



**King County**

Department of Natural Resources and Parks  
**Solid Waste Division**

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CEDAR HILLS REGIONAL LANDFILL  
WEST SIDE LANDFILL GAS RECOVERY WELL  
INSTALLATION AND INFLUENCE TESTING  
REPORT

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December 2013





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December 2013

*Prepared for King County by:*

AMEC Environment & Infrastructure, Inc. and  
Herrera Environmental Consultants, Inc.





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# **CEDAR HILLS REGIONAL LANDFILL WEST SIDE LANDFILL GAS RECOVERY WELL INSTALLATION AND INFLUENCE TESTING REPORT**

Cedar Hills Regional Landfill  
Maple Valley, Washington

## **1.0 INTRODUCTION AND BACKGROUND**

In late 2011, the King County Solid Waste Division (KCSWD) requested that the AMEC team, consisting of AMEC Environment & Infrastructure, Inc. (AMEC) and Herrera Environmental Consultants, Inc. (Herrera), assist in developing a response to exceedances in methane concentrations in two of the western perimeter landfill gas (LFG) probes (GP-33C and GP-30B) at Cedar Hills Regional Landfill (CHRLF), under King County Contract E53019E. Figure 1 shows the location of CHRLF. When reviewing quarterly perimeter LFG probe data from GP-33C in September 2011, KCSWD noted that methane concentrations in three monthly readings from GP-33C exceeded the lower explosive limit (LEL) of 5 percent methane, with readings ranging from 6.6 to 20.5 percent. When these readings were collected, GP-33 was under positive pressure of up to 0.4 inch of water (KCSWD, 2011a and 2011b). Figure 2 is a detailed site map that shows the locations of the perimeter LFG probes along the western property boundary.

GP-33 is a multiple-completion LFG probe (GP-33A, GP-33B, and GP-33C) with three screened depths at approximately 7, 16, and 34 feet, respectively. The methane concentration increases were noted in GP-33C, the deepest of these LFG probes. GP-33 is one of nine multiple-completion perimeter LFG probes located along the western boundary of the CHRLF. After reviewing the methane data and confirming the readings, KCSWD sent a letter to inform Public Health–Seattle and King County, in accordance with Washington Administrative Code, Section 173-351-200, that daily LFG probe readings would be collected and that a mitigation plan was being developed. After daily measurements at GP-33 began in late September 2011, low concentrations of methane were detected in the shallower LFG probe (GP-33B), but none of these methane readings have exceeded the LEL.

Landfill operations staff collected daily perimeter LFG probe readings at eight of the perimeter LFG probes (GP-30 to GP-37) along the western perimeter of the landfill, starting in October 2011 (Figure 2). On October 28, 2011, an increase in methane above the LEL was detected in GP-30B during the daily survey of the perimeter LFG probes. Elevated methane readings ranging from 1.1 to 7.9 percent were observed, and pressures up to 1.9 inches of water were noted. A second letter documenting the exceedance at this LFG probe was sent to Public Health–Seattle and King County

(PH-SKC) on November 7, 2011 (KCSWD, 2011b). Like GP-33, GP-30 is a multiple-completion LFG probe (GP-30A and GP-30B) with two screened depths of 7 and 57 feet, respectively. No methane was observed in the shallower GP-30A probe.

KCSWD initiated a series of actions as part of the immediate response to address the methane exceedances of the LEL in these probes. Landfill operations staff performed the following actions:

- Began monitoring methane concentrations in the LFG probes on a daily basis starting in late September 2011.
- Increased LFG recovery flow rates using existing wells in unlined areas that could have contributed to increases of LFG concentration at GP-30 and GP-33, focusing on the South Solid Waste Area and the Main Hill (Figure 2).
- Retained an on-call industrial hygiene contractor on October 20, 2011, to conduct an initial survey of methane concentrations in indoor and ambient air at residences located within a 1,000-foot radius of GP-33.
- Conducted a second round of surveys at residences during the week of November 14, 2011, in response to the methane exceedances noted at GP-33C and GP-30B.
- Completed methane surveys at 11 of the 19 residences within 1,000 feet of these two probes.

Methane monitoring in the neighborhood did not detect any measurable concentrations of methane in the crawl spaces, basements, living areas, or exterior areas of any of the residences.

In addition to the actions described above, KCSWD increased LFG production from all extraction points throughout the Main Hill, Refuse Areas 2/3, Area 4, Area 5, and Area 6 (Figure 2). Landfill operations staff also started collecting LFG from the Refuse Area 6 and Refuse Area 7 hydraulic control system or underdrain, located under the bottom lining systems (Figure 3). The underdrain was constructed under the bottom liner to allow for the collection of perched groundwater, which had been encountered during construction of these two refuse areas. Part of the system includes piped and perforated conveyances. LFG has been recovered from the underdrain since early November 2011.

KCSWD then determined that additional recovery of LFG was needed along the west side of the landfill. KCSWD and the AMEC team reviewed the LFG probe methane data and visited CHRLF to review the existing data from the LFG probes, and to evaluate possible locations for recovering LFG along the west side of the landfill. An LFG mitigation plan was submitted to Public Health–Seattle, King County, and the Washington State Department of Ecology (Ecology) on November 21, 2011 (KCSWD, 2011c). The mitigation plan discussed the installation of LFG recovery wells along the West Haul road. A series of seven LFG wells (Phase 1) were installed in early January through late

February 2012 (Figure 3, See Section 2.1 for details). These wells were needed to establish control of LFG along the west side of the landfill.

After an initial attempt to test the influence of the first phase of wells resulted in a temporary loss of LFG control, King County determined that additional LFG monitoring points were needed to establish the extent of influence between the wells without necessarily having to shut off the existing LFG recovery wells. A second set (Phase 2) of six additional wells were installed during two separate mobilizations, one from August 2012 to September 2012 and a second during February 2013 (Figure 3). While these additional Phase 2 wells were designed and installed in a similar fashion as the Phase 1 wells, they were intended to function as LFG probes to allow for influence testing of the Phase 1 wells (AMEC, 2013), and were therefore not connected to the active extraction system.

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## **2.0 SUMMARY OF LFG WELL INSTALLATION**

This section summarizes the Phase 1 and Phase 2 LFG well installations and the geology encountered in these borings.

### **2.1 PHASE 1 WEST SIDE LFG RECOVERY WELL INSTALLATION**

In order to recover LFG from the higher-permeability stratified drift or advance outwash sediments underlying the glacial till, a series of seven Phase 1 West Side LFG recovery wells (MGW1701X, MGW1705X, MGW1709X, MGW1711X, MGW1716X, MGW1720X, and MGW1723X) were installed as part of mitigation activities designed to control LFG migration to the perimeter LFG probes. Well installation began on January 10, 2012, and continued through February 24, 2012. The wells were installed along the West Haul Road using sonic drilling methods and were spaced at intervals of approximately 325 to 375 feet. Figure 3 shows the West Side LFG recovery well locations and the location of geologic cross section A to A', which is shown in Figure 4. The geologic cross-section was created based on the LFG recovery well and probe boring logs. The general well construction details for the Phase 1 wells are shown in Table 1, and the boring logs for these wells are included in Appendix A.

LFG was found at all well locations; initially at concentrations as high as 40 percent methane, with most wells ranging from 20 to 35 percent methane. Six out of the seven Phase 1 West Side LFG recovery wells produce LFG at flow rates of 80 to 160 standard cubic feet per minute (scfm). By late July 2012, methane concentrations in the northernmost wells (MGW1723X and MGW1720X) had decreased to less than 0.1 percent. Methane concentrations in the rest of the wells ranged from 7 to 30 percent in the remaining wells, with the highest concentrations in MGW1705X.

While methane is present in the southernmost Phase 1 well, MGW1701X, at concentrations of up to 20 percent, this well produces very low volumes of LFG ranging from 0 to 15 scfm. In this location, the till is thicker and the contact with the higher-permeability stratified drift/advanced outwash is 30 feet lower in elevation than the more northern Phase 1 wells. The lower flow rates from this well could be caused by the shorter 20-foot-long well screen, the presence of perched groundwater in the native materials reducing permeability to gas flow, or the lower-permeability silty sand in the screen interval.

### **2.2 PHASE 2 WEST SIDE LFG PROBE WELL INSTALLATION**

Because the Phase 1 wells were spaced approximately 300 or more feet apart, it was not known whether the wells had overlapping areas of influence. An initial attempt to test the well influence occurred in March 2012. Four wells (MGW1701X through MGW1711X) were turned off overnight on Sunday, March 11, 2012, in preparation for the first influence test the following morning. Early Monday morning, an LFG probe reading at GP-33C contained methane at a concentration of 12 percent

methane, which was a sudden increase from the previous reading of 0 percent methane the previous day.

One of the factors in the overnight increase in methane in GP-33C was the passage of a low pressure weather system on March 11 and 12, 2012, which caused atmospheric pressure to drop precipitously. This drop in barometric pressure coupled with the shut-off of four of the West Side LFG recovery wells appeared to be responsible for the sudden increase in methane concentrations in GP-33C. This unexpectedly quick response indicated that the continued operation of the Phase 1 West Side LFG recovery wells was critical in preventing LFG migration. The four wells that were shut off on March 11, 2012, were returned to service on March 12, 2012, immediately after the methane increase was noted in GP-33C.

King County felt that it was important to establish how much the operation of the Phase 1 wells could influence LFG migration, and whether there were sufficient numbers of LFG recovery wells installed to control future LFG migration. However, it was necessary to install additional probe wells in order to provide monitoring points located between the Phase 1 wells.

Geophysical testing of the subsurface performed prior to installation of the Phase 2 probes suggested that there were higher permeability areas at depth just to the west of the haul road (AMEC, 2013). A copy of the geophysical test report is included in Appendix A. One of the secondary goals of the Phase 2 probe installation program was to determine if there was LFG present in this deeper part of the advanced outwash sediments.

Phase 2 drilling began on August 15, 2012 at the location of MGW-1710S. Drilling progress was very slow due to difficult drilling conditions, including large cobbles and boulders. The difficult drilling also took a toll on the sonic drilling equipment and time was spent retrieving broken drill rods and fittings during installation of MGW-1710S. At the initial MGPW1710D location near MGPW1710S, large boulders in the upper part of the boring caused the sonic drill casing to angle off to the side, eventually causing this boring to be abandoned due to refusal. Well MGPW1710D was relocated and re-drilled. Perched water was encountered at 150 feet and AMEC was unable to case the perched groundwater off, so the borehole was stopped at 186 feet in depth. We installed a well in the boring after retracting the drill casing to 145 feet in depth. Two more Phase 2 probes (MGPW1703 and MGPW1714) were completed, as shown in Table 1.

Previous commitments required the drilling contractor to relocate the sonic rig to another job in mid-September 2012. Due to the slow drilling progress caused by difficult drilling conditions and equipment failure, all the Phase 2 probes had not yet been installed. Phase 2 drilling resumed in February 2013 and two additional Phase 2 probes (MGPW1700 and MGPW1708) were installed in

February 2013, for a total of six Phase 2 probes. Boring and well construction logs for the Phase 2 probes can be found in Appendix B

### **2.3 WEST SIDE GEOLOGY**

Figure 4 shows geologic cross-section A to A'. Glacial till was encountered in all of the wells at thicknesses ranging from 45 to 102 feet. The till/advanced outwash contact is present at approximately 580 to 590 feet in elevation at the crest of the hill, dropping off to approximately 510 feet in elevation to the south as the till increases in thickness. Most of the Phase 1 wells were screened just below or across the 585-foot elevation where GP-30B and GP-33C are screened.

Perched groundwater was encountered in four of the seven Phase 1 borings; the northern wells (MGW1720X and MGW1716X) had shallower perched water layers that appeared to be related to nearby wetlands west of the wells. The two southern Phase 1 borings with perched groundwater (MGW1701X and MGW1705X) contained perched groundwater at 535 feet mean sea level (msl) in elevation.

MGPW1710D encountered perched groundwater at an elevation of approximately 520 feet. KCSWD staff confirmed that a similar perched water zone was encountered at a similar elevation during the Area 6 development.

Consistent with the conceptual site model presented in the Phase 2 Work Plan (AMEC, 2013) it appears that LFG is migrating through higher-permeability sediments described as stratified drift or advance outwash deposits. Both the stratified drift and outwash units are layered sedimentary units characterized by higher-permeability sandy gravels, sands, and sometimes silty sands of the Esperance Sand (Galster and Laprade, 1991). Horizontal permeability is typically higher than vertical permeability in layered sand and gravel sedimentary deposits. In addition, these higher-permeability sediments are capped by lower-permeability clays and silts of the glacial or Vashon till (Galster and Laprade, 1991). The Vashon till not only has a lower permeability, it is also denser and more compacted than the underlying sands and gravels. Due to the presence of perched groundwater at the 150-foot depth in MGPW1710D we were unable to confirm if there was LFG below the area already explored in the earlier Phase 1 borings.

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### **3.0 LFG RECOVERY WELL INFLUENCE TESTING**

This section presents the results of the LFG influence tests performed using the Phase 1 wells and monitored using the Phase 2 wells.

The goal of influence testing the LFG recovery wells along the West Perimeter Road was to determine the effectiveness of the wells in preventing LFG migration to the property boundary. The extent of coverage for each extraction well is indicated by pressure responses in neighboring extraction wells and probes.

Influence testing of the West Side LFG Recovery Wells was performed primarily by one or more KCSWD employees, with oversight and direction from Herrera staff. A vacuum was induced in a series of LFG recovery well locations, using a new manifold system conveying LFG to the skid-mounted flare located adjacent to the North Flare Station. The recently-installed flare (LFG Specialties Model CF62618 Candlestick flare) provided the vacuum necessary for influence testing (multi-stage centrifugal landfill gas blower extracting 820 scfm at 60 inches of water column).

Similar influence tests were performed at the East Main Hill area in 2010 (AMEC and Herrera, 2011). Section 3.1 describes how the LFG test methodology was modified to specifically address the West Side LFG recovery wells, which are screened in native soils adjacent to Areas 5 and 7. Influence testing of West Side LFG recovery wells was performed between May and July of 2013.

The purpose of influence testing is to maximize the efficiency of LFG collection by determining whether adjacent wells have overlapping influences. If no effect is seen, additional extraction wells may be needed between those two wells. The Phase 2 LFG wells were installed to provide additional monitoring points to allow for influence testing while maintaining control of LFG migration. Section 3.1 describes the LFG influence test methodology.

### **3.1 LFG INFLUENCE TEST METHODS AND PROCEDURE**

Six wells were tested: MGW1701X, MGW1705X, MGW1709X, MGW1711X, MGW1716X, and MGW1720X. Each of these wells was tested for one week (five days) and the overall test took six weeks to complete.

- MGW1711X was the first well tested, due to its low methane concentrations and moderate flows. This well also has Phase 2 wells on either side to assist with determination of its influence range. The test monitoring locations included MGW1709X, MGW1716X, MGPW1710S, MGPW1710D, MGPW1714, and GP-33C (Figure 3). The test monitoring locations were monitored for vacuum and LFG concentrations to determine if there is connectivity or influence from the test well.

- Well MGW1709X was tested during Week 2 and monitoring locations included MGW1705X, MGPW1708, MGPW1710D, MGPW1710S, MGW1711X, and GP-33C.
- Well MGW1705X was tested during Week 3 and monitoring locations included MGW1701X, MGPW1703, MGPW1708, MGW1709X, and GP-33C.
- Well MGW1716X was tested during Week 4 and monitoring locations included MGW1711X, MGPW1714, MGW1720X, GP-30B, and GP-33C.
- Well MGW1701X was tested during Week 5 and monitoring locations included MGPW1700, MGPW1703, MGW1705X, and GP-33C.
- Well MGW1720X was tested during Week 6 and monitoring locations included MGPW1714, MGW1716X, MGW1723X, GP-30B, and GP 33C.
- Barometric pressure was monitored during testing and trends were documented. Testing continued despite changes in barometric pressure because there was enough variation in barometric pressure during six weeks of testing to track variation in well data collected during the test.

The week-long test procedure is as follows:

- Day 1 (Monday) – At the beginning of the day, the valve positions of all wells included in the testing zone were noted. The valve on the test well was completely opened and the valves on adjacent wells were slightly cracked open. The time and barometric pressure were recorded and static pressure and concentrations of methane, oxygen, and carbon dioxide were monitored using a GEM meter at all test zone wells. Monitoring continued at all test zone well locations, three more times at two-hour intervals, for a total of four times per day. Testing continued overnight.
- Day 2 through Day 5 (Tuesday through Friday) – Monitoring continued at all test zone well locations at two-hour intervals, four times throughout the day, for the next four days. At the end of testing on Day 5 (Friday), the valve positions were returned to the settings used prior to beginning the test.

Upon completion of testing, King County operations staff rebalanced the flows from the West Side LFG wells, as required.

LFG data, including barometric pressure (inches of mercury), methane, carbon dioxide, and oxygen as percent, static pressure and differential pressure (inches of water) are provided in Appendix C for each of six weekly influence test stages. Static pressure and barometric pressure for each of the six test stages are shown in Figures 5 through 10.

It should be noted that the accuracy of the data depends on the allowable tolerances of the LFG monitoring equipment. The monitor used by KC staff is the Landtec GEM 2000, and according to the manufacturer's data, it reads to an accuracy of +/- 0.1 inches of water column and +/- 3.0 percent of

the gas concentrations for CH<sub>4</sub> and CO<sub>2</sub> or +/- 1.0 % for O<sub>2</sub>. For instance, if the GEM meter indicates a CH<sub>4</sub> reading of 30%, the actual reading could range from 27% to 33%; for O<sub>2</sub>, if the meter reads 5%, the actual reading could range from 4% to 6%.

## **3.2 DATA FIGURES AND ANALYSIS**

The discussion of wells is presented beginning from the southern end of the West Side LFG recovery wells, moving to the north.

### **MGW1701X**

MGW1701X is screened in native soil outside of the refuse limits at an elevation of approximately 531 to 551 feet above msl. MGW1701X was fully opened to the vacuum system during testing, while adjacent well MGW1705X remained cracked. The five additional wells to the north remained open in their normal operating positions.

#### ***Pressure:***

Phase 1 wells MGW1701X and MGW1705X were connected to the header during the test. Figure 5 shows that MGW1701X had approximately 18 inches of vacuum when isolated; however, minimal gas flow (approximately 30 scfm) was measured within the well during testing. Comparatively MGW1705X had a gas flow during testing of 55 scfm at a vacuum of -2.4 inches water column. Prior to testing, MGW1701X and MGW1705X had respective flow rates of 8 and 120 scfm.

Well MGPW1703 and gas probe GP-33C showed an increase in vacuum (2-4 inches water column) after initiation of influence testing at MGW-1701, indicating that vacuum influences likely extend from test well MGW1701X or possibly MGW1705X to MGPW1703, and GP 33C.

### **MGW1705X**

MGW1705X is screened in native soil outside of the refuse limits at an elevation of approximately 529 to 549 feet above msl. MGW1705X was fully opened to the vacuum system during testing, while adjacent wells MGW1701X and MGW1709X remained cracked. The four additional wells to the north remained open in their normal operating positions.

#### ***Pressure:***

Phase 1 wells MGW1701X, MGW1705X, and MGW1709X were connected to the header during this test. Figure 6 shows that MGW1705X had approximately 15 inches of vacuum when isolated and an average gas flow of 375 scfm was measured within the well during testing. The two adjacent wells, MGW1701X and MGW1709X, had a flow of approximately 30 scfm each. Prior to testing, MGW1701X, MGW1705X, and MGW1709X had respective flow rates of 8, 120, and 100 scfm.

Well MGPW1703 showed a slight increase in vacuum (1 inch) after initiation of influence testing at MGW1705X, indicating that vacuum influences likely extend between those wells and test well MGW1701X. Negative static pressure was observed in observation wells MGPW1708 and GP-33C at the start of the test. Pressure fluctuated and decreased over 1 inch in MGPW1708 during testing, but there was no change when comparing the beginning static pressure with the final pressure. GP-33C behaved comparably, with a net change of -0.2 inch between the beginning and end of testing and fluctuations reached -0.7 inch during testing indicating some influence on GP-33C from MGW1705X.

### **MGW1709X**

MGW1709X is screened in native soil outside of the refuse limits at an elevation of approximately 542 to 582 feet above msl. MGW1709X was fully opened to the vacuum system during testing, while adjacent wells MGW1705X and MGW1711X remained cracked. The three additional wells to the north and one to the south remained open in their normal operating positions.

#### ***Pressure:***

Phase 1 wells MGW1705X, MGW1709X, and MGW1711X were connected to the header during this test. Figure 7 shows that MGW1709X had approximately 15 inches of vacuum when isolated and an average gas flow of 440 scfm was measured within the well during testing. The two adjacent wells MGW1705X and MGW1711X had flows ranging from zero to approximately 30 scfm. Prior to testing, MGW1705X, MGW1709X, and MGW1711X had respective flow rates of 120, 100, and 100 scfm.

Negative static pressure was observed in observation wells MGPW1708, MGPW1710S, MGPW1710D, and GP-33C at the start of the test, indicating that vacuum influences likely extend between those wells and the Phase I wells. Pressure fluctuated from 1 to 1.6 inches in the four observation wells during testing, and a vacuum was maintained in the four wells throughout the test.

