06/08 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 05/06/09 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 10/28/09 | 2.00 | <10 | <200 | <1 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <1 | <50 | <20 |
| 05/27/10 | <5 | 7.10 | 92.8 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | <10 | <100 |
| 11/18/10 | <5 | 6.16 | 101 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | <10 | <100 |
| 05/11/11 | <5 | <5 | 105 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | <10 | <100 |
| 11/16/11 | <5 | <5 | 99.3 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 23.3 | <100 |
| **MW-14** | | | | | | | | | | | | | | | |
| 05/16/06 | | <10 | <200 | | <2 | <5 | | <25 | <3 | | 60 | | | | |
| 07/10/06 | | <10 | <200 | | <2 | <5 | | <25 | <3 | | 16.7 | | | | |
| 11/09/06 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 6.7 | <5 | <2 | <50 | <20 |
| 02/22/07 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 10.4 | <5 | <2 | <50 | <20 |
| 04/26/07 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 9.2 | <5 | <2 | <50 | <20 |
| 09/12/07 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 10.2 | <5 | <2 | <50 | <20 |
| 11/01/07 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 10.6 | <5 | <2 | <50 | <20 |
| 02/21/08 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 15.4 | <5 | <2 | <50 | <20 |
| 04/30/08 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | <5 | <5 | <2 | <50 | <20 |
| 08/27/08 | <6 | | | <4 | | | <50 | | | <40 | | <5 | <2 | <50 | <20 |
| 11/06/08 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 37.2 | <5 | <2 | <50 | <20 |
| 05/06/09 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 63.1 | <5 | <2 | <50 | <20 |
| 10/27/09 | <1 | <10 | <200 | <1 | <2 | <5 | <50 | <25 | <3 | <40 | 8.10 | <5 | <1 | <50 | <20 |
| 05/25/10 | <5 | <5 | 34.0 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 22.3 | <100 |
| 11/18/10 | <5 | <5 | 33.8 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 24.1 | <100 |
| 05/11/11 | <5 | <5 | 39.4 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | 65.3 | <10 | <1 | 12.0 | <100 |
| 11/15/11 | <5 | <5 | 37.6 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | 63.7 | <10 | <1 | 11.6 | <100 |

Note: Duplicate dates indicate blind duplicate samples.

## Table 9
## Appendix I Total Metal Data

| Sampling Date | Antimony (µg/L) | Arsenic (µg/L) | Barium (µg/L) | Beryllium (µg/L) | Cadmium (µg/L) | Chromium (µg/L) | Cobalt (µg/L) | Copper (µg/L) | Lead (µg/L) | Nickel (µg/L) | Selenium (µg/L) | Silver (µg/L) | Thallium (µg/L) | Vanadium (µg/L) | Zinc (µg/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MW-15 | | | | | | | | | | | | | | | |
| 05/16/06 | | <10 | <200 | | <2 | <5 | | <25 | <3 | | 21.6 | | | | |
| 07/07/06 | | <10 | <200 | | <2 | <5 | | <25 | <3 | | 19.8 | | | | |
| 11/08/06 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 32 | <5 | <2 | <50 | <20 |
| 02/21/07 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 28.6 | <5 | <2 | <50 | <20 |
| 04/25/07 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 26.9 | <5 | <2 | <50 | <20 |
| 09/11/07 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 27.7 | <5 | <2 | <50 | <20 |
| 09/11/07 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 22.6 | <5 | <2 | <50 | <20 |
| 10/30/07 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 19.7 | <5 | <2 | <50 | <20 |
| 02/19/08 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 19.6 | <5 | <2 | <50 | <20 |
| 04/29/08 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 19.7 | <5 | <2 | <50 | <20 |
| 08/26/08 | <6 | | | <4 | | | <50 | | | <40 | | <5 | <2 | <50 | <20 |
| 11/05/08 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 19.7 | <5 | <2 | <50 | <20 |
| 11/05/08 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 22.2 | <5 | <2 | <50 | <20 |
| 05/05/09 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 28.7 | <5 | <2 | <50 | <20 |
| 10/27/09 | <1 | <10 | <200 | <1 | <2 | <5 | <50 | <25 | <3 | <40 | 28.2 | <5 | <1 | <50 | <20 |
| 05/25/10 | <5 | <5 | 28.5 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 24.4 | <100 |
| 11/18/10 | <5 | <5 | 26.0 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 24.0 | <100 |
| 05/10/11 | <5 | <5 | 29.9 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 23.2 | <100 |
| 11/15/11 | <5 | <5 | 28.5 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 23.4 | <100 |

Note: Duplicate dates indicate blind duplicate samples.