### **MGW1711X**

MGW1711X is screened in native soil outside of the refuse limits at an elevation of approximately 542 to 582 feet above msl. MGW1711X was fully opened to the vacuum system during testing, while adjacent wells MGW1709X and MGW1716X remained cracked. The additional wells to the north and two to the south remained open in their normal operating positions.

#### ***Pressure:***

Phase 1 wells MGW1709X, MGW1711X, and MGW1716X were connected to the header during the test. Figure 8 shows that MGW1711X had approximately 16 inches of vacuum when isolated and an average gas flow of 440 scfm was measured within the well during testing. The two adjacent wells MGW1709X and MGW1716X had flows of approximately 30 and 40 scfm, respectively. Prior to

testing, MGW1709X, MGW1711X, and MGW1716X had respective flow rates of 100, 100, and 20 scfm.

Negative static pressure was observed in observation wells MGPW1708, MGPW1710S, MGPW1710D, and GP-33C at the start of the test, indicating that vacuum influences likely extend between those wells and the Phase I wells. Pressure fluctuated from 1 to 1.6 inches in the four observation wells during testing, and a vacuum was maintained in the four wells throughout the test.

### **MGW1716X**

MGW1716X is screened in native soil outside of the refuse limits at an elevation of approximately 530 to 560 feet above msl. MGW1716X was fully opened to the vacuum system during testing, while adjacent wells MGW1711X and MGW1720X remained cracked. The one additional well to the north and three to the south remained open in their normal operating positions.

#### ***Pressure:***

Phase 1 wells MGW1711X, MGW1716X, and MGW1720X were connected to the header during the test. Figure 9 shows that MGW1716X had approximately 14 inches of vacuum when isolated and an average gas flow of 350 scfm was measured within the well during testing. The two adjacent wells, MGW1711X and MGW1720X, each had a flow of approximately 30 scfm. Prior to testing, MGW1711X, MGW1716X, and MGW1720X had respective flow rates of 100, 20, and 10 scfm.

Negative static pressure was observed in observation wells MGPW1714, GP-30B, and GP-33C at the start of the test, indicating that vacuum influences likely extend between those wells and the Phase I wells. Pressure fluctuated from 1 to 1.6 inches in the three observation wells during testing, and a vacuum was maintained in those three wells throughout the test with comparable static pressures recorded at the beginning and end of the test.

### **MGW1720X**

MGW1720X is screened in native soil outside of the refuse limits at an elevation of approximately 541 to 581 feet above msl. MGW1720X was fully opened to the vacuum system during testing, while adjacent wells MGW1716X and MGW1723X remained cracked. The four additional wells to the south remained open in their normal operating positions.

#### ***Pressure:***

Phase 1 wells MGW1716X, MGW1720X, and MGW1723X were connected to the header during the test. Figure 10 shows that MGW1720X had approximately 10 inches of vacuum when isolated and an average gas flow of 400 scfm was measured within the well during testing. The two adjacent wells

MGW1716X and MGW1723X had flows of 30 and a range of 0 to 30 scfm, respectively. Prior to testing, MGW1716X, MGW1720X, and MGW1723X had respective flow rates of 20, 10, and 20 scfm.

Negative static pressure was observed in observation wells MGPW1714, GP-30B, and GP-33C at the start of the test, indicating that vacuum influences likely extend between those wells and the Phase I wells. Pressure fluctuated from 0.9 to 1.5 inches in the three observation wells during testing, and a vacuum was maintained in those three wells throughout the test.

### **3.3 ADDITIONAL DATA TRENDING ANALYSIS**

To further depict the effects of the West Side LFG recovery wells, King County staff compiled static pressure data for GP-33C and GP-30B over the time period prior to detection of methane in those probes (January 2011) through July of 2013. Figure 11 provides a trend analysis of pressures measured in these two gas probes. As the LFG recovery wells were brought on-line in January and February 2012 (as shown by the green shading), the static pressure in the probes dropped from 0 to negative 6 inches, indicating an influence from the extraction well pumping. When the new header and rental flare was installed in July/August 2012, an influence continued despite a decrease in the average extraction flow from over 800 scfm to approximately 400 scfm. Static pressures remain below 0 under current operational conditions.

#### **4.0 CONCLUSIONS AND RECOMMENDATIONS**

The following conclusions can be drawn from the West Side LFG recovery well installation, operation, and influence testing:

- Under the current system of extraction wells, LFG recovery from the West Side LFG recovery wells is necessary to control LFG migration in the native soils adjacent to Areas 5, 6, and 7.
- Operation of the LFG recovery successfully eliminated the elevated pressures and the presence of methane in perimeter LFG probes GP-30B and GP-33C.
- Influence testing shows that negative pressures were maintained in all of the wells and probes during testing, and the recovery wells are effectively spaced for controlling gas migration.

There is no need for additional influence testing of the West Side recovery wells and additional West Side LFG recovery wells are not necessary to control LFG migration at this time.

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## TABLES

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**TABLE 1**

**PHASE 1 AND 2 WELL CONSTRUCTION DETAILS<sup>1, 2, 3</sup>**

Cedar Hills Regional Landfill

Maple Valley, Washington

<b>Well Name</b>	<b>Date Well/Probe Installation Complete</b>	<b>Northing (feet)</b>	<b>Easting (feet)</b>	<b>Top Lid Elevation (feet above msl)</b>	<b>Total Boring Depth (feet)</b>	<b>Screen Length (feet)</b>	<b>Blank Casing Length<sup>4</sup> (feet)</b>	<b>Screen Depth Range (feet bgs)</b>
MGPW1700	2/26/2013	169966.84	1698300.65	616.30	170	20	135	135 to 155
MGW1701X	1/13/2012	170137.30	1698304.80	625.66	120	20	75	75 to 95
MGPW1703	8/31/2012	170337.60	1698311.32	639.84	145	30	104	104 to 134
MGW1705X	2/15/2012	170502.77	1698315.88	651.77	137	20	103	103 to 123
MGPW1708	2/28/2013	170677.26	1698318.91	665.98	120	40	70	70 to 110
MGW1709X	2/1/2012	170878.93	1698322.78	670.39	140	40	85	85 to 125
MGPW1710S	8/24/2012	171064.71	1698325.05	671.53	134	40	94	94 to 134
MGPW1710D	9/27/2012	171037.66	1698323.49	673.01	186	30	115	115 to 145
MGW1711X	1/25/2012	171160.68	1698329.94	670.46	138	40	85	85 to 125
MGPW1714	9/19/2012	171376.85	1698338.78	672.98	140	40	90	90 to 130
MGW1716X	2/20/2012	171639.93	1698344.58	662.43	142	30	100	100 to 130
MGW1720X	2/24/2012	171999.91	1698352.38	653.45	123	40	70	70 to 110
MGW1723X	1/27/2012	172374.23	1698359.68	640.94	110	40	50	50 to 90

Notes

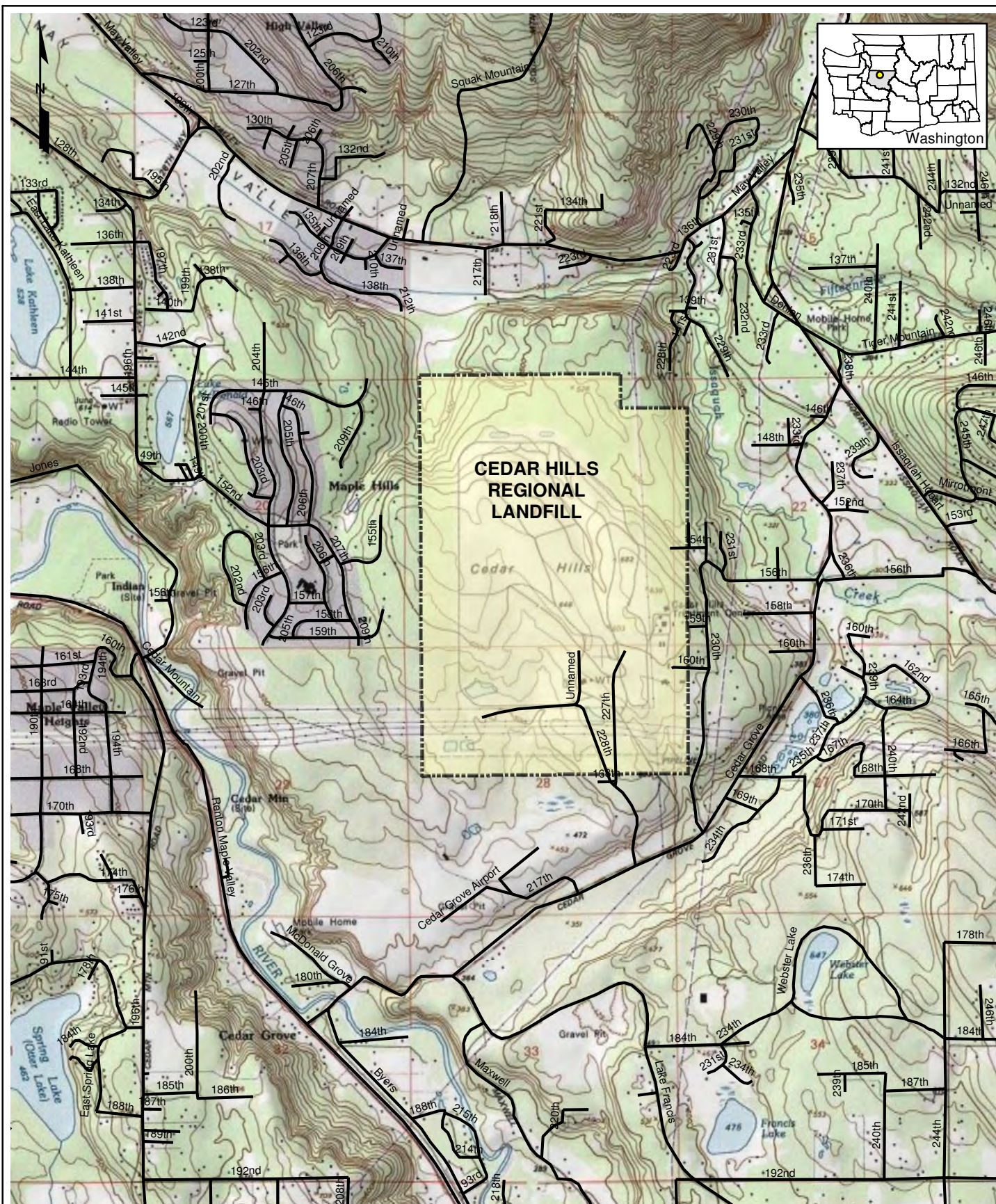
1. All Northings and Eastings in State Plane North Coordinates.
2. All elevations in National Geodetic Vertical Datum 1929.
3. All locations surveyed by King County Solid Waste Division.
4. All casings are 4 inches in diameter.

Abbreviations

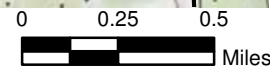
bgs = below ground surface  
msl = mean sea level

## FIGURES

---



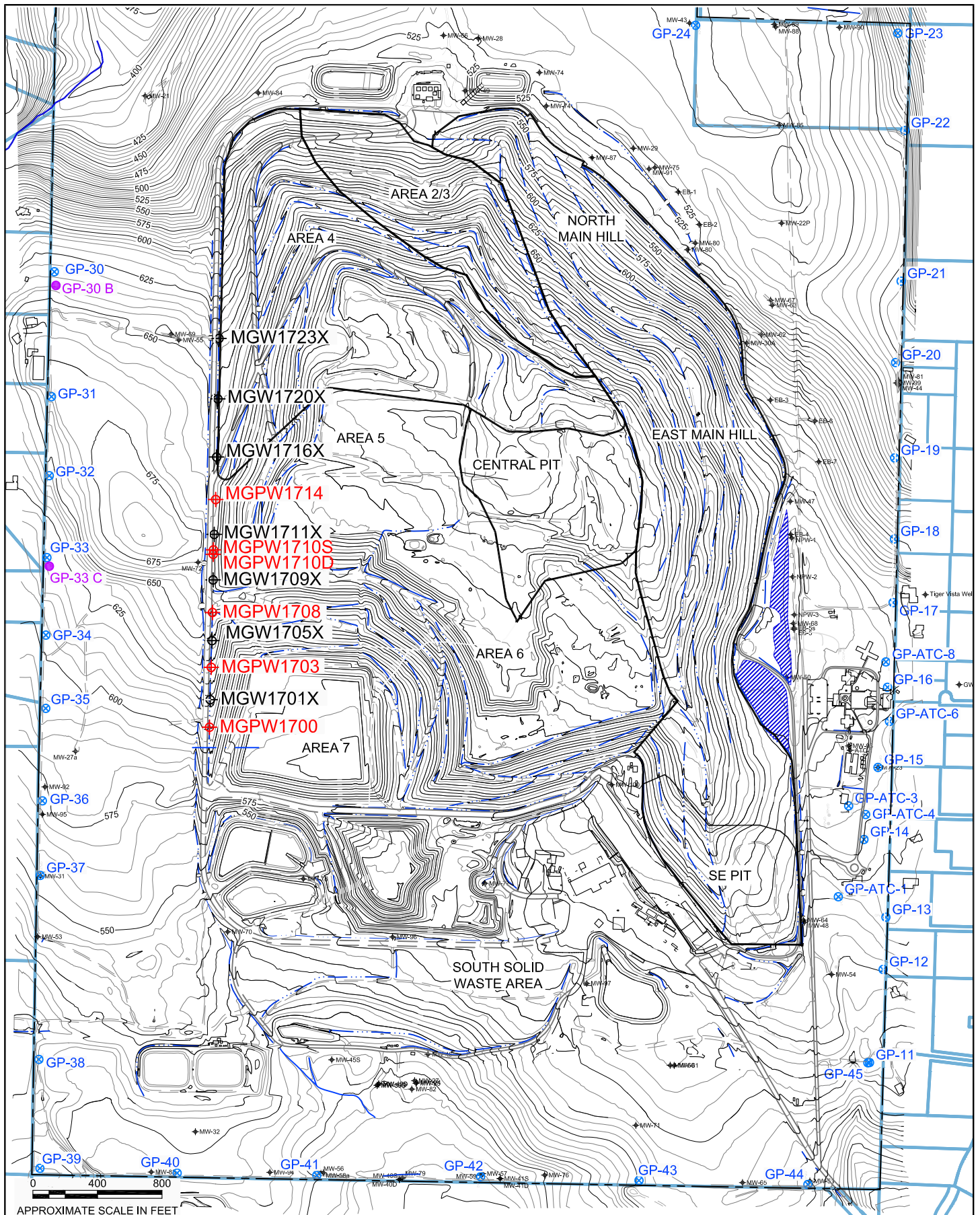
Note: Base map from U.S.G.S. 24k



# **Site Vicinity** **Cedar Hills Regional Landfill** Maple Valley, Washington

DATE:  
August 03, 2012  
 DESIGNED BY:  
JDL  
 DRAWN BY:  
APS  
 REVISED BY:  
JDL

PROJECT NO.  
**10031**  
 FIGURE NO.  
**1**



APPROXIMATE SCALE IN FEET



King County

## DETAILED SITE MAP

Cedar Hills Regional Landfill  
Maple Valley, Washington

DATE:  
DECEMBER 24, 2013

DESIGNED BY:  
JDL

DRAWN BY:  
MDS

REVISED BY:  
JDL

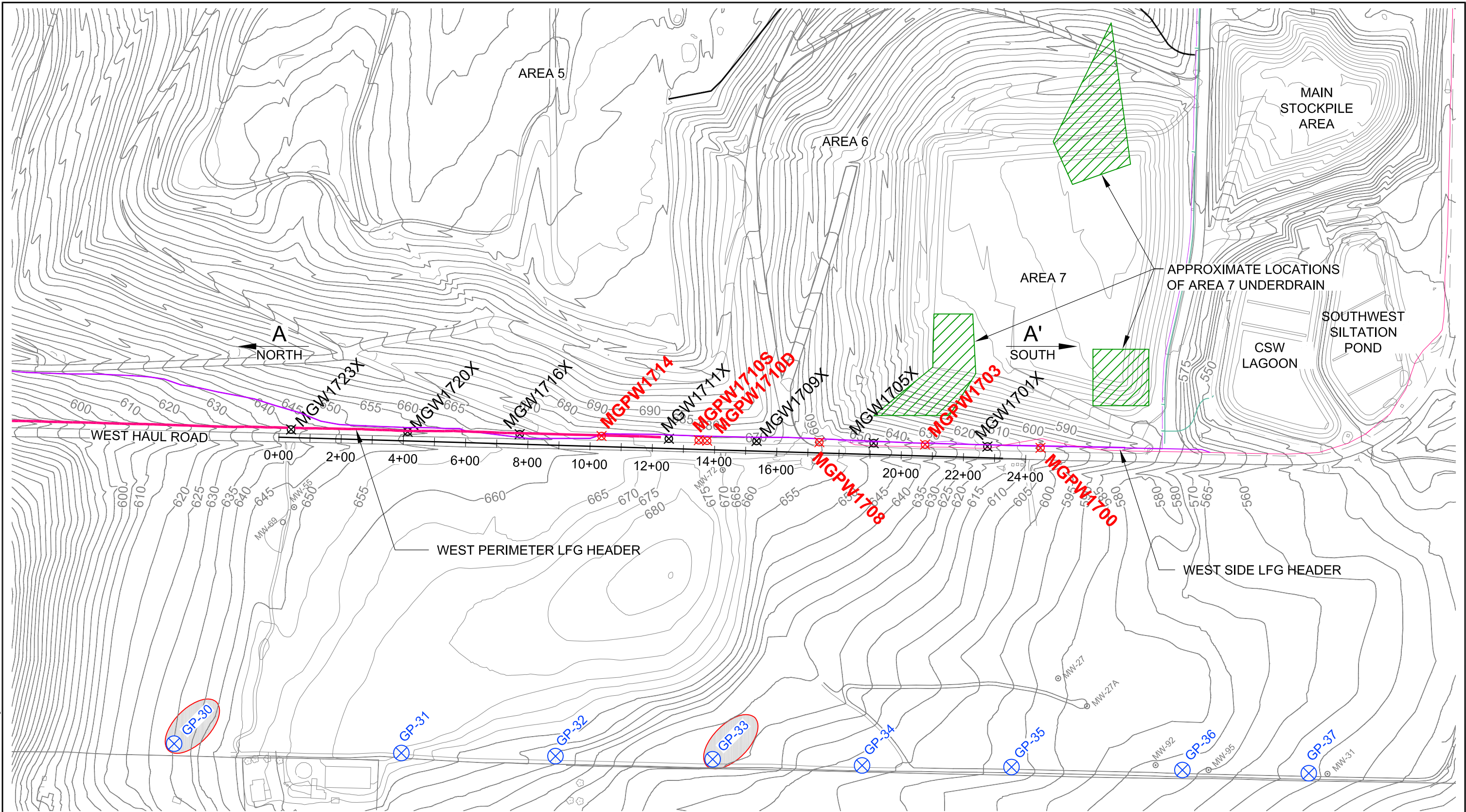
PROJECT NO.

10031


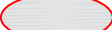


FIGURE NO.