## Table 9
## Appendix I Total Metal Data

| Sampling Date | Antimony (µg/L) | Arsenic (µg/L) | Barium (µg/L) | Beryllium (µg/L) | Cadmium (µg/L) | Chromium (µg/L) | Cobalt (µg/L) | Copper (µg/L) | Lead (µg/L) | Nickel (µg/L) | Selenium (µg/L) | Silver (µg/L) | Thallium (µg/L) | Vanadium (µg/L) | Zinc (µg/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **MW-16** | | | | | | | | | | | | | | | |
| 05/17/06 | | <10 | <200 | | <2 | <5 | | <25 | <3 | | 16.4 | | | | |
| 07/07/06 | | <10 | <200 | | <2 | <5 | | <25 | <3 | | 13.8 | | | | |
| 11/08/06 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 13.5 | <5 | <2 | <50 | <20 |
| 02/21/07 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 15.1 | <5 | <2 | <50 | <20 |
| 04/25/07 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 18.9 | <5 | <2 | <50 | <20 |
| 09/11/07 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 13.5 | <5 | <2 | <50 | <20 |
| 10/30/07 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 10.4 | <5 | <2 | <50 | <20 |
| 02/20/08 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 10.5 | <5 | <2 | <50 | <20 |
| 04/29/08 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 12.6 | <5 | <2 | <50 | <20 |
| 08/26/08 | <6 | | | <4 | | | <50 | | | <40 | | <5 | <2 | <50 | <20 |
| 08/26/08 | <6 | | | <4 | | | <50 | | | <40 | | <5 | <2 | <50 | <20 |
| 11/04/08 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 14.5 | <5 | <2 | <50 | <20 |
| 05/05/09 | <6 | <10 | <200 | <4 | <2 | <5 | <50 | <25 | <3 | <40 | 15.5 | <5 | <2 | <50 | <20 |
| 10/28/09 | <1 | <10 | <200 | <1 | <2 | <5 | <50 | <25 | <3 | <40 | 15.5 | <5 | <1 | <50 | 34.9 |
| 10/28/09 | <1 | <10 | <200 | <1 | <2 | <5 | <50 | <25 | <3 | <40 | 14.7 | <5 | <1 | <50 | <20 |
| 03/03/10 | | | | | | | | | | | | | | | <20 |
| 05/26/10 | <5 | <5 | 25.4 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 30.7 | <100 |
| 11/16/10 | <5 | <5 | 27.0 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 30.5 | <100 |
| 11/16/10 | <5 | <5 | 26.1 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 28.0 | <100 |
| 05/11/11 | <5 | <5 | 28.7 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 27.8 | <100 |
| 11/16/11 | <5 | <5 | 22.6 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 32.3 | <100 |
| **MW-17** | | | | | | | | | | | | | | | |
| 05/27/10 | <5 | <5 | 42.8 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 28.2 | <100 |
| 08/25/10 | <5 | <5 | 38.8 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 26.1 | <100 |
| 08/25/10 | <5 | <5 | 40.9 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 27.8 | <100 |
| 11/18/10 | <5 | <5 | 42.6 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 28.4 | <100 |
| 02/16/11 | <5 | <5 | 43.2 | <4 | <2 | <20 | 6.10 | <10 | <15 | <20 | <50 | <10 | <1 | 30.3 | <100 |
| 05/11/11 | <5 | <5 | 42.1 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 28.3 | <100 |
| 05/11/11 | <5 | <5 | 42.0 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 28.7 | <100 |
| 08/31/11 | <5 | <5 | 41.1 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 28.2 | <100 |
| 08/31/11 | <5 | <5 | 41.0 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 28.6 | <100 |
| 11/16/11 | <5 | <5 | 41.6 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 27.4 | <100 |
| 03/01/12 | <5 | <5 | 42.7 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 28.9 | <100 |

Note: Duplicate dates indicate blind duplicate samples.