2

Path: S:\10031\1012\_WestSideGeologicCrossSection\Phase2\_wells\_KCCHRL\_122413.dwg  
Plot Date: 12/24/2013 11:09 AM  
Cad User: Stenberg, Adam



**LEGEND:**

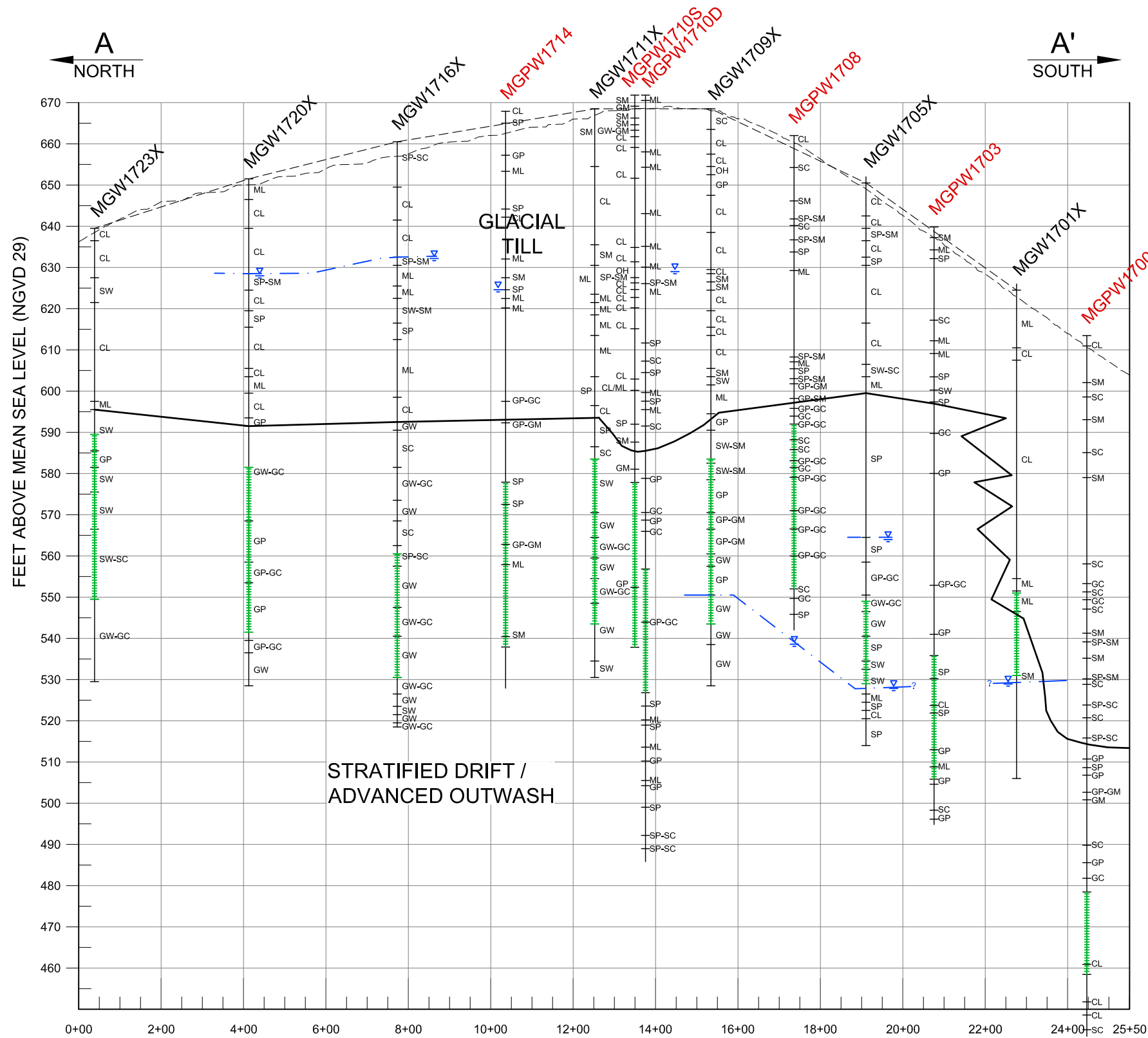
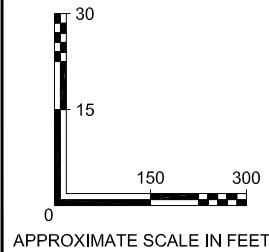
-  GP-33 EXISTING LFG PROBE LOCATION AND NUMBER
-  EXISTING LFG PROBE WITH METHANE EXCEEDANCES IN FALL 2011
-  MGW1711X PHASE I WEST SIDE LFG WELL LOCATION
-  MGPW1714 PHASE II WEST SIDE LFG PROBE LOCATION



**LOCATION OF WEST SIDE LFG RECOVERY WELLS  
AND PROBES AND GEOLOGIC CROSS SECTION A TO A'**  
Cedar Hills Regional Landfill  
Maple Valley, Washington

DATE: DECEMBER 24, 2013	PROJECT NO. <b>10031</b>
DESIGNED BY: JDL	FIGURE NO. <b>3</b>
DRAWN BY: LJT	
REVISED BY: JDL	

Path: S:\10031012\_WestSideGeologicCrossSection\CedarHills-SiteMap\_ERT-survey\Lines\_122413.dwg  
Plot Date: 12/24/2013 11:09 AM  
Cad User: Stenberg, Adam



#### LEGEND:

- APPROXIMATE CONTACT BETWEEN TILL MATERIALS AND HIGHER PERMEABILITY STRATIFIED DRIFT/ ADVANCED OUTWASH SEDIMENTS
- APPROXIMATE LAND SURFACE ELEVATION
- WELL SCREEN
- APPROXIMATE PERCHED GROUNDWATER LEVEL
- MGW1701X PHASE I WEST SIDE LFG WELL
- MGPW1700 PHASE II WEST SIDE LFG PROBE LOCATION

#### ABBREVIATIONS:

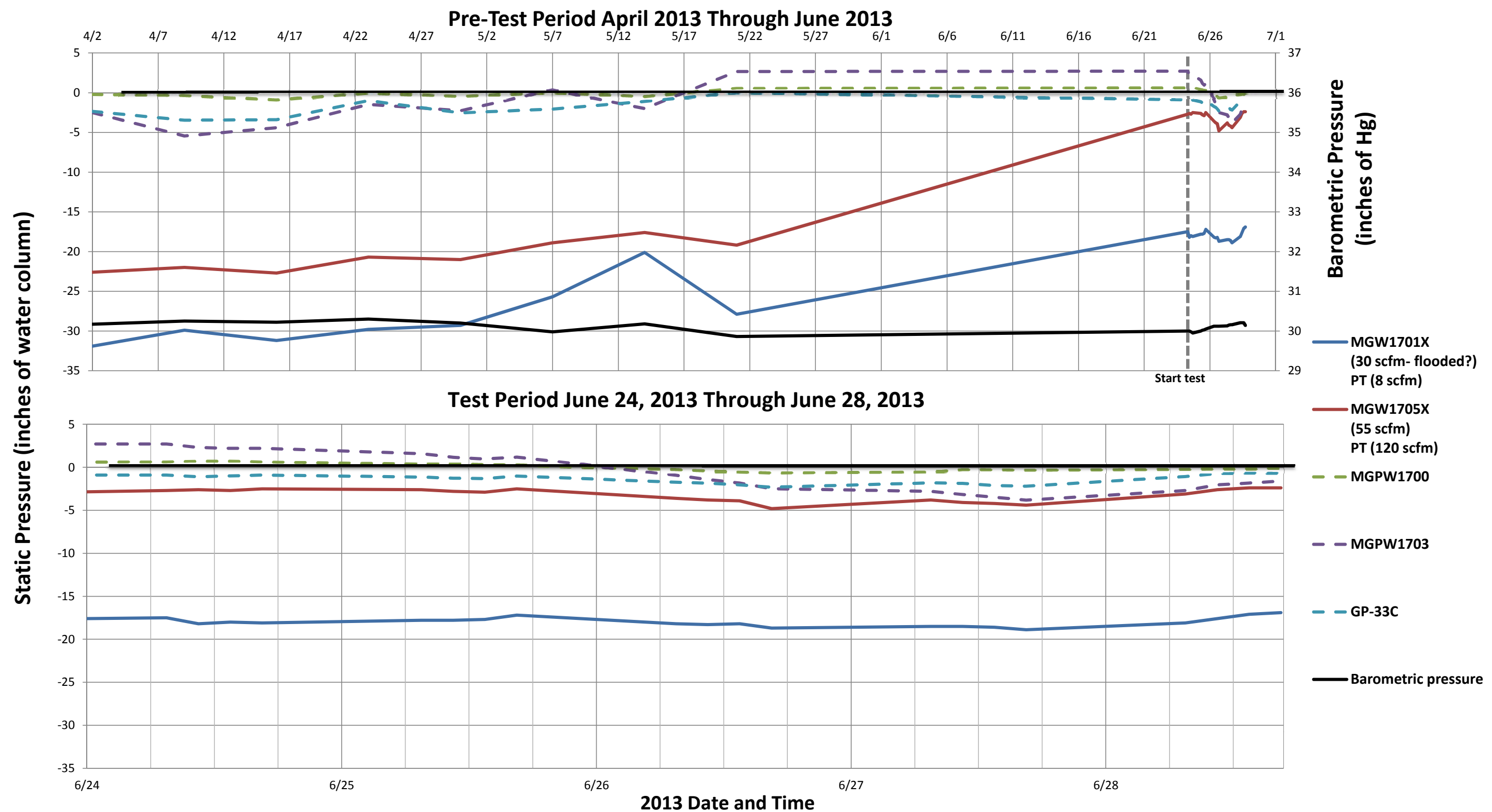
- SC CLAYEY SAND
- SW WELL GRADED SANDS
- SP POORLY GRADED SANDS
- SM SILTY SAND
- GW WELL GRADED GRAVELS
- GP POORLY GRADED GRAVEL
- GM SILTY GRAVEL
- TS TOP SOIL



### GEOLOGIC CROSS SECTION A - A'

Cedar Hills Regional Landfill  
Maple Valley, Washington

DATE: DECEMBER 24, 2013	PROJECT NO. <b>10031</b>
DESIGNED BY: JDL	FIGURE NO. <b>4</b>
DRAWN BY: LJT	
REVISED BY: JDL	




**Notes:**

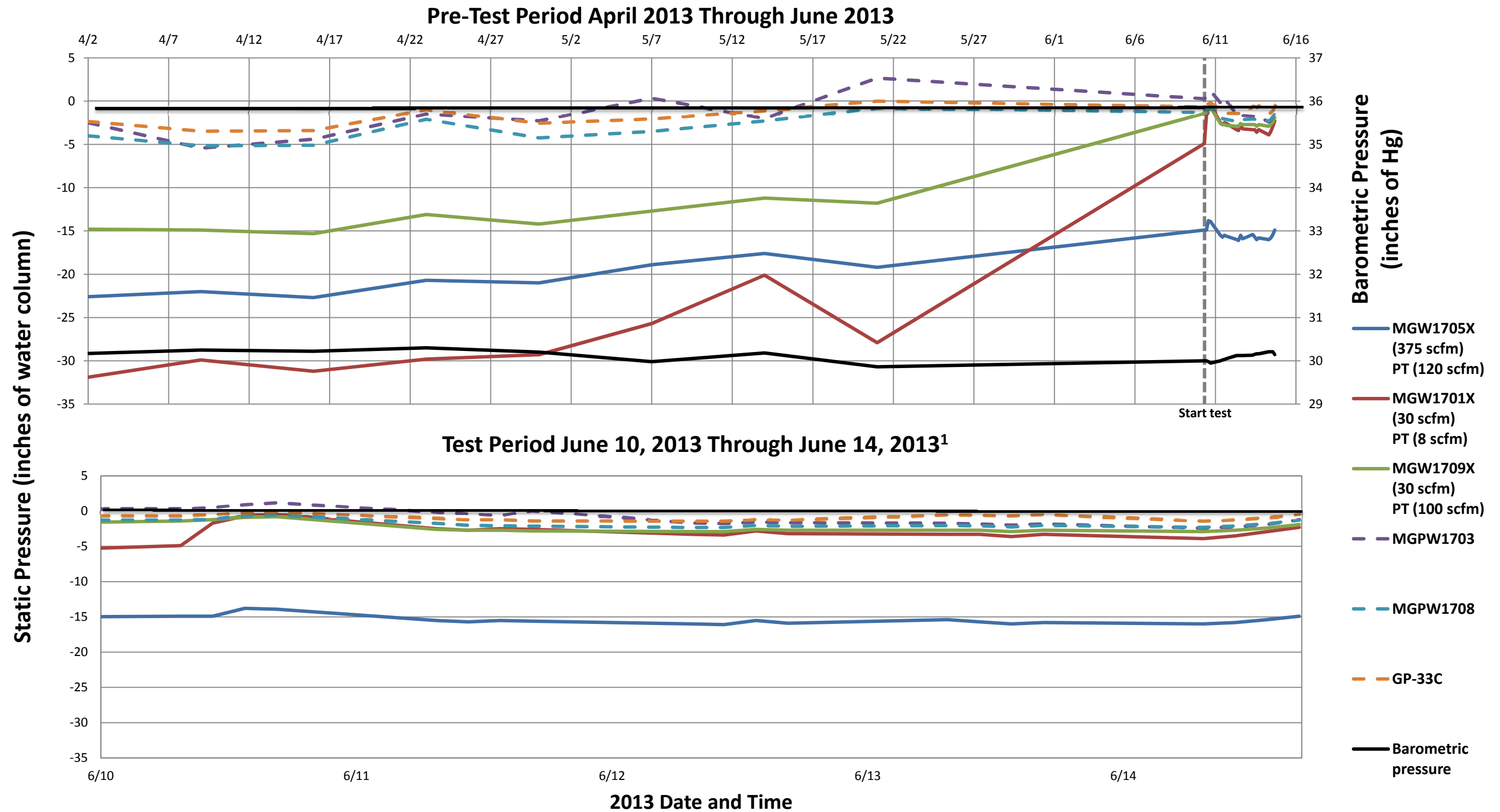
1. Pressure readings were collected four times a day during the test period.

**Abbreviations:**

PT = Pre-Test

scfm = standard cubic feet per minute

 <b>King County</b>	<b>MGW1701X LFG INFLUENCE TEST PRESSURES</b> <b>APRIL 2013 THROUGH JUNE 2013</b> Cedar Hills Regional Landfill Maple Valley, Washington	DATE: 08/16/13	PROJECT NO. 10031
		BY: JDL	FIGURE NO. 5



**Notes:**

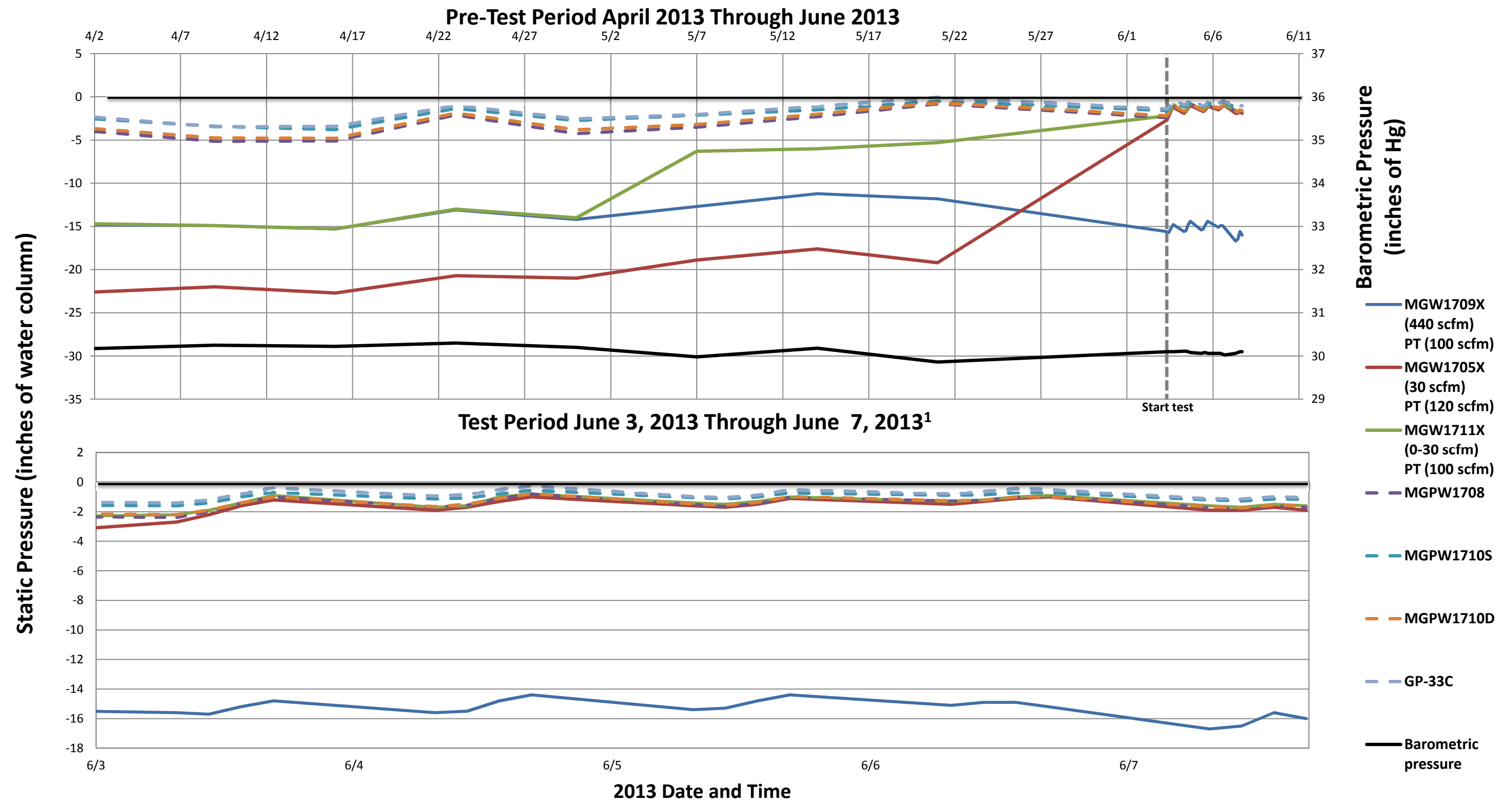
1. Pressure readings were collected four times a day during the test period.

**Abbreviations:**

PT = Pre-Test

scfm = standard cubic feet per minute

 King County	<b>MGW1705X LFG INFLUENCE TEST PRESSURES</b> <b>APRIL 2013 THROUGH JUNE 2013</b> Cedar Hills Regional Landfill Maple Valley, Washington	DATE: 08/16/13	PROJECT NO. 10031
		BY: JDL	FIGURE NO. 6



**Notes:**

1. Pressure readings were collected four times a day during the test period.

**Abbreviations:**

PT = Pre-Test

scfm = standard cubic feet per minute



**King County**

**MGW1709X LFG INFLUENCE TEST PRESSURES  
APRIL 2013 THROUGH JUNE 2013**

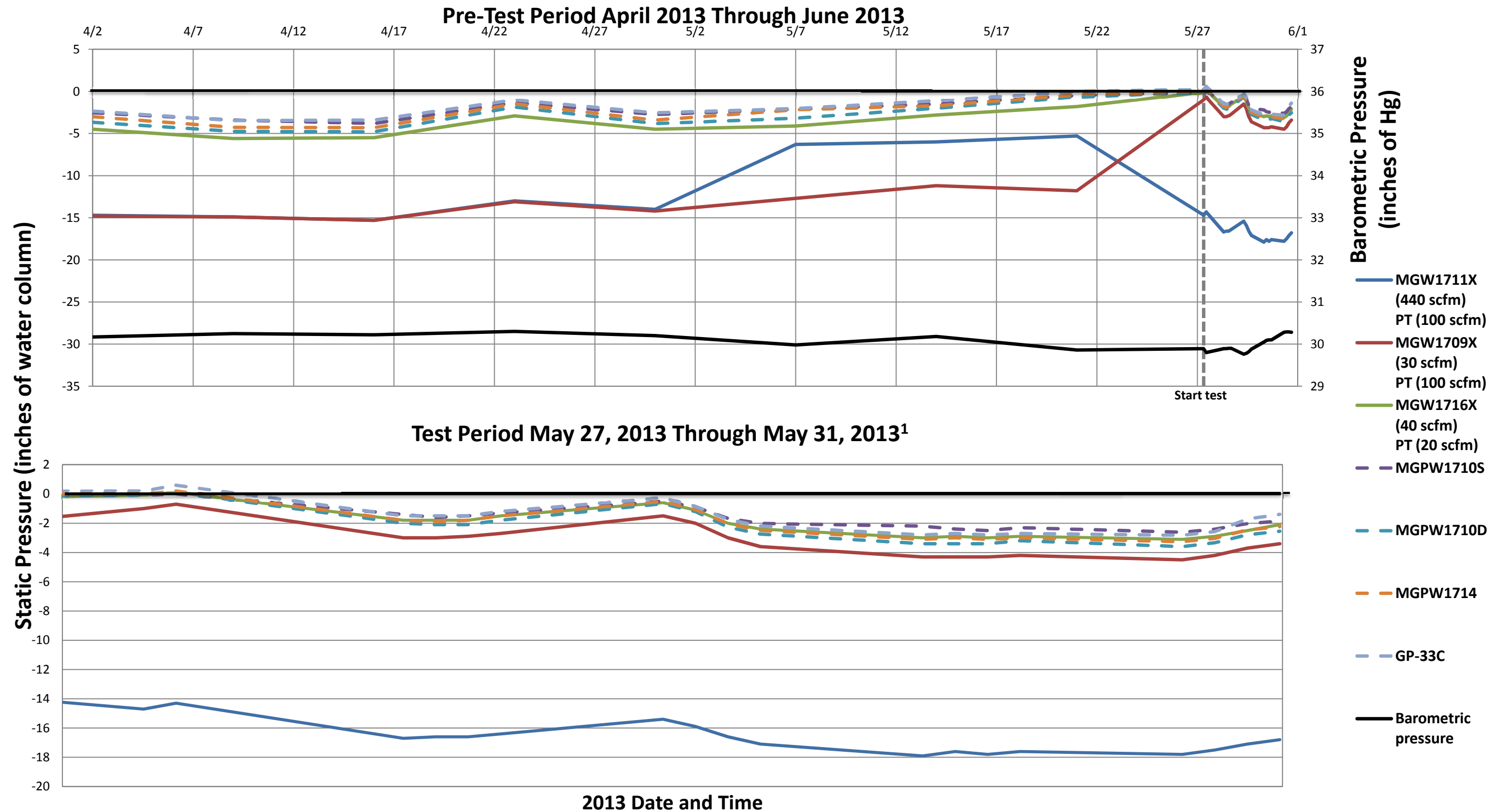
Cedar Hills Regional Landfill  
Maple Valley, Washington

DATE:  
08/16/13

PROJECT NO.  
10031

BY:  
JDL

FIGURE NO.  
7



**Notes:**

1. Pressure readings were collected four times a day during the test period.

**Abbreviations:**

PT = Pre-Test

scfm = standard cubic feet per minute



**MGW1711X LFG INFLUENCE TEST PRESSURES**  
**APRIL 2013 THROUGH JUNE 2013**  
 Cedar Hills Regional Landfill  
 Maple Valley, Washington

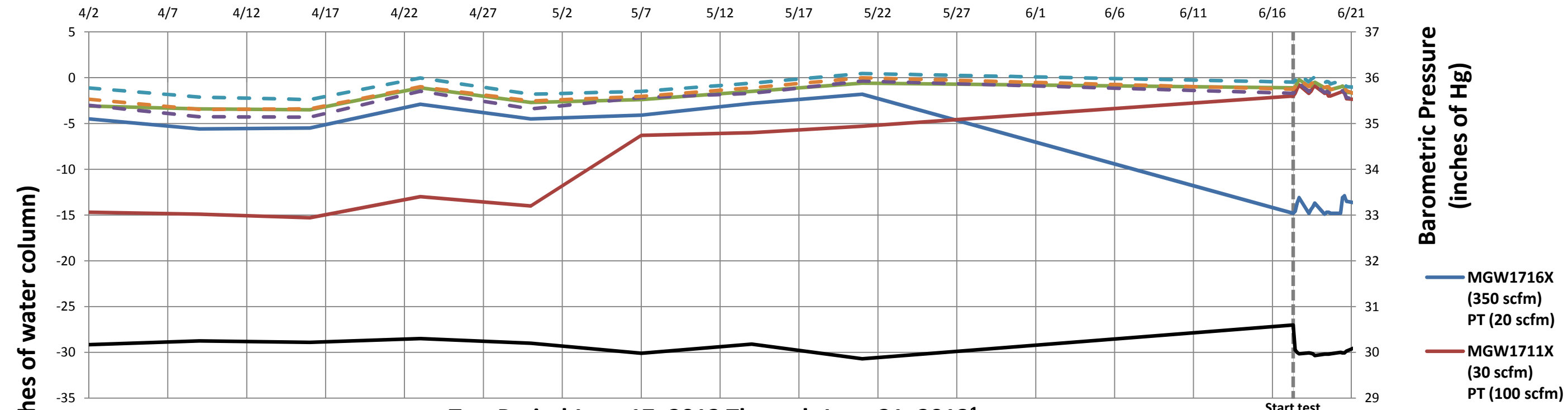
DATE:  
08/16/13

PROJECT NO.  
10031

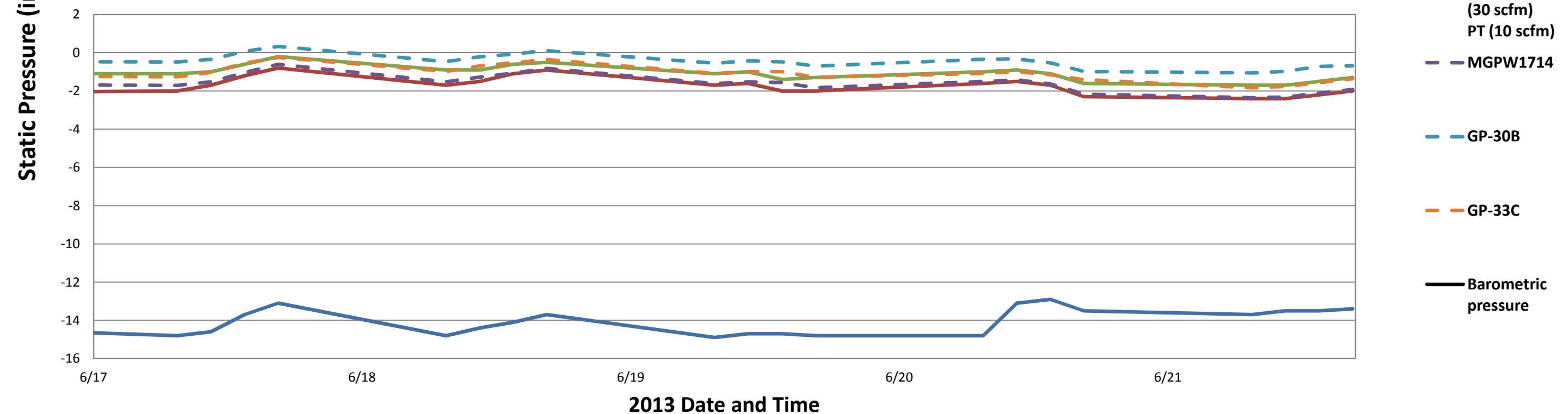
BY:  
JDL

FIGURE NO.  
8

Pre-Test Period April 2013 Through June 2013



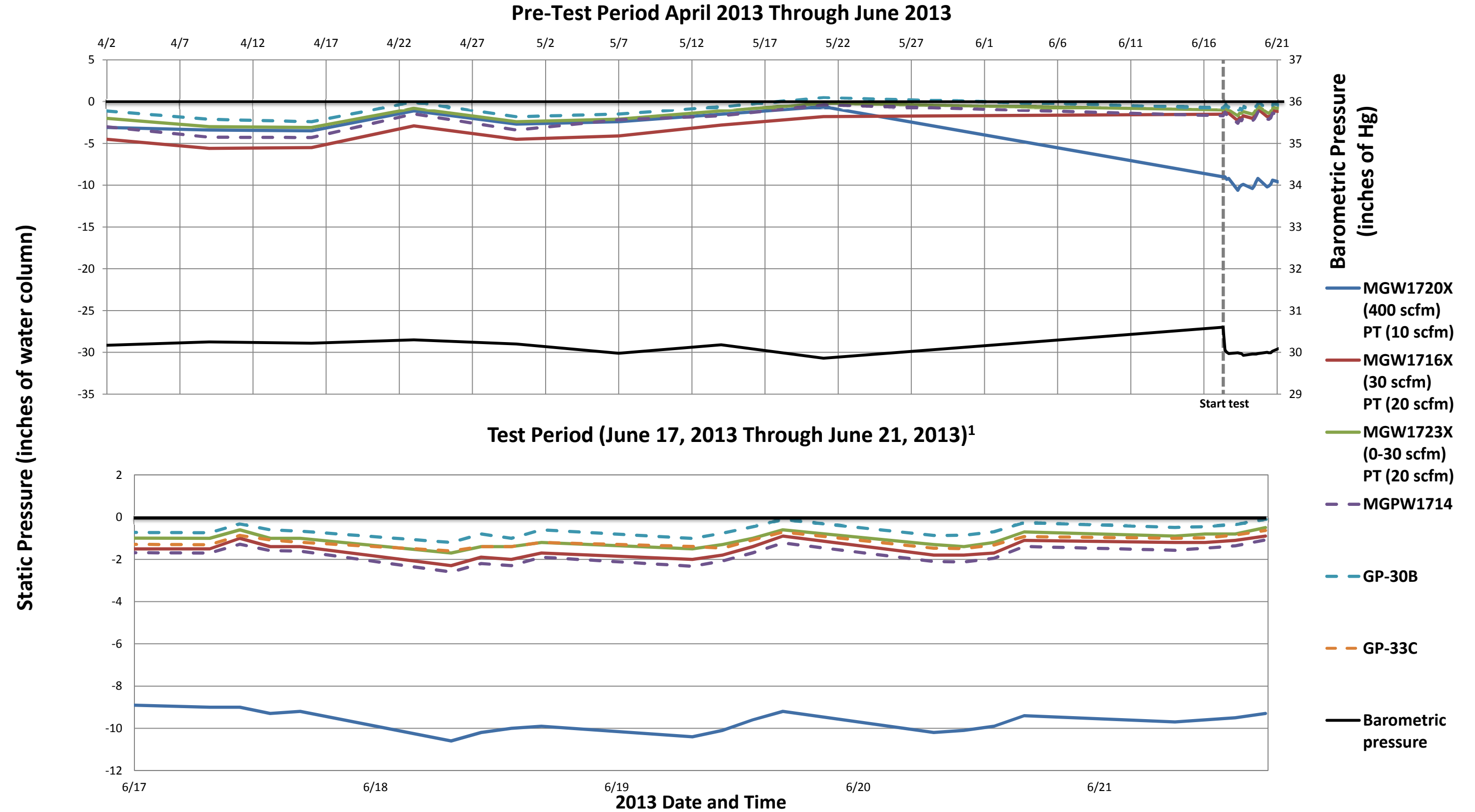
Test Period June 17, 2013 Through June 21, 2013<sup>1</sup>



Notes:  
1. Pressure readings were collected four times a day during the test period.

Abbreviations:  
PT = Pre-Test  
scfm = standard cubic feet per minute

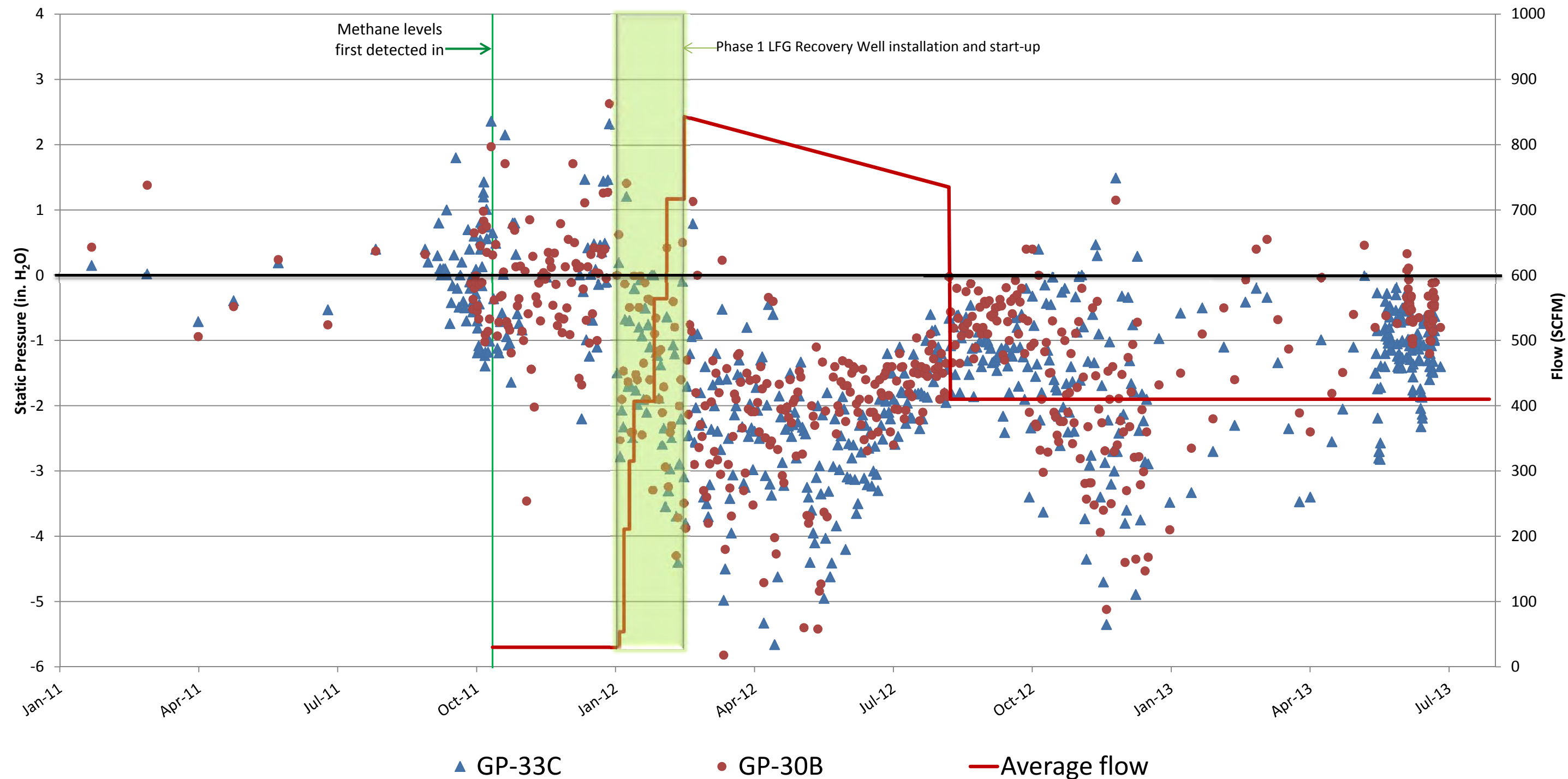
 King County	MGW1716X LFG INFLUENCE TEST PRESSURES APRIL 2013 THROUGH JUNE 2013 Cedar Hills Regional Landfill Maple Valley, Washington	DATE: 08/16/13	PROJECT NO. 10031
		BY: JDL	FIGURE NO. 9




**Notes:**  
1. Pressure readings were collected four times a day during the test period.

**Abbreviations:**  
PT = Pre-Test  
scfm = standard cubic feet per minute

	<b>MGW1720X LFG INFLUENCE TEST PRESSURES</b> <b>APRIL 2013 THROUGH JUNE 2013</b> Cedar Hills Regional Landfill Maple Valley, Washington	DATE: 08/16/13	PROJECT NO. 10031
		BY: JDL	FIGURE NO. 10

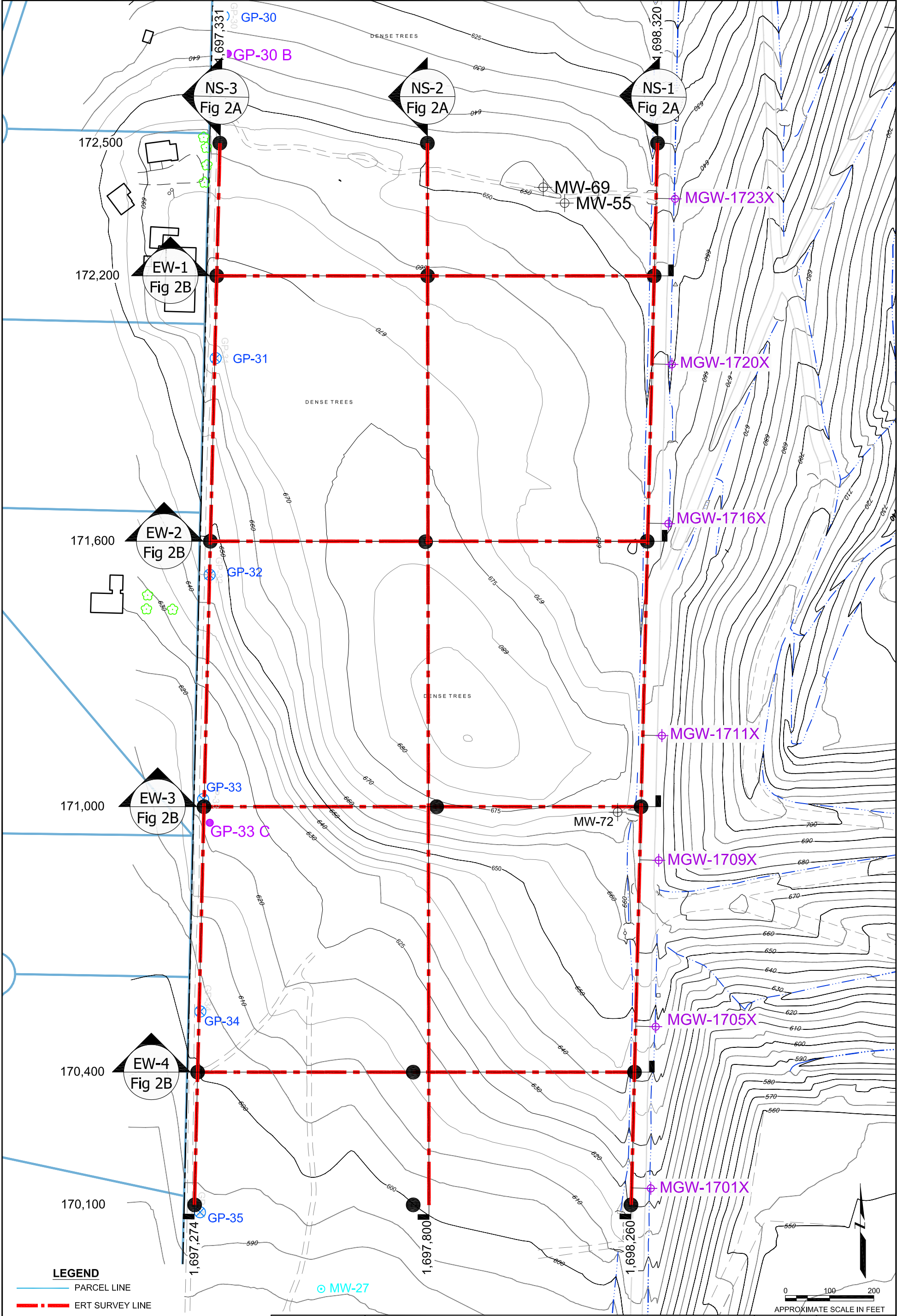


 <b>King County</b>	<b>STATIC PRESSURE TRENDS IN LFG PERIMETER</b> <b>GAS PROBES GP-30B AND GP-33C</b> <b>JANUARY 2011 THROUGH JULY 2013</b> Cedar Hills Regional Landfill Maple Valley, Washington	DATE: 08/16/13	PROJECT NO. 10031
		BY: JDL	FIGURE NO. <b>11</b>