## Table 9
## Appendix I Total Metal Data

| Sampling Date | Antimony (µg/L) | Arsenic (µg/L) | Barium (µg/L) | Beryllium (µg/L) | Cadmium (µg/L) | Chromium (µg/L) | Cobalt (µg/L) | Copper (µg/L) | Lead (µg/L) | Nickel (µg/L) | Selenium (µg/L) | Silver (µg/L) | Thallium (µg/L) | Vanadium (µg/L) | Zinc (µg/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **MW-18** | | | | | | | | | | | | | | | |
| 05/27/10 | <5 | <5 | 48.0 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 34.6 | <100 |
| 08/25/10 | <5 | 18.4 | 42.9 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 40.7 | <100 |
| 11/19/10 | <5 | 14.7 | 49.9 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 31.6 | <100 |
| **MW-19** | | | | | | | | | | | | | | | |
| 05/26/10 | <5 | <5 | 98.8 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 34.4 | <100 |
| 08/25/10 | <5 | <5 | 115 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 21.2 | <100 |
| 11/19/10 | <5 | <5 | 118 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 22.2 | <100 |
| 02/16/11 | <5 | <5 | 122 | <4 | <2 | <20 | 7.20 | <10 | <15 | <20 | <50 | <10 | <1 | 27.6 | <100 |
| 05/11/11 | <5 | <5 | 115 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 25.4 | <100 |
| 08/31/11 | <5 | <5 | 98.4 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 26.3 | <100 |
| 11/15/11 | <5 | <5 | 114 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 25.6 | <100 |
| 02/29/12 | <5 | <5 | 115 | <4 | 2.30 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 28.3 | <100 |
| **MW-20** | | | | | | | | | | | | | | | |
| 05/26/10 | <5 | <5 | 302 | <4 | <2 | <20 | 5.03 | <10 | <15 | <20 | <50 | <10 | <1 | 22.5 | <100 |
| **MW-21** | | | | | | | | | | | | | | | |
| 05/26/10 | <5 | 5.90 | 120 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 29.4 | <100 |
| 08/24/10 | <5 | <5 | 58.5 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 27.7 | <100 |
| 11/17/10 | <5 | <5 | 52.0 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 31.1 | <100 |
| 02/15/11 | <5 | <5 | 52.6 | <4 | <2 | <20 | 5.20 | <10 | <15 | <20 | <50 | <10 | <1 | 33.5 | <100 |
| 05/10/11 | <5 | <5 | 50.2 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 29.5 | <100 |
| 08/30/11 | <5 | <5 | 51.3 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 28.9 | <100 |
| 11/15/11 | <5 | <5 | 51.8 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 28.1 | <100 |
| 02/29/12 | <5 | <5 | 59.4 | <4 | 2.00 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 29.2 | <100 |
| **MW-22** | | | | | | | | | | | | | | | |
| 05/26/10 | <5 | <5 | 45.7 | <4 | <2 | <20 | 5.60 | <10 | <15 | <20 | <50 | <10 | <1 | 23.7 | <100 |
| 08/24/10 | <5 | <5 | 41.9 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 22.1 | <100 |
| 11/15/10 | <5 | <5 | 43.9 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 23.0 | <100 |
| 02/15/11 | <5 | <5 | 45.3 | <4 | <2 | <20 | 5.40 | <10 | <15 | <20 | <50 | <10 | <1 | 25.5 | <100 |
| 05/10/11 | <5 | <5 | 39.9 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 24.2 | <100 |
| 08/30/11 | <5 | 5.28 | 45.2 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 25.3 | <100 |
| 11/15/11 | <5 | <5 | 44.9 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 27.4 | <100 |
| 02/29/12 | <5 | <5 | 46.0 | <4 | 2.00 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 27.7 | <100 |

Note: Duplicate dates indicate blind duplicate samples.