## **APPENDIX A**

---

Geophysical Survey Report



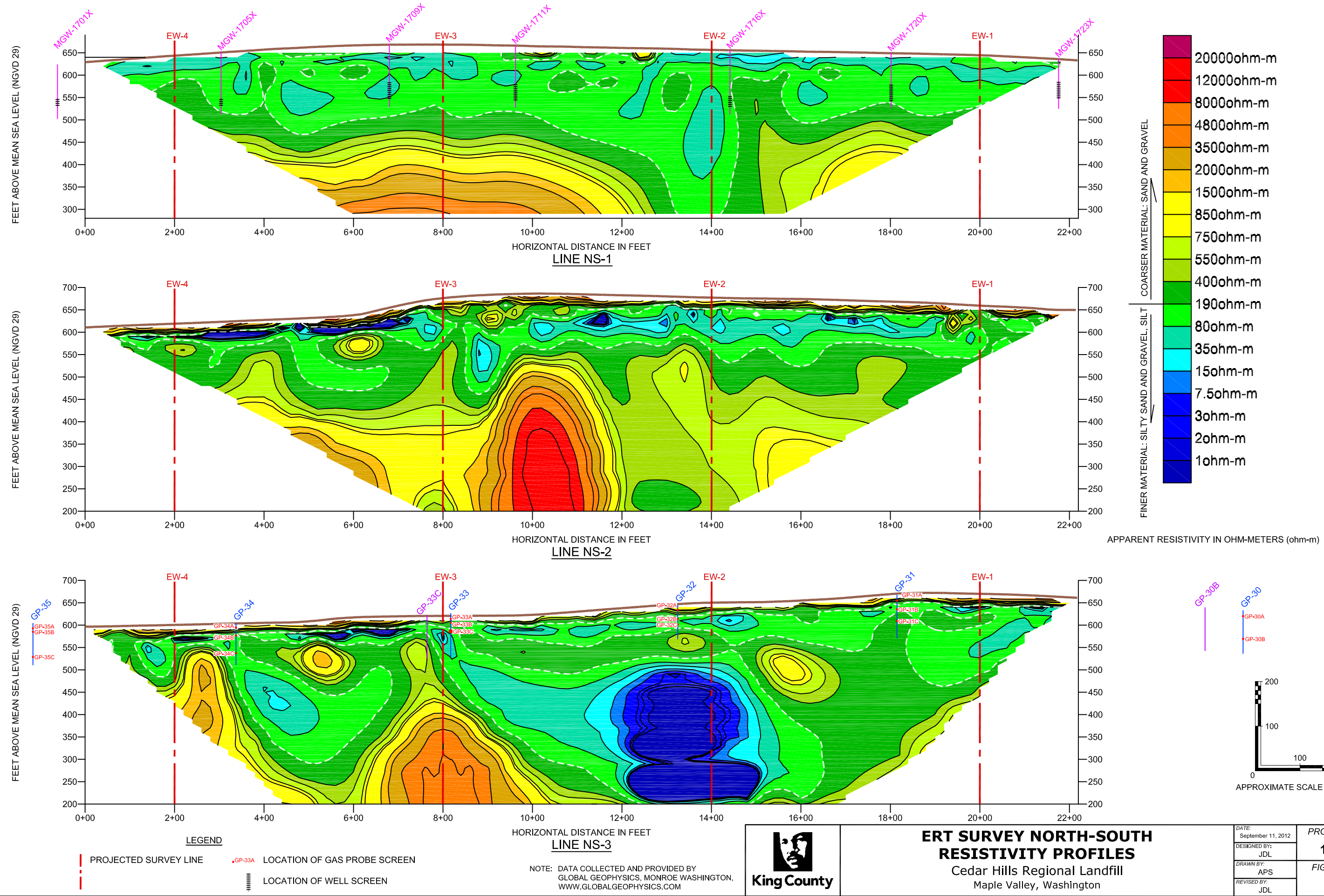
LEGEND

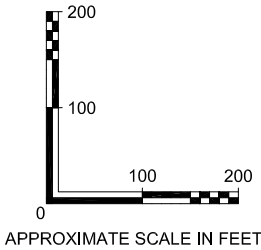
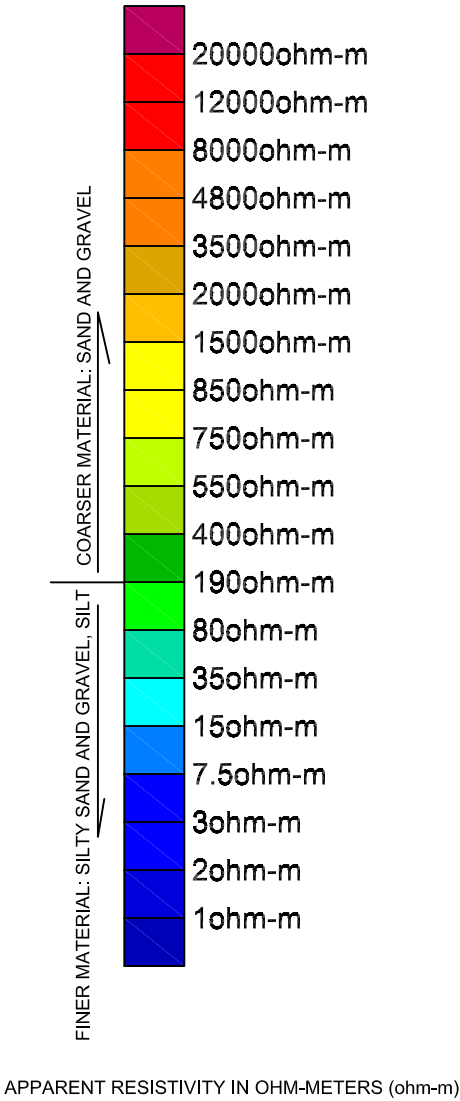
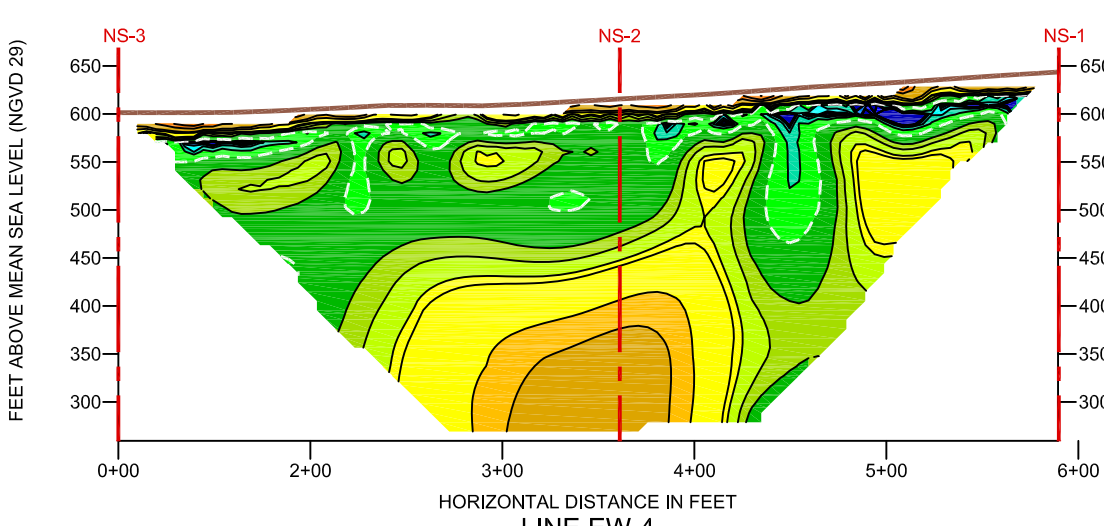
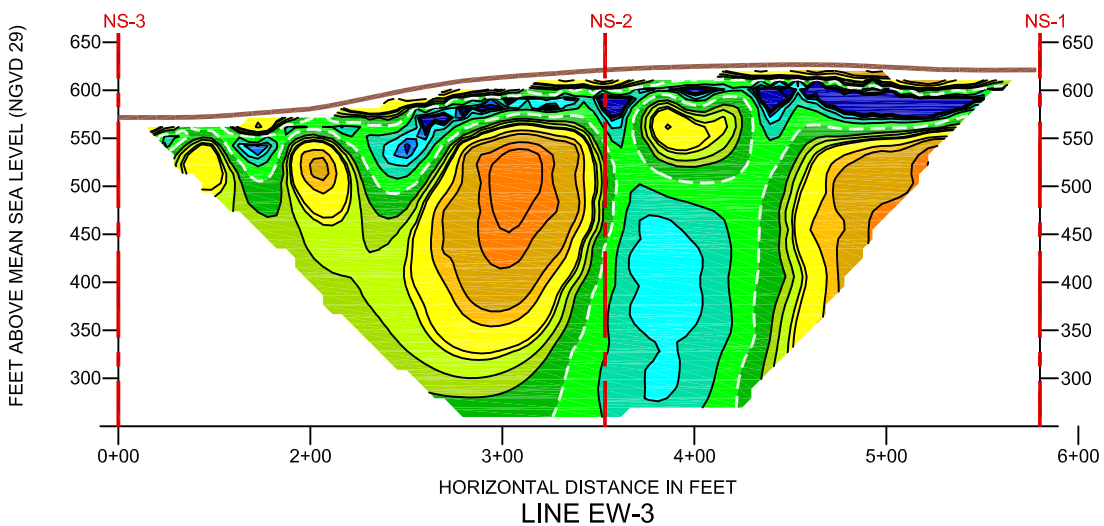
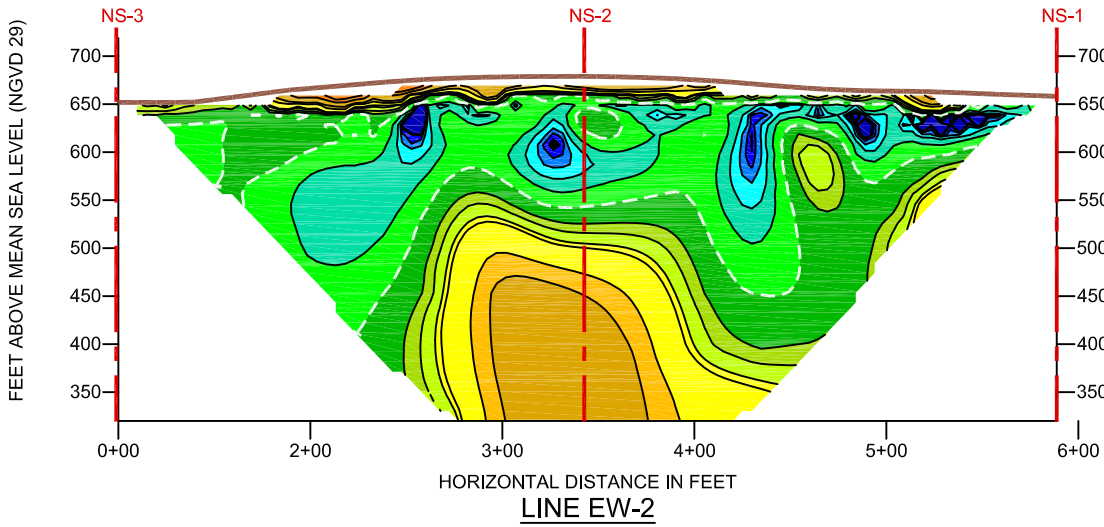
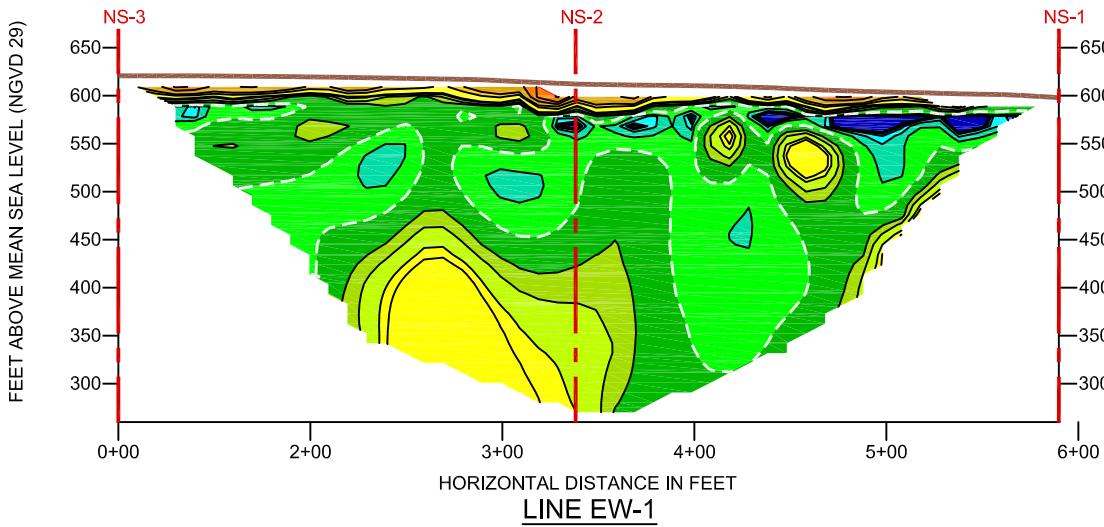
- PARCEL LINE
- ERT SURVEY LINE
- GP-30 B PERIMETER LFG PROBE  
LOCATION WITH CH<sub>4</sub> > LOWER  
EXPLOSIVE LIMIT
- MGW-1701 EXISTING LFG RECOVERY WELL
- GP-33 PERIMETER LFG PROBE



ERT SURVEY LINE LOCATIONS  
Cedar Hills Regional Landfill  
Maple Valley, Washington

DATE: September 11, 2012	PROJECT NO. <b>10031</b>
DESIGNED BY: JDL	FIGURE NO. <b>1</b>
DRAWN BY: APS	
REVISED BY: JDL	



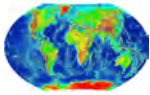


NOTE: DATA COLLECTED AND PROVIDED BY  
GLOBAL GEOPHYSICS, MONROE WASHINGTON,  
WWW.GLOBALGEOPHYSICS.COM



**ERT SURVEY EAST-WEST  
RESISTIVITY PROFILES**  
Cedar Hills Regional Landfill  
Maple Valley, Washington

DATE: September 11, 2012	PROJECT NO. <b>10031</b>
DESIGNED BY: JDL	
DRAWN BY: APS	FIGURE NO. <b>2B</b>
REVISED BY: JDL	



August 30, 2012

Our Ref.: 102-0401.000

AMEC Environment & Infrastructure  
600 University Street, Suite 600  
Seattle, Washington, 98101

Attention: Mr. John Long

**RE: REPORT ON THE GEOPHYSICAL SURVEY AT CEDAR HILL LANDFILL,  
ISSAQUAH, WA**

Dear Mr. Long:

Global Geophysics conducted an electrical resistivity tomography survey on the west side of the existing landfill in August, 2012. The proposed objective of the geophysical investigation is to study the subsurface stratigraphy.

**METHODOLOGY AND INSTRUMENTATION**

**Electrical Resistivity Tomography (ERT)**

The electrical resistivity imaging technique maps differences in the electrical properties of geologic materials. These differences can result from variations in lithology, water content, and pore-water chemistry. The method involves transmitting an electric current into the ground between two electrodes and measuring the voltage between two other electrodes. The direct measurement is an apparent resistivity of the area beneath the electrodes that includes deeper layers as the electrode spacing is increased. Recent advances in technology permit rapid collection of multiple soundings, using up to 56 electrodes for each spread. The data are modeled to create a 2-D geo-electric cross-section that is useful for mapping both vertical and horizontal variations of the subsurface strata.

We utilized an AGI SuperSting system and place up to 112 electrodes at 20 ft interval. Once cable was laid on the ground and electrode placed on the ground, multiple soundings were automatically carried out by the control unit. The data was downloaded into computer and inverted using specialized inversion software on site. The result was presented as a color-contoured cross-section that highlights stratigraphic features or other information (presence of bedrock) that represent variations in resistivity.

## RESULTS

The survey was completed in five days. The locations of the lines are shown in Figure 1. The inverted resistivity profiles are shown in Figures 2A and 2B. Two resistivity group units are interpreted:

1. Areas of resistivity greater than 190 ohm-m (darker green to red in colors) are interpreted as coarser materials such as sand and gravels.
2. Areas of resistivity less than 190 ohm-m (blue to light green in colors) are interpreted as finer materials such as silty sand and gravels, silt.

## LIMITATIONS OF THE GEOPHYSICAL METHOD

Global geophysics services are conducted in a manner consistent with the level of care and skill ordinarily exercised by other members of the geophysical community currently practicing under similar conditions subject to the time limits and financial and physical constraints applicable to the services. ERT is a remote sensing geophysical method that may not detect all subsurface conditions due to the limitations of the methods and soil conditions.

Sincerely,

**Global Geophysics**



John Liu, Ph.D., R.G.  
Principal Geophysicist

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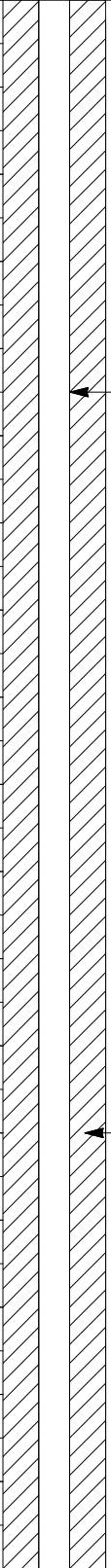
**APPENDIX B****West Side LFG Well Boring and Construction Logs**

PROJECT: + KCCHRL		Log of Well No. MGPW1700	
BORING LOCATION: West Side, KCCHRL		GROUND SURFACE ELEVATION AND DATUM: Temporary fill surface	
DRILLING CONTRACTOR: Cascade		DATE STARTED: 2/19/13	DATE FINISHED: 2/26/13
DRILLING METHOD: Sonic		TOTAL DEPTH (ft.): 170.0	SCREEN INTERVAL (ft.): 134.7-154.7
DRILLING EQUIPMENT: SonicCor 50k		DEPTH TO FIRST WATER: 121.5	COMPL. NA CASING: 4" Schedule 40 PVC
SAMPLING METHOD: Sonic core		LOGGED BY: C. Jefferson and J.D. Long	
HAMMER WEIGHT:	DROP:	RESPONSIBLE PROFESSIONAL: J.D. Long	REG. NO. LHg 1354

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	Foot		NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.  Surface Elevation:	
0						GRAVELLY LEAN CLAY with SAND (CL): very dark grayish brown (10YR 3/2), moist, firm 60% low plasticity fines, 25% medium-coarse sand, 10% fine gravel, 5% coarse gravel	2' temporary stickup before hook into LFG system
1							
2							
3							Basalite Concrete
4						sub-angular gravel	
5						coarse gravel content increases	
6							OVM Reading = CH4 / CO2 / O2 / BAL %s
7							
8						some firm, medium plasticity clay blobs	
9						dark brown (10YR 3/3),	4" diameter Schedule 40 PVC casing
10						coarse gravel content decreases and fine-medium sand content increases	
11						SILTY SAND with GRAVEL (SM): dark grayish brown (2.5Y 4/2), moist, 30% low plasticity fines, 30% fine-medium sand, 20% fine gravel, 10% coarse sand, 10% coarse gravel	
12						large woody debris, some mottling	Cetco 3/8" medium bentonite chips
13							
14						CLAYEY SAND with GRAVEL (SC): dark gray (2.5Y 4/1), moist, 45% fine-medium sand, 30% low plasticity fines, 15% fine gravel, 10% coarse sand	
15							

OAKWELLV (REV. 8/2011)

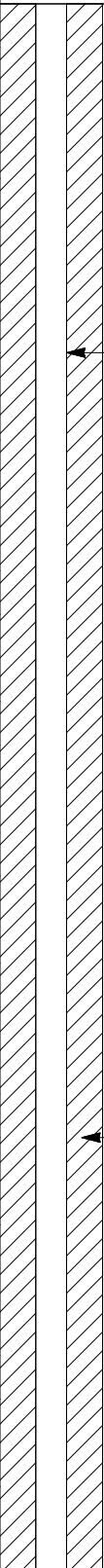
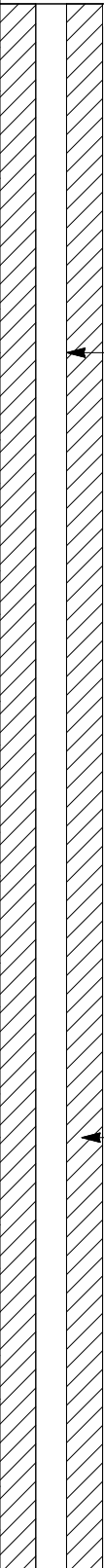
PROJECT: + KCCHRL					Log of Well No. MGPW1700 (cont'd)		
DEPTH (feet)	SAMPLES				DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.		WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample Blows/ Foot	Foot	OVN Reading			
15					CLAYEY SAND with GRAVEL (SC): Continued		
16					angular to sub-angular gravel		
17							
18				10.1 26.4 1.8 61.7	very small lenses of fine-medium sand		
19							4" diameter Schedule 40 PVC casing
20					SILTY SAND with GRAVEL (SM): grayish brown (2.5Y 5/2), dry, 35% fine-medium sand, 25% fine gravel, 15% coarse gravel, 15% low plasticity fines, 10% coarse sand		
21							
22							
23					dark grayish brown (2.5Y 4/2),		
24							
25					sub-rounded and sub-angular gravel		
26					dark gray (2.5Y 4/1),		
27							
28					CLAYEY SAND with GRAVEL (SC): dark gray (2.5Y 4/1), moist, 40% fine-medium sand, 35% low plasticity fines, 10% fine gravel, 10% coarse gravel, 5% coarse sand		Cetco 3/8" medium bentonite chips
29							
30					olive gray (5Y 4/2), coarse sand increases, some mottling		
31							
32					sub-angular gravel		
33							

PROJECT: + KCCHRL					Log of Well No. MGPW1700 (cont'd)		
DEPTH (feet)	SAMPLES				DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS	
	Sample No.	Sample	Blows/ Foot	OM Reading			
33					CLAYEY SAND with GRAVEL (SC): Continued	 <p>4" diameter Schedule 40 PVC casing</p> <p>Cetco 3/8" medium bentonite chips</p>	
34					SILTY SAND with GRAVEL (SM): very dark gray (2.5Y 3/1), dry, 35% fine-medium sand, 25% fine gravel, 20% coarse sand, 15% low plasticity fines, 5% coarse gravel		
35							
36					sub-rounded and sub-angular gravel		
37							
38					coarse gravel and coarse sand content increase		
39							
40				0.3 1.0 16.8 81.9	dark gray (2.5Y 4/1), sub-angular gravel		
41							
42					very small lenses of poorly graded sand		
43					gray (2.5Y 5/1), moist		
44							
45					fine-medium sand content increases		
46							
47							
48					fines content increases		
49							
50					greenish gray and dark greenish gray staining		
51							

PROJECT: + KCCHRL					Log of Well No. MGPW1700 (cont'd)		
DEPTH (feet)	SAMPLES				DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.		WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample Blows/ Foot	Foot	OVN Reading			
51					SILTY SAND with GRAVEL (SM): Continued		
52							
53					sub-rounded and sub-angular gravel		
54							
55					CLAYEY SAND with GRAVEL (SC): dark gray (2.5Y 4/1), moist, 35% fine-medium sand, 25% low plasticity fines, 20% coarse gravel, 15% fine gravel, 5% coarse sand		
56							4" diameter Schedule 40 PVC casing
57							
58					coarse gravel content decreases		
59							
60				0.1 0.2 17.8 81.9	CLAYEY GRAVEL with SAND (GC): dark gray (2.5Y 4/1), moist, 30% fine gravel, 20% coarse sand, 20% fine-medium sand, 15% coarse gravel, 15% low plasticity fines		
61					some mottling		
62					CLAYEY SAND with GRAVEL (SC): dark gray (2.5Y 4/1), moist, 40% fine-medium sand, 30% low plasticity fines, 15% fine gravel, 10% coarse gravel, 5% coarse sand		
63							Cetco 3/8" medium bentonite chips
64					CLAYEY GRAVEL with SAND (GC): dark gray (2.5Y 4/1), moist, 30% fine gravel, 25% fine-medium sand, 20% low plasticity fines, 15% coarse gravel, 10% coarse sand		
65							
66					CLAYEY SAND with GRAVEL (SC): dark gray (2.5Y 4/1), moist, 40% fine-medium sand, 20% coarse gravel, 20% low plasticity fines, 10% fine gravel, 10% coarse sand		
67							
68					fine-medium sand increases and coarse gravel content decreases		
69							

PROJECT: + KCCHRL					Log of Well No. MGPW1700 (cont'd)		
DEPTH (feet)	SAMPLES				DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.		WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample Blows/ Foot	Foot	OVM Reading			
69					CLAYEY SAND with GRAVEL (SC): Continued		
70							
71							
72					SILTY SAND with GRAVEL (SM): dark grayish brown (2.5Y 4/2), moist, 65% fine-medium sand, 20% low plasticity fines, 10% coarse sand, 5% fine gravel		
73							
74					POORLY-GRADED SAND with SILT and GRAVEL (SP-SM): dark gray (2.5Y 4/1), moist, 40% fine-medium sand, 20% fine gravel, 15% coarse sand, 15% coarse gravel, 10% low plasticity fines		4" diameter Schedule 40 PVC casing
75							
76							
77					coarse gravel content increases		
78					SILTY SAND with GRAVEL (SM): dark gray (2.5Y 4/1), dry, 45% fine-medium sand, 20% coarse sand, 20% low plasticity fines, 10% fine gravel, 5% coarse gravel		
79				0.3 0.1 16.8 82.8			
80							
81					sub-rounded gravel		Cetco 3/8" medium bentonite chips
82							
83					POORLY-GRADED SAND with SILT and GRAVEL (SP-SM): dark gray (2.5Y 4/1), dry, 40% coarse sand, 30% fine-medium sand, 15% fine gravel, 10% low plasticity fines, 5% coarse gravel		
84					CLAYEY SAND with GRAVEL (SC): dark gray (2.5Y 4/1), moist, 60% fine-medium sand, 20% low plasticity fines, 10% fine gravel, 10% coarse sand		
85							
86							
87							

PROJECT: + KCCHRL					Log of Well No. MGPW1700 (cont'd)		
DEPTH (feet)	SAMPLES				DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.		WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample Blows/ Foot	Foot	OVN Reading			
87					CLAYEY SAND with GRAVEL (SC): Continued		
88					↓ coarse sand and fine gravel content increases and fine-medium sand content decreases		
89					POORLY-GRADED SAND with CLAY and GRAVEL (SP-SC): dark gray (2.5Y 4/1), dry, 40% coarse sand, 20% fine-medium sand, 20% fine gravel, 10% coarse gravel, 10% low plasticity fines		
90							← 4" diameter Schedule 40 PVC casing
91							
92					CLAYEY SAND with GRAVEL (SC): dark gray (2.5Y 4/1), moist, 35% fine-medium sand, 30% low plasticity fines, 15% coarse gravel, 10% fine gravel, 10% coarse sand		
93							
94					↓ fine gravel content increases and fine-medium sand content decreases		
95					sub-rounded gravel		
96							
97					POORLY-GRADED SAND with CLAY and GRAVEL (SP-SC): dark gray (2.5Y 4/1), moist, 35% fine-medium sand, 30% coarse sand, 20% fine gravel, 10% low plasticity fines, 5% coarse gravel		
98							
99							
100				0.2 0.2 14.0 85.6			← Cetco 3/8" medium bentonite chips
101							
102					POORLY-GRADED GRAVEL with SAND (GP): dark gray (2.5Y 4/1), moist, 55% fine gravel, 20% coarse sand, 10% coarse gravel, 10% fine-medium sand, 5% non-plastic fines		
103					sub-angular gravel		
104					POORLY-GRADED SAND with GRAVEL (SP): dark gray (2.5Y 4/1), moist, 45% fine gravel, 35% fine-medium sand, 20% coarse sand		
105							

PROJECT: + KCCHRL					Log of Well No. MGPW1700 (cont'd)		
DEPTH (feet)	SAMPLES			OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS	
	Sample No.	Sample Blows/ Foot	Foot				
105					POORLY-GRADED SAND with GRAVEL (SP): Continued		4" diameter Schedule 40 PVC casing
106					POORLY-GRADED GRAVEL with SAND (GP): dark gray (2.5Y 4/1), dry, 50% fine gravel, 20% coarse sand, 15% fine-medium sand, 10% coarse gravel, 5% non-plastic fines		
107							
108							
109				0.1 0.1 20.0 79.9	coarse sand content decreases and fine-medium sand content increases		
110							
111					sub-rounded gravel		
112							
113							
114					sub-angular gravel		
115					POORLY-GRADED GRAVEL with SILT and SAND (GP-GM): dark gray (2.5Y 4/1), dry, 30% fine gravel, 25% fine-medium sand, 20% coarse sand, 15% coarse gravel, 10% low plasticity fines		Cetco 3/8" medium bentonite chips
116							
117					SILTY GRAVEL (GM): dark gray (2.5Y 4/1), moist, 55% fine gravel, 20% coarse gravel, 10% fine-medium sand, 15% low plasticity fines		
118				0.1 0.0 19.7 80.2			
119					fine gravel content decreases and fine-medium sand content increases		
120							
121					sub-angular and sub-rounded gravel		
122					wet		
123							

amec

Project No. 10031

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OAKWELLV (REV. 8/2011)

PROJECT: + KCCHRL					Log of Well No. MGPW1700 (cont'd)		
DEPTH (feet)	SAMPLES				DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.		WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	OVN Reading			
123					CLAYEY SAND with GRAVEL (SC): dark gray (2.5Y 4/1), moist, 40% fine-medium sand, 35% low plasticity fines, 15% fine gravel, 10% coarse sand		
124							
125				0.1 0.0 19.8 80.1	very small lenses of hard, medium plasticity lean clay		4" diameter Schedule 40 PVC casing
126							
127							
128					POORLY-GRADED GRAVEL with SAND (GP): dark gray (2.5Y 4/1), moist, 70% fine gravel, 10% coarse gravel, 15% fine-medium sand, 5% non-plastic fines		
129					fine gravel content decreases		Cetco 3/8" medium bentonite chips
130				0.1 0.0 19.7 80.2			
131					CLAYEY GRAVEL with SAND (GC): dark gray (2.5Y 4/1), moist, 35% low plasticity fines, 30% fine gravel, 15% fine-medium sand, 10% coarse sand, 10% coarse gravel		
132					sub-angular gravel		20/40 Sweet Sand
133							
134					gravel content increases and fines content decreases		
135							
136					coarse gravel content decreases		
137				0.1 0.0 20.2 79.7			Sakrete All Purpose Gravel
138					fine-medium sand content increases		
139							
140				0.1 0.0 17.9 82.0	sub-angular and sub-rounded gravel		
141							

PROJECT: + KCCHRL					Log of Well No. MGPW1700 (cont'd)		
DEPTH (feet)	SAMPLES				DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.		WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample Blows/ Foot	Foot	OVM Reading			
141					CLAYEY GRAVEL with SAND (GC): Continued		
142					↓ coarse gravel content increases		
143							
144							
145							4" diameter Schedule 40 PVC well screen with 0.020 V Wire MXF
146							
147							
148							
149							
150							Sakrete All Purpose Gravel
151							
152				0.1 0.0 18.6 81.3	SANDY LEAN CLAY (CL): dark gray (2.5Y 4/1), moist, 55% low plasticity fines, 30% fine-medium sand, 10% coarse sand, 5% fine gravel		
153							
154							
155							
156					lean clay lenses		4" diameter Schedule 40 PVC casing
157							
158							Cetco 3/8" medium bentonite chips
159							

OAKWELLV (REV. 8/2011)

PROJECT: + KCCHRL					Log of Well No. MGPW1700 (cont'd)		
DEPTH (feet)	SAMPLES				DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.		WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	OVN Reading			
159					LEAN CLAY (CL): very dark gray (GLEYS 1 1/N), moist, hard, 90% low plasticity fines, 10% fine-medium sand		
160				0.0 0.0 19.9 80.1			
161					SANDY LEAN CLAY with GRAVEL (CL): dark grayish brown (2.5Y 4/2), wet, hard, 35% low plasticity fines, 30% fine-medium sand, 20% fine gravel, 15% coarse sand		
162							4" diameter Schedule 40 PVC casing
163							
164					SANDY LEAN CLAY with GRAVEL (CL): dark grayish brown (2.5Y 4/2), moist, hard, 40% low plasticity fines, 25% fine-medium sand, 20% coarse sand, 15% fine gravel		
165							
166							
167							
168					CLAYEY SAND (SC): dark grayish brown (2.5Y 4/2), moist, 50% fine-medium sand, 45% low plasticity fines, 5% coarse sand		Cetco 3/8" medium bentonite chips
169				0.0 0.0 17.3 82.8			
170					Bottom of boring at 170'		
171							
172							
173							
174							
175							
176							
177							

PROJECT: KCCHRL West Side LFG KCCHRL						<b>Log of Well No. MGW1701X</b>			
BORING LOCATION: West Side, KCCHRL						GROUND SURFACE ELEVATION AND DATUM: Temporary fill surface			
DRILLING CONTRACTOR: Cascade						DATE STARTED: 1/10/12		DATE FINISHED: 1/13/12	
DRILLING METHOD: Sonic						TOTAL DEPTH (ft.): 120.0		SCREEN INTERVAL (ft.): 75-95	
DRILLING EQUIPMENT: SDC390-14						DEPTH TO WATER:	FIRST 95	COMPL. NA	CASING: 4" Schedule 40 PVC
SAMPLING METHOD: Sonic core						LOGGED BY: D. O'Reilly			
HAMMER WEIGHT:			DROP:			RESPONSIBLE PROFESSIONAL: J.D. Long			REG. NO. LHg 1354

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.  Surface Elevation:	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot				
0						CLAYEY SILT with GRAVEL (ML): light brown (7.5YR 6/3), moist, 80% fines, 15% gravel, 5% medium sand, low to moderate plasticity	2' temporary stickup before hook into LFG system
1						strong brown (7.5YR 5/8)	
2							Baselite Concrete
3							
4							
5							
6							OVM Reading = CH4 / CO2 / O2 / BAL %s
7						more gravel (20-25%)	
8						strong brown (7.5YR 5/8) mottling, large subangular cobble	
9						less gravel (5-10%), more rounded, finer	
10							
11							
12						40% sand lens, sandier (10-15%) below	
13							
14						SILTY CLAY (CL): brown (7.5YR 4/2), moist, 85% fines, 10% gravel, 5% medium sand, moderate plasticity	
15							

## Log of Well No. MGW1701X (cont'd)

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.			WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	Foot					
15									
16									
17						SILTY CLAY with GRAVEL (CL): dark gray (7.5YR 4/1), moist, 65% fines, 35% gravel, moderate plasticity			
18									
19									
20					0.0 0.2 19.8 80.0	large cobbles, rock flour from drilling through			
21						more gravel (40-45%)			
22									
23									
24									
25									Cetco 3/8" medium bentonite chips
26						less gravel (20%)			
27									
28									
29									
30						gravel at 25%; lots of angular pieces and fresh faces from drilled-through cobbles			
31									
32									
33									

PROJECT: KCCHRL West Side LFG  
KCCHRL

## Log of Well No. MGW1701X (cont'd)

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.			WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	Foot					
33									
34									
35									
36					0.1 0.0 18.6 81.3				
37									
38						fewer broken cobbles, more smaller (2-3") subrounded gravel			
39									
40									
41									
42						same percentages, but more indurated- large conglomerates of peds and fines forming tight balls			
43									
44									
45									
46						looser again, less indurated, more broken cobbles			
47									
48									
49									
50									
51									

4" diameter Schedule 40  
PVC casing

OAKWELLV (REV. 8/2011)

PROJECT: KCCHRL West Side LFG  
KCCHRL

## Log of Well No. MGW1701X (cont'd)

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.			WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	Foot					
51									
52									
53						copious rock flour from pulverizing a large cobble			
54									
55									
56									
57									
58					0.0 0.0 20.9 79.1				
59									
60						large subangular cobbles; gray rock flour coexistent in sections with angular faced, freshly-broken surfaces on largest cobbles			
61									
62						copious rock flour from pulverizing a large cobble			
63									
64						5% trace fine sand, subrounded medium cobbles			
65									
66									
67									
68						copious rock flour			
69									

OAKWELLV (REV. 8/2011)

# Log of Well No. MGW1701X (cont'd)


DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	Foot			
69							
70						GRAVELLY SILT with SAND (ML): dark gray (7.5YR 4/1), moist, 55% fines, 35% fine to coarse subrounded gravel, 10% medium sand	
71							20/40 Sweet Sand
72						very large cobbles (1 > 6"), copious rock flour	
73						GRAVELLY SILT (ML): dark gray (7.5YR 4/1), moist, 70% fines, 25% gravel, 5% medium sand, low induration	
74							
75							
76							
77							
78					3.9 0.3 7.9 87.9	SILTY SAND with GRAVEL (SM): dark gray (7.5YR 4/1), moist, 45% fine sand, 30% fines, 25% gravel grading finer with depth	
79							
80							Sakrete All Purpose Gravel
81							
82							
83							
84						brown (7.5YR 4/4)	
85							4" diameter Schedule 40 PVC well screen with 0.020 V Wire MXF
86							
87							

PROJECT: KCCHRL West Side LFG KCCHRL					Log of Well No. MGW1701X (cont'd)		
DEPTH (feet)	SAMPLES				DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.		WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	OVM Reading			
87							
88				7.2 0.1 4.9 87.8			
89							
90							
91							
92							
93							
94					larger cobbles		
95					wet		
96							
97							
98							
99				8.3 0.1 3.9 87.7			
100					coarsening sand strong brown (7.5YR 6/4)		
101							
102							
103							
104							
105							

PROJECT: KCCHRL West Side LFG KCCHRL						Log of Well No. MGW1701X (cont'd)	
DEPTH (feet)	SAMPLES			OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS	
	Sample No.	Sample	Blows/ Foot				
105							
106							
107							
108					brown (7.5YR 5/4), dry to moist		
109				0.0 0.4 4.6 95.0			
110							
111							
112							
113							
114							
115							
116					brown (7.5YR 5/2)		
117							
118				0.0 0.4 4.6 95.0			
119							
120					Bottom of boring at 120 feet. WSDOE well tag= BHM 101.		
121							
122							
123							

Cetco 3/8" medium  
bentonite chips

OAKWELLV (REV. 8/2011)



Project No. 10031

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PROJECT: KCCHRL West Side LFG KCCHRL						<b>Log of Well No. MGPW1703</b>			
BORING LOCATION: West Side, KCCHRL						GROUND SURFACE ELEVATION AND DATUM: Temporary fill surface			
DRILLING CONTRACTOR: Cascade						DATE STARTED: 8/27/12		DATE FINISHED: 8/31/12	
DRILLING METHOD: Sonic						TOTAL DEPTH (ft.): 145.0		SCREEN INTERVAL (ft.): 104-134	
DRILLING EQUIPMENT: SDC390-14						DEPTH TO WATER: 86	FIRST 86	COMPL. NA	CASING: 4" Schedule 40 PVC
SAMPLING METHOD: Sonic core						LOGGED BY: D. O'Reilly			
HAMMER WEIGHT:				DROP:		RESPONSIBLE PROFESSIONAL: J.D. Long			REG. NO. LHg 1354

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	Foot		NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	
0						Surface Elevation:	
1						road base	
2						SILTY SAND with GRAVEL (SM): brown (7.5YR 4/4), dry to moist, 15% medium sand, 50% fine sand, 20% fines, 15% subrounded gravel	2' temporary stickup before hook into LFG system
3							Baselite Concrete
4							
5						SILT (ML): very dark gray (7.5YR 3/1), moist, 95% low plasticity fines, 5% trace subangular gravel	
6							
7						POORLY-GRADED SAND with SILT and GRAVEL (SP): very dark gray (7.5YR 3/1), moist, 20% medium sand, 55% fine sand, 15% subrounded gravel, 10% fines	
8							
9						wood fragments	
10						more gravel, some cobbles, some dark brown (7.5YR 3/4) pockets, 10% cobbles, 15% gravel, 10% medium sand, 55% fine sand, 10% fines	
11							
12							
13							
14						clay lens, low plasticity	
15							

OAKWELLV (REV. 8/2011)  
 Project No. 10031      Page 1 of 9

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS	
	Sample No.	Sample	Blows/ Foot					
15								
16								
17						5" subangular granodiorite cobble		
18								
19						6" subangular cobble		
20					0.2 0.0 19.5 80.3			
21								
22						CLAYEY SAND with GRAVEL (SC): brown (7.5YR 4/3), moist, some strong brown (7.5YR 4/6) streaks, 10% cobbles, 25% subrounded to rounded gravel, 10% medium sand, 40% fine sand, 15% fines		
23								
24								
25								Cetco 3/8" medium bentonite chips
26						less gravel, 5% cobbles, 10% gravel, 10% medium sand, 50% fine sand, 15% fines		
27						SILT (ML): dark gray (7.5YR 4/1), moist, 5% subangular gravel, 10% fine sand, 85% low plasticity fines		
28								
29								
30						SILT with GRAVEL and SAND (ML): very dark gray (7.5YR 3/1), moist, 15% cobbles, 15% subangular gravel, 25% fine sand, 45% low plasticity fines		
31								
32								
33								

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.			WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	Foot					
33									
34									
35									
36						POORLY-GRADED SAND (SP): brown (7.5YR 5/4), moist, 100% fine sand			
37									
38									
39						WELL-GRADED SAND with GRAVEL (SW): brown (7.5YR 5/2), moist, 15% subangular gravel, 30% coarse sand, 30% medium sand, 20% fine sand, 5% fines			
40					0.0 0.0 21.7 78.3				
41									
42						POORLY-GRADED SAND with GRAVEL (SP): light brown (7.5YR 6/3), moist, 20% subrounded cobbles, 25% subrounded gravel, 55% fine sand			
43						brown (7.5YR 5/2)			
44									
45									
46									
47						gray (7.5YR 6/1)			
48						more fines, 20% subrounded cobbles, 25% subrounded gravel, 45% fine sand, 10% fines			
49									
50						CLAYEY GRAVEL with SAND (GC): gray (7.5YR 6/1), moist, 30% cobbles, 20% subrounded gravel, 15% medium sand, 10% fine sand, 25% moderate plasticity fines			
51									

4" diameter Schedule 40  
PVC casing

PROJECT: KCCHRL West Side LFG  
KCCHRL

## Log of Well No. MGPW1703 (cont'd)

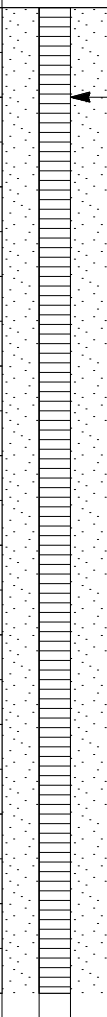
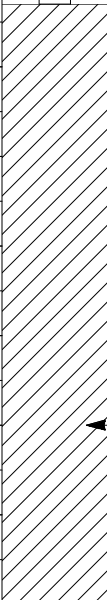
DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS	
	Sample No.	Sample	Blows/ Foot	Foot				
51								
52								
53								
54								
55								
56						strong brown (7.5YR 6/4)		
57								
58						brown (7.5YR 5/2)		
59								
60					0.0 0.0 20.8 79.2	POORLY-GRADED GRAVEL with SAND (GP): brown (7.5YR 5/2), moist, 30% cobbles, 25% subrounded to subangular gravel, 20% coarse sand, 20% medium sand, 5% fines, some shattered rock/ broken cobble faces		
61								
62								
63								
64						iron oxide staining		
65								
66								
67								
68						more fine gravel, 15% cobbles, 40% gravel, 20% coarse sand, 10% medium sand, 10% fine sand, 5% fines		
69								

OAKWELLV (REV. 8/2011)

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS	
	Sample No.	Sample	Blows/ Foot	Foot				
69								
70						gravel coarser again, more subangular, 30% cobbles, 20% gravel, 25% medium sand, 20% fine sand, 5% fines		
71								
72								
73								
74						iron oxide staining		
75								
76						large subrounded cobbles, 35% cobbles, 20% gravel, 20% medium sand, 20% fine sand, 5% fines		
77								
78								
79								
80					0.1 0.0 21.3 78.6	30% cobbles, 20% gravel, 20% medium sand, 20% fine sand, 5% fines		
81								
82						finer, more subangular gravel, 10% cobbles, 45% gravel, 20% medium sand, 20% fine sand, 5% fines		
83						gravel and clay lens		
84								
85								
86								
87								

PROJECT: KCCHRL West Side LFG KCCHRL					Log of Well No. MGPW1703 (cont'd)		
DEPTH (feet)	SAMPLES				DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.		WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	OVM Reading			
87					POORLY-GRADED GRAVEL with CLAY and SAND (GP-GC): light brown (7.5YR 6/3), moist- almost wet, 30% cobbles, 30% subrounded to subangular gravel, 15% coarse sand, 10% fine sand, 15% moderate plasticity fines  iron oxide staining  lots of fine subangular gravel, 20% cobbles, 30% gravel, 25% coarse sand, 15% fines  yellowish red (5YR 5/8)  sand lens		
88							
89							
90							
91							
92							
93							
94							
95							
96							
97					POORLY-GRADED GRAVEL with SAND (GP): brown (7.5YR 5/2), moist, 15% cobbles, 40% subrounded to subangular gravel, 20% medium sand, 20% fine sand, 5% fines  finer gravel, more subangular, 5% cobbles, 45% gravel, 15% coarse sand, 25% medium sand, 5% fine sand, 5% fines  more fines, brown (7.5YR 4/2), 15% cobbles, 30% gravel, 15% coarse sand, 25% medium sand, 5% fine sand, 10% fines		
99							
100							
101							
102							
103				0.0 0.0 21.2 78.8			
104							
105							