## Table 9
## Appendix I Total Metal Data

| Sampling Date | Antimony (µg/L) | Arsenic (µg/L) | Barium (µg/L) | Beryllium (µg/L) | Cadmium (µg/L) | Chromium (µg/L) | Cobalt (µg/L) | Copper (µg/L) | Lead (µg/L) | Nickel (µg/L) | Selenium (µg/L) | Silver (µg/L) | Thallium (µg/L) | Vanadium (µg/L) | Zinc (µg/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **MW-23** | | | | | | | | | | | | | | | |
| 05/26/10 | <5 | <5 | 49.4 | <4 | <2 | <20 | 5.90 | <10 | <15 | <20 | <50 | <10 | <1 | 17.1 | <100 |
| 05/26/10 | <5 | <5 | 50.1 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 17.0 | <100 |
| 08/24/10 | <5 | <5 | 29.6 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 20.5 | <100 |
| 11/18/10 | <5 | <5 | 32.4 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 21.7 | <100 |
| 02/16/11 | <5 | <5 | 46.0 | <4 | <2 | <20 | 5.00 | <10 | <15 | <20 | <50 | <10 | <1 | 22.0 | <100 |
| 05/10/11 | <5 | <5 | 49.4 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 19.3 | <100 |
| 08/30/11 | <5 | <5 | 45.8 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 19.8 | <100 |
| 11/15/11 | <5 | <5 | 38.8 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 15.7 | <100 |
| 02/29/12 | <5 | 6.48 | 75.9 | <4 | 2.00 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 12.3 | <100 |
| **MW-24** | | | | | | | | | | | | | | | |
| 05/26/10 | <5 | <5 | 66.8 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 15.9 | <100 |
| 08/24/10 | <5 | <5 | 35.4 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 20.8 | <100 |
| 11/18/10 | <5 | <5 | 34.2 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 26.5 | <100 |
| 02/16/11 | <5 | <5 | 33.9 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 27.3 | <100 |
| 02/16/11 | <5 | <5 | 33.9 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 27.2 | <100 |
| 05/10/11 | <5 | <5 | 29.3 | <4 | <2 | <20 | <5 | <10 | <15 | 20.9 | <50 | <10 | <1 | 25.2 | <100 |
| 08/30/11 | <5 | <5 | 27.2 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 22.9 | <100 |
| 11/15/11 | <5 | <5 | 27.9 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 25.7 | <100 |
| 02/29/12 | <5 | <5 | 26.8 | <4 | <2 | <20 | <5 | <10 | <15 | <20 | <50 | <10 | <1 | 26.2 | <100 |

Note: Duplicate dates indicate blind duplicate samples.

# 4 GROUNDWATER FLOW RATE AND DIRECTION

The following is provided in compliance with §330.415(e)(3), which states that the annual corrective action report shall include; *the groundwater flow rate and direction in the uppermost aquifer. The groundwater flow rate and direction of groundwater flow shall be established using the data collected during the preceding calendar year's sampling events from the monitoring wells of the Corrective Action Program. The owner or operator shall also include in the report all documentation used to determine the groundwater flow rate and direction of groundwater flow.*

Groundwater flow directions were evaluated by constructing potentiometric surface maps for the 2012 monitoring events (Figures D.1 through D.4). Groundwater within the Leona Aquifer flows perpendicular to water level elevation isopleth lines and flows generally to the south across the site. However, groundwater flows at oblique angles to the point of compliance at the eastern boundary of the site and occasionally at the western boundary of the site. After groundwater advances through the site to the south, flow direction becomes south-southeasterly generally toward the Concho River.

Historical groundwater velocities within the Leona interval vary from less than 2 feet per year to about 47 feet per year, depending on the lithology. Historical hydraulic conductivities of the various Leona lithologies are shown in Table 10. The groundwater gradient across the site is about .005 feet/foot (see Appendix D). Calculated historical groundwater velocities are shown by lithology in Table 10. The predominant lithology in the Leona at the site is clayey gravel. In addition, the lithology on the south end of the site, which is the downgradient point of compliance, is predominately clayey gravel and conglomerate. The groundwater velocity for clayey gravel is calculated to be about 4 feet per year. The groundwater velocity for the conglomerate is calculated to be less than 2 feet per year.

Groundwater flow velocities for the 2012 monitoring events are calculated in Appendix C and listed in Table 11. The 2012 flow velocities are consistent with historical values.

**Table 10**
**Historical Groundwater Flow Velocities**

| Lithology | From Slug Test in Wells | Hydraulic Conductivity ($^{cm}/_{sec}$) | Velocity ($^{ft}/_{year}$) |
|---|---|---|---|
| Overall | All Wells | $2.80 \times 10^{-4}$ | 2.89 |
| Clayey Gravel | MW-7RR, MW-8R, MW-5, MW-15 | $3.93 \times 10^{-4}$ | 4.07 |
| Conglomerate | MW-6R, MW-13, MW-16 | $1.37 \times 10^{-4}$ | 1.42 |
| Gravel | MW-8 | $4.58 \times 10^{-3}$ | 47 |

## Table 11
## 2012 Groundwater Flow Velocities

| Groundwater Monitoring Event | Velocity* ($^{ft}/_{year}$) |
|---|---|
| February/March 2012 | **4.83** |
| May 2012 | **4.83** |
| August 2012 | **4.83** |
| October 2012 | **4.83** |

*for all monitoring wells

# 5 POTENTIOMETRIC SURFACE AND WATER LEVELS

The following is provided in compliance with §330.415(e)(4), which states that the annual corrective action report shall include; *a contour map of piezometric water levels in the uppermost aquifer based at a minimum upon concurrent measurement in all monitoring wells. All data or documentation used to establish the contour map should be included in the report;*

Potentiometric surface maps were constructed using groundwater elevations measured during the February/March, May, August, and October 2012 sampling events (see Appendix D). The potentiometric surface for groundwater in the uppermost aquifer is illustrated in Figures D.1 through D.4. The groundwater elevations used to produce these maps are tabulated in Figures D.1 through D.4.

# 6 RECOMMENDATION

The following is provided in compliance with §330.415(e)(5), which states that the annual corrective action report shall include *recommendation for any changes.*

Groundwater monitoring in 2012 indicates that the groundwater quality at San Angelo Landfill is continuing to improve, as a result of the activation of the LFG extraction system. Trends in groundwater quality are discussed in Section 7. In addition to the declining concentrations of LFG related compounds in the groundwater, consistent with quarterly readings since December 2006, there were no LFG detections in perimeter gas probes, other than a low-level reading of 0.3% at GMP-10A in the fourth quarter of 2012. This detection was well below the regulatory limit of 5%.

With steadily declining VOC concentrations being observed each year, the groundwater monitoring and statistical analysis results demonstrate that the LFG extraction system has been effective in controlling the source of VOCs in the groundwater. Because groundwater quality is continuing to improve, it is recommended that the LFG extraction system continue operating under its current configuration and that the effectiveness of the system in removing organic compounds from the groundwater be evaluated annually, as part of the annual corrective action monitoring report.

Quarterly monitoring for VOCs at the 22 site wells and 3 offsite wells will continue in 2013. Semiannual monitoring for Appendix I total metals is scheduled for May and November 2013. Groundwater sampling and reporting in 2013 will be conducted in accordance with the Subchapter J rules, the approved corrective action monitoring plan, and the GWSAP. At this time, there is no recommended change for the groundwater monitoring program.

# 7 STATUS OF CORRECTIVE ACTION

As previously stated, the site is in corrective action because of VOC detections at statistically significant levels above groundwater protection standards. In accordance with the corrective action plan approved by the TCEQ in March 2006, a LFG collection and control system was installed at the landfill and the system became operational in October 2006. Monitoring for VOCs is being conducted quarterly at all wells, including three offsite wells. The 2006 hydrogeologic study demonstrated that it is unlikely that VOCs from the landfill could have migrated to the offsite locations about ½ mile south.