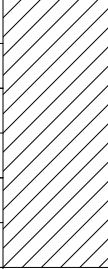
DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample Blows/ Foot	Sample Blows/ Foot	Sample Blows/ Foot			
105							
106						coarser sand, no fines, 20% cobbles, 25% gravel, 30% coarse sand, 15% medium sand, 10% fine sand	
107							
108						finer sand, light gray (7.5YR 7/1), 15% cobbles, 35% gravel, 10% medium sand, 30% fine sand, 10% fines	
109							
110						POORLY-GRADED SAND (SP): dark gray (7.5YR 4/1), moist, hard to distinguish from silt but contains visible sediments, indurated, some strong brown (7.5YR 5/6) mottling, 100% fine sand	
111							
112							
113							
114							Sakrete All Purpose Gravel
115							
116							
117						CLAY (CL): strong brown (7.5YR 5/6), moist, broken into chunks, 100% moderate plasticity fines	
118						POORLY-GRADED SAND with GRAVEL (SP): brown (7.5YR 5/3), moist, 10% subrounded cobbles, 20% subangular gravel, 20% coarse sand, 40% medium sand, 10% fine sand	
119							
120					0.0 0.0 21.3 78.7		
121							
122							
123							

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.		WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample Blows/ Foot	Foot					
123						more fine grains, 10% cobbles, 10% gravel, 10% coarse sand, 25% medium sand, 40% fine sand, 5% fines		 <p>4" diameter Schedule 40 PVC well screen with 0.020 V Wire MXF</p>
124								
125								
126								
127						POORLY-GRADED GRAVEL with SAND (GP): light gray (7.5YR 7/1), moist, 35% cobbles, 20% subrounded to subangular gravel, 20% medium sand, 25% fine sand		
128								
129								
130								
131						SILT with GRAVEL (ML): light gray (7.5YR 7/1), moist, fines like baking powder but doesn't appear to be rock flour (no angular cobbles), 35% cobbles, 10% subrounded gravel, 55% fines		
132								
133								
134								
135						POORLY-GRADED GRAVEL with SAND (GP): gray (7.5YR 6/1), moist, 30% subrounded to subangular cobbles, 20% subrounded to subangular gravel, 45% fine sand, 5% fines		 <p>Cetco 3/8" medium bentonite chips</p>
136								
137						fewer cobbles, 10% cobbles, 40% gravel, 40% fine sand, 10% fines		
138								
139						more cobbles, brown (7.5YR 5/2), 35% cobbles, 35% gravel, 10% medium sand, 20% fine sand		
140								
141								

OAKWELLY (REV. 8/2011)

Project No. 10031

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PROJECT: KCCHRL West Side LFG KCCHRL					Log of Well No. MGPW1703 (cont'd)	
DEPTH (feet)	SAMPLES			OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot			
141				0.0 0.1 8 91.9		
142					CLAYEY SAND (SC): brown (7.5YR 4/2), moist, 10% gravel, 40% medium sand, 25% fine sand, 25% fines	
143						
144					POORLY-GRADED GRAVEL with SAND (GP): brown (7.5YR 5/2), moist, 35% cobbles, 25% subrounded gravel, 35% medium sand, 5% fines	
145					Bottom of boring at 145 feet.	
146						
147						
148						
149						
150						
151						
152						
153						
154						
155						
156						
157						
158						
159						

PROJECT: KCCHRL West Side LFG KCCHRL						<b>Log of Well No. MGW1705X</b>			
BORING LOCATION: West Side, KCCHRL						GROUND SURFACE ELEVATION AND DATUM: Temporary fill surface			
DRILLING CONTRACTOR: Cascade						DATE STARTED: 2/14/12		DATE FINISHED: 2/15/12	
DRILLING METHOD: Sonic						TOTAL DEPTH (ft.): 137.0		SCREEN INTERVAL (ft.): 103-123	
DRILLING EQUIPMENT: SDC390-14						DEPTH TO WATER: 86	FIRST 86	COMPL. NA	CASING: 4" Schedule 40 PVC
SAMPLING METHOD: Sonic core						LOGGED BY: D.O'Reilly			
HAMMER WEIGHT:			DROP:			RESPONSIBLE PROFESSIONAL: J.D. Long			REG. NO. LHg 1354

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	Foot		NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	
0						Surface Elevation:	
1						CLAY with SAND (CL): brown (7.5YR 5/2), moist, 80% fines, 15% fine sand, 5% fine gravel, medium induration	2' temporary stickup before hook into LFG system
2							
3							
4							
5							
6						CLAY (CL): gray (7.5YR 5/1), 100% low plasticity fines, medium induration	Baselite Concrete
7							
8							
9							
10							
11						POORLY SORTED SAND with SILT (SP-SM): brown (7.5YR 4/2), 45% medium sand, 40% fine sand, 15% fines, some organics	OVM Reading = CH4 / CO2 / O2 / BAL %s
12							
13							
14							
15							
15						CLAY (CL): gray (7.5YR 5/1), 95% low plasticity fines, 5% fine subrounded gravel, medium induration	

OAKWELLV (REV. 8/2011)  
 Project No. 10031      Page 1 of 8

PROJECT: KCCHRL West Side LFG  
KCCHRL

## Log of Well No. MGW1705X (cont'd)

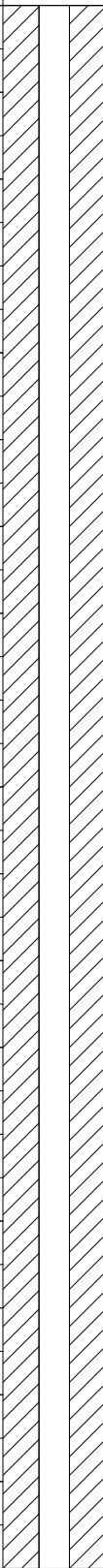
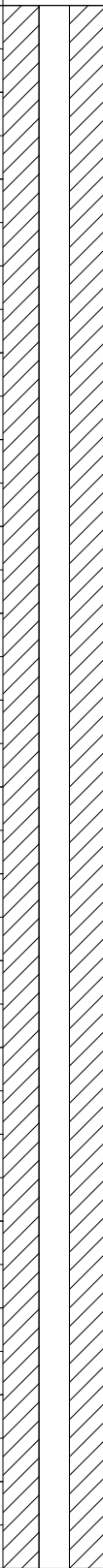
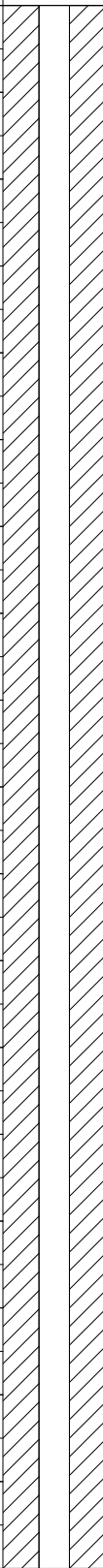
DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS	
	Sample No.	Sample	Blows/ Foot	Foot				
15								
16								
17								
18								
19					4.4 1.5 12.5 81.6	POORLY GRADED SAND (SP): dark brown (7.5YR 3/5), 35% medium sand, 55% fine sand, 10% fines as gray clay balls		
20						CLAY with GRAVEL (CL): gray (7.5YR 5/1), 80% non to low plasticity fines, 10% subrounded cobbles, 10% fine subrounded gravel, medium induration		
21								
22								
23								
24								
25								
26								
27								
28								
29								
30						dark gray (7.5YR 4/1)		
31								
32						85% non to low plasticity fines, 10% fine subrounded gravel, 5% subrounded cobbles		
33								

OAKWELLV (REV. 8/2011)

# Log of Well No. MGW1705X (cont'd)

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.			WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	Foot					
33									
34						CLAY (CL): gray (7.5YR 5/1), 90% non to low plasticity fines, 5% subangular to subrounded cobbles, 5% fine subangular to subrounded gravel			
35									
36									
37									
38									
39					0.3 0.4 19.6 79.7				
40									Cetco 3/8" medium bentonite chips
41									
42									
43						fine sand lens			
44						WELL GRADED SAND with CLAY (SW-SC): brown (7.5YR 4/3), 30% coarse sand, 30% medium sand, 15% fine sand, 20% fines, 5% fine gravel			
45									
46									
47						SILT (ML): strong brown (7.5YR 5/6), 95% low plasticity fines, 5% fine sand, medium induration			
48									
49						lens of SW-SC as above			
50						brown (7.5YR 5/2)			4" diameter Schedule 40 PVC casing
51									

## Log of Well No. MGW1705X (cont'd)

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS	
	Sample No.	Sample	Blows/ Foot	Foot				
51						POORLY GRADED SAND with GRAVEL (SP): brown (7.5YR 5/4), 50% coarse sand, 20% medium sand, 10% fine sand, 5% subrounded to subangular cobbles, 10% fine subrounded to subangular gravel, 5% fines as coherent clumps		
52								
53								
54								
55								
56						brown (7.5YR 5/2); 30% coarse sand, 20% medium sand, 5% fine sand, 20% subrounded to subangular cobbles, 20% fine subrounded to subangular gravel, 5% fines as coherent clumps		
57								
58								
59					0.2 0.1 20.5 79.2			
60								
61						15% coarse sand, 30% medium sand, 10% fine sand, 25% subrounded to subangular cobbles, 20% fine subrounded to subangular gravel		
62								
63								
64								
65								
66								
67								
68								
69								
69								

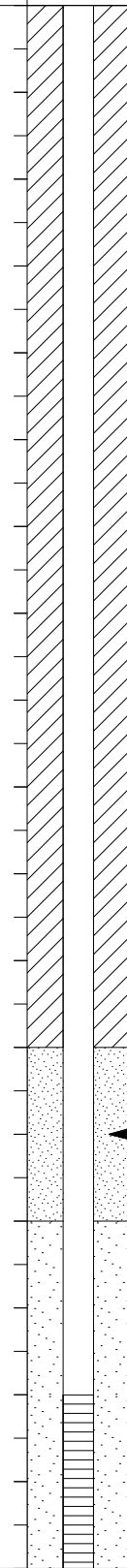
PROJECT: KCCHRL West Side LFG  
KCCHRL

## Log of Well No. MGW1705X (cont'd)

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS	
	Sample No.	Sample	Blows/ Foot	Foot				
69					0.2 0.0 20.8 79.0			
70								
71								
72						brown (7.5YR 4/3); 30% coarse sand, 25% medium sand, 10% fine sand, 10% subrounded to subangular cobbles, 25% fine subrounded to subangular gravel		
73								
74								
75						↓ light brownish gray (10YR 6/2)		
76								
77								
78					0.2 0.0 20.8 79.0			
79						↓ pale brown (10YR 6/3), wetter		
80								
81								
82								
83								
84								
85								
86								
87								

OAKWELLV (REV. 8/2011)

## Log of Well No. MGW1705X (cont'd)

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	Foot			
87						WELL GRADED SAND with GRAVEL (SP): light brown (10YR 6/4), wet, 10% coarse sand, 20% medium sand, 30% fine sand, 5% subrounded cobbles, 30% fine subrounded gravel, 5% fines	
88							
89							
90					0.2 0.0 21.0 78.8		
91							
92						POORLY GRADED GRAVEL with SAND and CLAY (GP-GC): light brown (10YR 6/4), 30% subangular to subrounded cobbles, 25% fine subangular to subrounded gravel, 5% coarse sand, 20% medium sand, 10% fine sand, 10% fines	
93							
94							
95							
96							
97						large cobble	
98							
99							
100					0.2 0.0 21.1 78.7		
101							
102						WELL GRADED GRAVEL with SAND and CLAY (GW-GC): brown (7.5YR 5/3), 20% subrounded cobbles, 35% fine subrounded gravel, 10% coarse sand, 20% medium sand, 5% fine sand, 10% fines	
103							
104							
105							
106							

## Log of Well No. MGW1705X (cont'd)

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.		WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	Foot				
105					0.3 0.0 20.7 79.0	WELL GRADED GRAVEL with SAND (GW): brown (7.5YR 5/3), moist, 20% subrounded cobbles, 30% fine subrounded gravel, 15% coarse sand, 30% medium sand, 5% fine sand		4" diameter Schedule 40 PVC well screen with 0.020 V Wire MXF
106								
107								
108								
109								
110						POORLY GRADED SAND with GRAVEL (SP): brown (7.5YR 4/3), 5% coarse sand, 45% medium sand, 25% fine sand, 5% subrounded to subangular cobbles, 15% fine subangular gravel, 5% fines		
111								
112								
113								Sakrete All Purpose Gravel
114						5% coarse sand, 40% medium sand, 25% fine sand, 15% subrounded to subangular cobbles, 10% fine subangular gravel, 5% fines		
115								
116						WELL GRADED SAND with GRAVEL (SW): grayish brown (10YR 5/2), wet, 20% coarse sand, 25% medium sand, 20% fine sand, 5% subrounded cobbles, 20% fine subrounded gravel, 10% fines moist		
117								
118						WELL GRADED SAND with GRAVEL (SW): grayish brown (10YR 5/2), 20% coarse sand, 30% medium sand, 25% fine sand, 5% subrounded cobbles, 15% fine subrounded gravel, 5% fines		
119								
120					0.3 0.0 21.3 78.4			
121								
122						wet; 10% coarse sand, 30% medium sand, 45% fine sand, 5% subrounded cobbles, 10% fine subrounded gravel		
123								

amec

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OAKWELLV (REV. 8/2011)

# Log of Well No. MGW1705X (cont'd)

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	Foot			
123							
124						SILT (ML): strong brown (7.5YR 5/8), moist, 100% non-plastic fines, well indurated, planar bedding features	
125							
126						POORLY GRADED SAND (SP): brown (7.5YR 4/4), wet, 90% fine sand, 10% medium sand, some tabular bedding	
127							
128						CLAY (CL): dark gray (7.5YR 4/1), moist, 100% low plasticity fines, well indurated	
129						▼ strong brown (7.5YR 5/8)	
130					0.2 0.0 20.8 79.0	POORLY GRADED SAND with GRAVEL (SP): brown (10YR 5/3), 5% coarse sand, 40% medium sand, 30% fine sand, 5% subrounded to subangular cobbles, 20% fine subrounded to subangular gravel very pale brown (10YR 7/3) lens	
131							
132							
133							
134							
135							
136							
137						▼ wet	
138						Bottom of boring at 138'. WSDOE well tag= BHM 106.	
139							
140							
141							

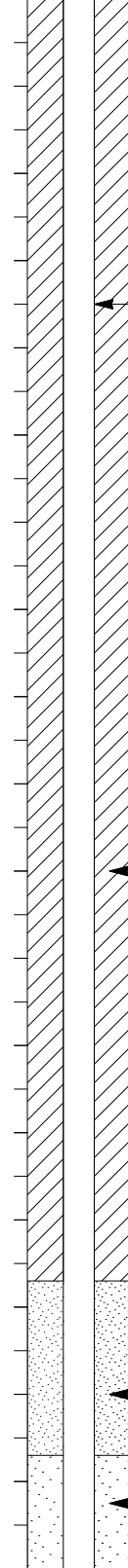
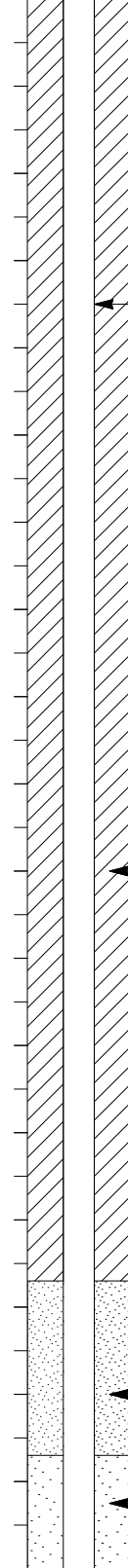
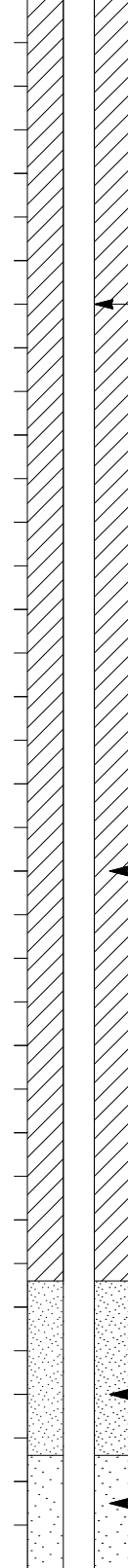
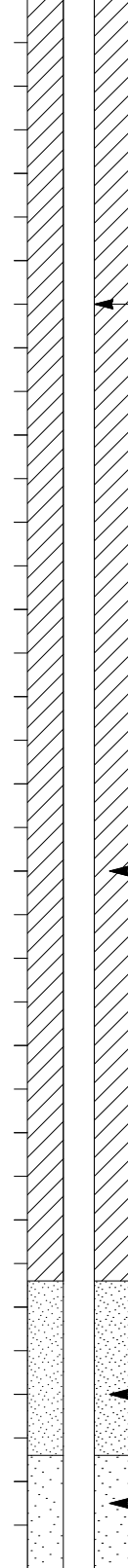
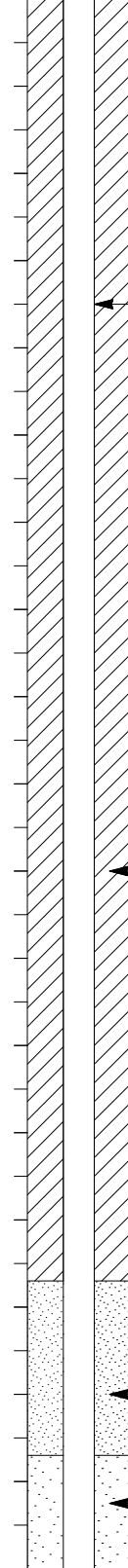
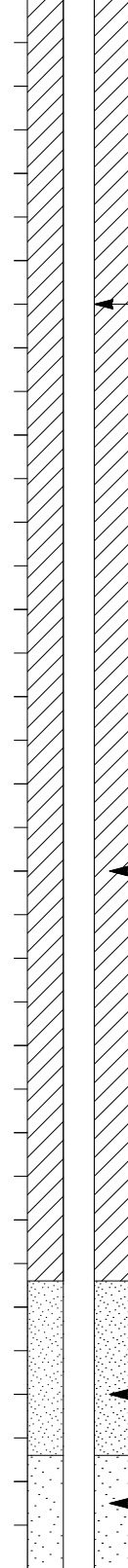
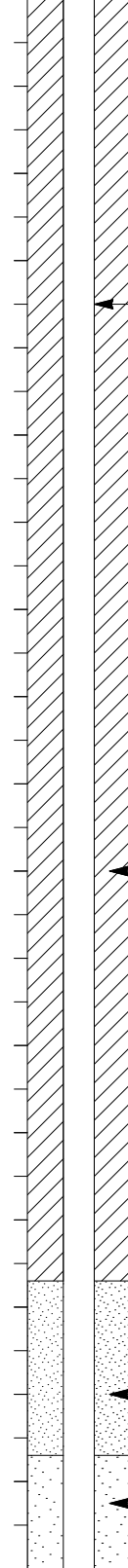
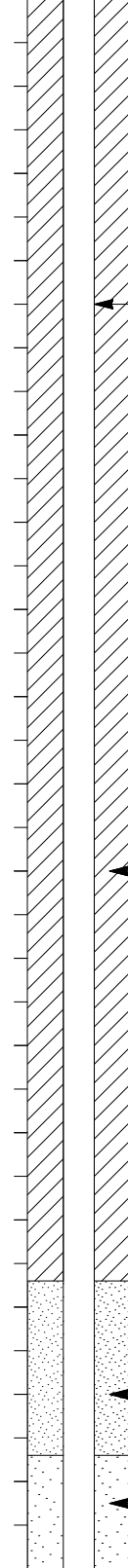
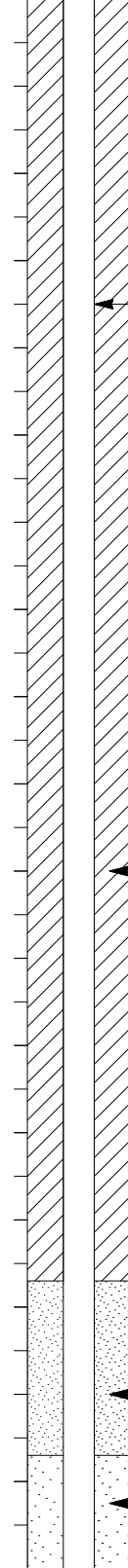
← Cetco 3/8" medium bentonite chips

PROJECT: + KCCHRL		Log of Well No. MGPW1708	
BORING LOCATION: West Side, KCCHRL		GROUND SURFACE ELEVATION AND DATUM: Temporary fill surface	
DRILLING CONTRACTOR: Cascade		DATE STARTED: 2/26/13	DATE FINISHED: 2/28/13
DRILLING METHOD: Sonic		TOTAL DEPTH (ft.): 120.0	SCREEN INTERVAL (ft.): 70-110
DRILLING EQUIPMENT: SonicCor 50k		DEPTH TO WATER: 61	COMPL. NA CASING: 4" Schedule 40 PVC
SAMPLING METHOD: Sonic core		LOGGED BY: C. Jefferson and J.D. Long	
HAMMER WEIGHT:	DROP:	RESPONSIBLE PROFESSIONAL: J.D. Long	REG. NO. LHg 1354