Statistical analysis of the VOC data is conducted quarterly and the results are documented in the Site Operating Record and reported to the TCEQ (see Table 1). The statistically significant levels of VOCs above MCLs or groundwater protection standards have been steadily decreasing since the LFG system became operational. The VOC data provided in Tables 12 and 13 demonstrate the overall decreases that have been observed historically at the older monitoring well locations. Statistical exceedances in VOCs that occurred five years ago (Table 12) are compared to the current (October 2012) statistical exceedances at the older wells (Table 13). Further comparisons and the observed improvements in groundwater quality are discussed on the following page.

**Table 12**
**November 2007 Statistically Significant Levels of VOCs above MCLs**

| Well No. | cis-1,2-Dichloroethene MCL 70 µg/L | Tetrachloroethene MCL 5 µg/L | Trichloroethene MCL 5 µg/L | Vinyl chloride MCL 2 µg/L |
|---|---|---|---|---|
| MW-4R | | 9.5 | | |
| MW-5R | | 12.5 | 17.4 | 2.5 |
| MW-6R | | 8.2 | | |
| MW-9R | | 9.6 | 5.8 | 2.7 |
| MW-10R | | 6.1 | 8.4 | 3.6 |
| MW-13 | 120 | 8.0 | 15.9 | 29.0 |
| MW-14 | | 6.5 | | |
| MW-15 | | 16.8 | | |

Note: Concentrations are in µg/L. A blank cell indicates no statistical exceedance.

**Table 13**
**October 2012 Statistically Significant Levels of VOCs above MCLs**
**(Older Wells for Comparison to Exceedances in Table 12))**

| Well No. | Tetrachloroethene MCL 5 µg/L | Trichloroethene MCL 5 µg/L | Vinyl chloride MCL 2 µg/L |
|---|---|---|---|
| MW-4R | 6.24 | | |
| MW-5R | 7.89 | 5.04 | |
| MW-9R | 7.59 | | |
| MW-10R | | 7.51 | |
| MW-13 | 6.54 | 6.49 | 2.14 |
| MW-15 | 7.19 | | |

Note: Concentrations are in µg/L. A blank cell indicates no statistical exceedance.

Historically, the constituents of concern have been cis-1,2-dichloroethene, methylene chloride, tetrachloroethene (PCE), trichloroethene (TCE), and vinyl chloride. Methylene chloride and cis-1,2-dichloroethene are no longer constituents of concern. As shown in Tables 12 and 13, the current VOC exceedances at the older wells are much lower in concentration than the exceedances reported five years ago, and at several locations, the VOCs are absent. There are no longer any constituents of concern at MW-6R and MW-14. PCE is no longer a constituent of concern at MW-10R and TCE is no longer a concern at MW-9R. Vinyl chloride is a constituent of concern only at MW-13 and the current statistical exceedance in vinyl chloride (2.14 µg/L) is only slightly above the MCL of 2 µg/L (see Table 13).

We have also observed improvements in the statistically significant levels of VOCs at the newer monitoring wells. Since last year, the statistically significant levels of PCE at MW-17, MW-19, and MW-23 have decreased, with the current levels at MW-19 and MW-23 only slightly above the MCL for PCE (5 µg/L). Currently, PCE is no longer a constituent of concern at MW-22 and the level of TCE at MW-21 (5.01 µg/L) only slightly exceeds the MCL for TCE (5 µg/L).

It should be noted that the statistical analysis procedure for VOC detections at this facility (upper confident limits) requires VOC data from the most recent four quarterly events. In the upper confidence limit calculation, one-half the MSW-PQL is used for non-detects. A statistical exceedance may still occur for a VOC even though the compound is not detected at the well. Vinyl chloride at MW-13 is a good example. Vinyl chloride was detected at MW-13 only once in 2012 (at 2.36 µg/L in May 2012); however, the current upper confidence limit for vinyl chloride is still slightly above the MCL (see Table 13). In this case, vinyl chloride may need to be absent (non-detect) for four consecutive events, before a statistical exceedance can be avoided.

Because the statistical results are not necessarily representative of current groundwater conditions, better comparisons can be made by looking at the actual VOC detections. To illustrate trends in the historical VOC data, Time Series graphs were created for the constituents of concern, using laboratory data collected since 2006. The Time Series graphs are provided in Appendix E. As illustrated in most graphs, VOC detections in the older wells are slowly declining and many compounds are now absent (<MSW-PQLs).

The most significant improvement in groundwater quality was observed during the recent October 2012 monitoring event. In the October 2012 laboratory results, all VOC detections at the landfill were below groundwater protection standards, except PCE at MW-17. The October 2012 PCE detection of 5.65 µg/L at MW-17 was only slightly above the MCL for this compound (5 µg/L) and all other VOC detections at the landfill were below groundwater protection standards. Other improvements observed in the October 2012 VOC results included no detections of PCE at MW-4R, MW-5R, MW-9R, MW-13, MW-15, MW-19, and MW-23 and no detections of TCE or vinyl chloride at any of the site well locations.

Other comparisons can be made using the total volume of the organic constituents of concern. Since the implementation and continued operation of the LFG collection and control system over much of the site, the total volume of the organic constituents continues to decline, indicating that the selected corrective action remedy is working and should be continued. A summary of the total concentrations of organic constituents of concern is shown in Tables 14 and 15. The total VOC concentration is the sum of all

detections of constituents of concern at each well for a specific monitoring event. When compared to historic highs in each well (see Tables 14 and 15), the current VOC data show significant declines in concentrations at all of the older and newer monitoring well locations.

**Table 14**
**Total VOC Concentrations in Older Monitoring Wells**
**for Constituents of Concern**
*(Reported in µg/L)*

| | MW-4R | MW-5R | MW-6R | MW-8R | MW-9R | MW-10R | MW-11R | MW-12 | MW-13 | MW-14 | MW-15 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Highest Value** | 15.9 | 111.3 | 13.5 | 5.7 | 73.3 | 77.9 | 21.0 | 34.1 | 145.0 | 17.3 | 26.2 |
| **Most Recent Monitoring Event (October 2012)** | 0.0 | 4.26 | 0.0 | 0.0 | 17.5 | 19.2 | 0.0 | 0.0 | 9.61 | 0.0 | 0.0 |
| **Percentage of Concentration Reduction** | 100% | 96% | 100% | 100% | 76% | 75% | 100% | 100% | 93% | 100% | 100% |

As shown in Table 14, there are no VOC detections at seven of the older monitoring wells, indicating a 100% reduction at that location. The other four older wells display various degrees of significant decline in the VOCs, ranging from 75% to 96% improvement. This illustrates an overall dramatic improvement in the groundwater quality.

**Table 15**
**Total VOC Concentrations in New Monitoring Wells**
**for Constituents of Concern**
*(Reported in µg/L)*

| | MW-17 | MW-19 | MW-21 | MW-22 | MW-23 | MW-24 |
|---|---|---|---|---|---|---|
| **Highest Value** | 11.14 | 6.99 | 43.83 | 18.68 | 7.93 | 6.21 |
| **Most Recent Monitoring Event (October 2012)** | 8.06 | 0.0 | 17.3 | 3.62 | 0.0 | 0.0 |
| **Percentage of Concentration Reduction** | 27.65% | 100% | 60.53% | 80.62% | 100% | 100% |

Table 15 illustrates that of the six new monitoring wells with historical VOC detections, three have shown a 100% reduction in VOCs and the other three new wells have shown a 28% to 81% overall improvement.

By comparing the total concentrations of VOCs currently detected in all monitoring wells (88.55 µg/L) to the highest total value in all wells ever detected (635.98 µg/L), an approximate reduction of 86% in VOC concentration is observed in the monitoring wells.

As demonstrated in this 2012 annual report, there has been considerable improvement in groundwater quality since operation of the LFG collection and control system. Continued improvement in groundwater quality is expected in 2013.