DEPTH (feet)	SAMPLES			OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample Blows/ Foot	Foot		Surface Elevation:	
0					GRAVELLY LEAN CLAY with SAND (CL): very dark grayish brown (10YR 3/2), moist, firm 60% low plasticity fines, 25% medium-coarse sand, 10% fine gravel, 5% coarse gravel	2' temporary stickup before hook into LFG system
1						
2						
3						
4					sub-angular gravel	Basalite Concrete
5					coarse gravel content increases	
6						OVM Reading = CH4 / CO2 / O2 / BAL %s
7					CLAYEY SAND with GRAVEL (SC): gray (2.5Y 5/1), moist, 40% fine-medium sand, 20% low plasticity fines, 15% fine gravel, 15% coarse sand, 10% coarse gravel	
8					sub-angular gravel	
9						4" diameter Schedule 40 PVC casing
10						
11					some mottling, fine-medium sand content increases	
12						
13					brown (10YR 4/3), sub-angular and sub-rounded gravel	Cetco 3/8" medium bentonite chips
14						
15						

PROJECT: + KCCHRL					Log of Well No. MGPW1708 (cont'd)		
DEPTH (feet)	SAMPLES				DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.		WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample Blows/ Foot	Foot	OM Reading			
15					SILTY SAND (SM): brown (10YR 4/3), moist, 65% fine-medium sand, 15% coarse sand, 15% low plasticity fines, 5% fine gravel		
16							
17					firm, medium plasticity clay blobs		
18							
19				0.0 0.1 19.9 80.0			
20					POORLY-GRADED SAND with SILT (SP-SM): grayish brown (10YR 5/2), moist, 85% fine to medium sand, 10% low plasticity fines, 5% coarse sand firm, medium plasticity clay blobs		4" diameter Schedule 40 PVC casing
21					CLAYEY SAND (SC): grayish brown (2.5Y 5/2), moist, 80% fine to medium sand, 15% medium plasticity fines, 5% coarse sand		
22							
23					very dark gray (2.5Y 3/1),		
24					POORLY-GRADED SAND with SILT (SP-SM): dark grayish brown (2.5Y 4/2), moist, 80% fine to medium sand, 10% coarse sand, 10% low plasticity fines		
25							
26							
27					POORLY-GRADED SAND (SP): dark grayish brown (2.5Y 4/2), moist, 70% fine-medium sand, 20% coarse sand, 5% fine gravel, 5% non-plastic fines		Cetco 3/8" medium bentonite chips
28							
29							
30					sub-rounded gravel		
31							
32					SILT (ML): dark yellowish brown (10YR 3/4), moist, firm 100% low plasticity fines very dark gray (2.5Y 3/1),		
33							

PROJECT: + KCCHRL						Log of Well No. MGPW1708 (cont'd)	
DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot				
33						SILT (ML): Continued	
34							
35							
36							
37						SILT with GRAVEL (ML): very dark gray (2.5Y 3/1), dry, firm 85% low plasticity fines, 10% fine gravel, 5% coarse gravel	
38					0.0 0.0 20.3 79.7	sub-angular gravel	4" diameter Schedule 40 PVC casing
39							
40						coarse gravel content increases	
41						SILT with SAND (ML): very dark gray (2.5Y 3/1), dry, firm 85% low plasticity fines, 10% fine-medium sand, 5% coarse sand	
42							
43						small lenses of fine-medium sand	
44							
45						SILT (ML): very dark gray (2.5Y 3/1), dry, firm 95% low plasticity fines, 5% fine gravel	Cetco 3/8" medium bentonite chips
46						sub-rounded gravel	
47							
48							
49							
50						SILT with SAND (ML): very dark grayish brown (2.5Y 3/2), dry, firm 70% low plasticity fines, 25% fine-medium sand, 5% coarse sand	
51							

PROJECT: + KCCHRL					Log of Well No. MGPW1708 (cont'd)		
DEPTH (feet)	SAMPLES				DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS	
	Sample No.	Sample	Blows/ Foot	OM Reading			
51					SILT with SAND (ML): Continued		
52					coarse sand content increases		
53					POORLY-GRADED SAND with SILT (SP-SM): olive brown (2.5Y 4/3), dry, 90% fine sand, 10% low plasticity fines		4" diameter Schedule 40 PVC casing
54					SILT with GRAVEL (ML): dark gray (2.5Y 4/1), dry, firm 80% low plasticity fines, 10% coarse sand, 5% fine gravel sub-rounded gravel		
55					POORLY-GRADED SAND (SP): olive brown (2.5Y 4/3), dry, 100% fine-medium sand		
56							
57							
58					POORLY-GRADED SAND with SILT (SP-SM): olive brown (2.5Y 4/3), dry, 85% fine-medium sand, 10% low plasticity fines, 5% fine gravel		
59					POORLY-GRADED SAND (SP): very dark gray (2.5Y 3/1), dry, 80% fine-medium sand, 10% coarse sand, 5% non-plastic fines, 5% fine gravel		
60				0.0 0.0 20.4 79.6	POORLY-GRADED GRAVEL with SILT and SAND (GP-GM): grayish brown (2.5Y 5/2), moist, 75% fine-medium sand, 10% coarse sand, 10% low plasticity fines, 5% fine gravel some mottling		
61							Cetco 3/8" medium bentonite chips
62							
63					POORLY-GRADED SAND with SILT (SP-SM): grayish brown (2.5Y 5/2), wet, 75% fine-medium sand, 10% coarse sand, 10% low plasticity fines, 5% fine gravel		
64							
65					POORLY-GRADED GRAVEL with CLAY and SAND (GP-GC): grayish brown (2.5Y 5/2), wet, 40% coarse gravel, 35% fine-medium sand, 15% fine gravel, 10% low plasticity fines		
66							
67					CLAYEY GRAVEL with SAND (GC): dark gray (2.5Y 4/1), moist, 40% fine gravel, 20% coarse sand, 20% fine-medium sand, 15% low plasticity fines, 5% coarse gravel		20/40 Sweet Sand  Sakrete All Purpose Gravel
68							
69							

PROJECT: + KCCHRL					Log of Well No. MGPW1708 (cont'd)		
DEPTH (feet)	SAMPLES				DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.		WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample Blows/ Foot	Foot	OVN Reading			
69					POORLY-GRADED GRAVEL with CLAY and SAND (GP-GC): dark gray (2.5Y 4/1), wet, 60% fine gravel, 15% fine-medium sand, 10% coarse gravel, 10% low plasticity fines, 5% coarse sand		
70							
71				0.1 0.0 19.8 80.1	coarse gravel content increases		
72							
73					CLAYEY SAND (SC): dark grayish brown (2.5Y 4/2), moist, 65% coarse sand, 15% fine-medium sand, 15% low plasticity fines, 5% fine gravel		
74							4" diameter Schedule 40 PVC well screen with 0.020 V Wire MXF
75					CLAYEY SAND with GRAVEL (SC): dark grayish brown (2.5Y 4/2), moist, 30% coarse gravel, 30% coarse sand, 15% fine-medium sand, 15% low plasticity fines, 10% fine gravel		
76							
77							
78					POORLY-GRADED GRAVEL with CLAY and SAND (GP-GC): dark grayish brown (2.5Y 4/2), moist, 60% coarse gravel, 15% fine-medium sand, 10% fine gravel, 10% low plasticity fines, 5% coarse sand		
79							
80					CLAYEY GRAVEL with SAND (GC): dark grayish brown (2.5Y 4/2), moist, 60% fine gravel, 15% low plasticity fines, 10% fine-medium sand, 10% coarse gravel, 5% coarse sand		
81							Sakrete All Purpose Gravel
82				0.0 0.0 19.9 80.1	POORLY-GRADED GRAVEL with CLAY and SAND (GP-GC): dark grayish brown (2.5Y 4/2), moist, 60% coarse gravel, 15% fine gravel, 10% fine-medium sand, 10% low plasticity fines, 5% coarse sand		
83							
84							
85					fine gravel content increases and coarse gravel content decreases		
86							
87							

PROJECT: + KCCHRL					Log of Well No. MGPW1708 (cont'd)		
DEPTH (feet)	SAMPLES			OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.		WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample Blows/ Foot					
87				0.0 0.0 20.0 80.0	POORLY-GRADED GRAVEL with CLAY and SAND (GP-GC): Continued		4" diameter Schedule 40 PVC well screen with 0.020 V Wire MXF
88					sub-rounded to sub-angular gravel		
89							
90							
91				0.0 0.0 20.1 79.9	POORLY-GRADED GRAVEL with CLAY (GP-GC): dark grayish brown (2.5Y 4/2), moist, 50% fine gravel, 30% coarse gravel, 10% fine-medium sand, 10% low plasticity fines		Sakrete All Purpose Gravel
92							
93							
94							
95				0.0 0.0 20.1 79.9	POORLY-GRADED GRAVEL with CLAY and SAND (GP-GC): dark grayish brown (2.5Y 4/2), moist, 50% fine gravel, 15% coarse gravel, 15% fine-medium sand, 10% coarse sand, 10% low plasticity fines		Sakrete All Purpose Gravel
96					POORLY-GRADED GRAVEL with CLAY (GP-GC): light brownish gray (2.5Y 6/2), moist, 50% coarse gravel, 35% fine gravel, 10% low plasticity fines, 5% coarse sand		
97							
98							
99				0.0 0.0 20.1 79.9			Sakrete All Purpose Gravel
100					angular to sub-angular gravel		
101							
102					POORLY-GRADED GRAVEL with CLAY and SAND (GP-GC): dark grayish brown (2.5Y 4/2), moist, 40% coarse gravel, 35% fine gravel, 10% fine-medium sand, 10% low plasticity fines, 5% coarse sand		
103				0.0 0.0 20.1 79.9			Sakrete All Purpose Gravel
104					gray (2.5Y 5/1),		
105							

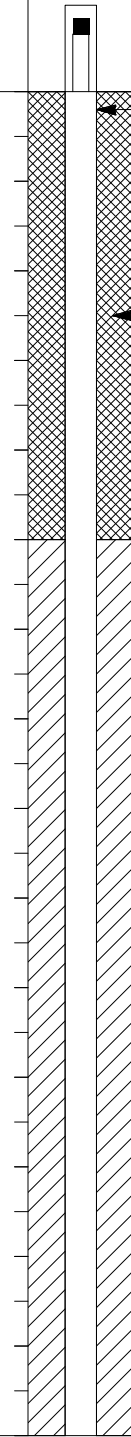
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PROJECT: + KCCHRL					Log of Well No. MGPW1708 (cont'd)	
DEPTH (feet)	SAMPLES				DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	OVN Reading		
105					POORLY-GRADED GRAVEL with CLAY and SAND (GP-GC): Continued	
106					fine gravel content increases and coarse gravel content decreases	
107						4" diameter Schedule 40 PVC well screen with 0.020 V Wire MXF
108						
109						
110				0.0 0.0 20.1 79.9	CLAYEY SAND with GRAVEL (SC): gray (5Y 5/1), moist, 40% fine-medium sand, 30% low plasticity fines, 15% fine gravel, 10% coarse gravel, 5% coarse sand	Sakrete All Purpose Gravel
111						
112					CLAYEY GRAVEL (GC): dark gray (2.5Y 4/1), moist, 30% coarse gravel, 25% low plasticity fines, 20% fine gravel, 15% fine-medium sand, 10% coarse sand	
113					sub-rounded gravel	
114						4" diameter Schedule 40 PVC casing
115						
116					POORLY-GRADED SAND with GRAVEL (SP): dark grayish brown (2.5Y 4/2), moist, 40% fine-medium sand, 25% fine gravel, 15% coarse gravel, 15% coarse sand, 5% non-plastic fines	
117					sub-rounded gravel	
118					some firm, medium plasticity clay blobs	Cetco 3/8" medium bentonite chips
119				0.1 0.0 20.0 79.9		
120					Bottom of boring at 120'	
121						
122						
123						

PROJECT: KCCHRL West Side LFG KCCHRL						<b>Log of Well No. MGW1709X</b>			
BORING LOCATION: West Side, KCCHRL						GROUND SURFACE ELEVATION AND DATUM: Asphalt			
DRILLING CONTRACTOR: Cascade						DATE STARTED: 1/27/12		DATE FINISHED: 2/1/12	
DRILLING METHOD: Sonic						TOTAL DEPTH (ft.): 140.0		SCREEN INTERVAL (ft.): 85-125	
DRILLING EQUIPMENT: SDC390-14						DEPTH TO WATER:	FIRST 125	COMPL. NA	CASING: 4" Schedule 40 PVC
SAMPLING METHOD: Sonic core						LOGGED BY: D.O'Reilly			
HAMMER WEIGHT:			DROP:			RESPONSIBLE PROFESSIONAL: J.D. Long			REG. NO. LHg 1354

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.  Surface Elevation:	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot				
0						CLAYEY SAND with GRAVEL (SC): grayish brown (10YR 5/2), moist, 40% fine sand, 25% subrounded cobbles, 10% fine gravel, 25% fines, some sections strong brown (7.5YR 6/4)	 <p>2' temporary stickup before hook into LFG system</p> <p>Baselite Concrete</p> <p>OVM Reading = CH4 / CO2 / O2 / BAL %s</p>
1							
2							
3							
4							
5						CLAY with GRAVEL (CL): dark gray (7.5YR 4/1), moist, 80% fines, 10% subrounded gravel, 5% coarse gravel, 5% fine sand, medium induration	
6							
7							
8							
9							
10							
11						SANDY CLAY (CL): brown (7.5YR 4/2), moist, 85% fines, 10% fine sand, 5% fine gravel, medium plasticity	
12							
13							
14							
15							


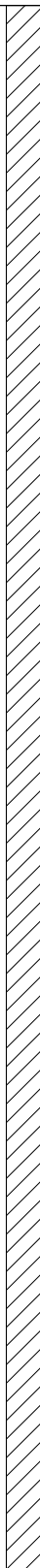

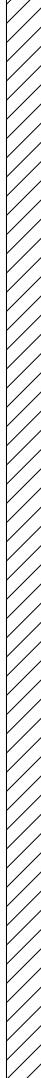

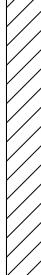


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OAKWELLV (REV. 8/2011)

## Log of Well No. MGW1709X (cont'd)

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS	
	Sample No.	Sample	Blows/ Foot	Foot				
15						<p>SANDY ORGANIC SOIL with GRAVEL (OH): brown (7.5YR 3/2), moist, 35% fine sand, 30% medium sand, 25% fines, 10% fine gravel, decaying wood (branches, roots), some rip-up clay clasts</p> <p>POORLY GRADED GRAVEL with CLAY (GP): brown (7.5YR 4/2), moist, 30% fine gravel, 25% coarse gravel, 25% fines, 15% fine sand, 5% medium sand, gravel subrounded to subangular, moderate induration</p>		
16								
17					20.0 35.3 0.6 44.1			
18								
19						<p>CLAY with GRAVEL (CL): dark gray (7.5YR 4/1), moist, 50% fines, 25% coarse gravel, 20% fine gravel, 5% fine sand, gravel subrounded, low to moderate induration</p>		
20								
21								
22								
23								
24								
25								
26								
27								
28								
29						<p>SANDY CLAY with GRAVEL (CL): very dark gray (7.5YR 3/1), moist, 60% fines, 15% fine sand, 10% medium sand, 15% fine subrounded gravel, low to moderate induration</p>		
30								
31								
32								
33								

## Log of Well No. MGW1709X (cont'd)

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.			WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	Foot					
33									
34									
35						finer grain sand			
36									
37									
38									
39						SILTY CLAY (CL): dark gray (7.5YR 4/1), moist, 85% fines, 10% fine sand, 5% medium sand, medium induration and plasticity			
40					21.1 30.5 6.8 41.6	SILTY SAND (SM): dark gray (7.5YR 4/1), moist, 60% fine sand, 10% medium sand, 15% silt fines, 15% very dark gray (7.5YR 3/1) clay balls, some strong brown (7.5YR 4/6) mottling			Cetco 3/8" medium bentonite chips
41									
42						SILTY SAND (SM): dark gray (7.5YR 4/1), moist, 55% fine sand, 5% medium sand, 15% silt fines, 25% very dark gray (7.5YR 3/1) clay balls, some strong brown (7.5YR 4/6) mottling			
43									
44						CLAY with GRAVEL (CL): dark gray (7.5YR 4/1), moist, 80% fines, 10% subrounded gravel, 10% subrounded cobbles, moderate induration			
45									
46									
47									
48									
49						CLAY with GRAVEL (CL): dark gray (7.5YR 4/1), moist, 65% fines, 20% subrounded gravel, 15% subrounded cobbles, moderate induration			
50									4" diameter Schedule 40 PVC casing
51									

PROJECT: KCCHRL West Side LFG  
KCCHRL

## Log of Well No. MGW1709X (cont'd)

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS	
	Sample No.	Sample	Blows/ Foot	Foot				
51								
52								
53						CLAY (CL): dark gray (7.5YR 4/1), moist, 95% fines, 5% subrounded gravel		
54								
55						CLAY with GRAVEL (CL): dark gray (7.5YR 4/1), moist, 65% fines, 20% subrounded gravel, 15% subrounded cobbles, moderate induration		
56								
57						large (6") cobble		
58						medium sand lens		
59								
60					2.1 1.2 12.6 84.1			
61								
62								
63						SILTY SAND (SM): grayish brown (10YR 5/2), moist, 30% fine sand, 20% medium sand, 15% coarse sand, 30% fines, 5% fine gravel, moderate induration		
64								
65						WELL GRADED SAND (SW): very dark grayish brown (10YR 3/2), moist, 35% coarse sand, 30% medium sand, 20% fine sand, 10% fine gravel, 5% fines, varied color lithics (including widespread quartz)		
66								
67						SILT (ML): strong brown (7.5YR 4/6), moist, 95% fines, 5% fine sand, moderately to well indurated, clear bedding structures (planar and cross)		
68					2.3 0.4 11.6 85.7			
69								

OAKWELLV (REV. 8/2011)

## Log of Well No. MGW1709X (cont'd)

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	Foot			
69						— brown (10YR 3/2) well graded sand lens	
70							
71						— brown (10YR 3/2) well graded sand lens	
72							
73							
74						POORLY GRADED GRAVEL with SAND (GP): yellowish brown (10YR 5/6), moist, 35% fine gravel, 20% cobbles, 20% medium sand, 10% coarse sand, 10% fine sand, 5% fines, gravel and cobbles subrounded to subangular	
75							
76						↓ grayish brown (10YR 5/2)	
77							
78						WELL GRADED SAND with SILT (SW-SM): grayish brown (10YR 5/2), moist, 30% medium sand, 25% coarse sand, 20% fine sand, 15% fines, 10% fine subangular gravel, some sections strong brown (7.5YR 4/6)	
79							
80					19.0 1.1 10.7 69.2		
81							
82							← 20/40 Sweet Sand
83							
84							
85							
86							
87							

## Log of Well No. MGW1709X (cont'd)

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.		WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	Foot				
87					10.6 1.1 16.1 72.2	WELL GRADED SAND with SILT (SW-SM): dark gray (7.5YR 4/1), wet (from above?), 35% medium sand, 25% fine sand, 15% coarse sand, 15% fines, 10% fine subangular gravel		
88								
89								
90						POORLY GRADED GRAVEL with SAND (GP): dark gray (7.5YR 4/1), moist, 30% cobbles, 25% fine gravel, 20% coarse sand, 15% medium sand, 5% fine sand, 5% fines, gravel and cobbles subrounded to subangular		
91								
92								
93								
94						grayish brown (10YR 5/2)		
95								Sakrete All Purpose Gravel
96								
97								
98					15.4 2.6 14.4 67.6	POORLY GRADED GRAVEL with SILT and SAND (GP-GM): brown (10YR 5/3), moist, 30% fine gravel, 25% cobbles, 15% fines, 10% coarse sand, 10% medium sand, 10% fine sand		
99								
100						subangular chunks- broken cobble		
101								
102						POORLY GRADED GRAVEL with SILT and SAND (GP-GM): brown (10YR 5/3), moist, 40% cobbles, 25% fine gravel, 15% fines, 10% coarse sand, 5% medium sand, 5% fine sand		
103								
104								
105								

Project No. 10031

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## Log of Well No. MGW1709X (cont'd)

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.			WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample Blows/ Foot							
105									4" diameter Schedule 40 PVC well screen with 0.020 V Wire MXF
106									
107									
108									
109					0.1 0.1 20.1 79.7	WELL GRADED GRAVEL with SAND (GW): grayish brown (10YR 5/2), moist, 35% fine subrounded gravel, 20% subangular cobbles, 25% medium sand, 10% coarse sand, 5% fine sand, 5% fines			
110						↓ dark gray (7.5YR 4/1)			
111									
112						POORLY GRADED GRAVEL with SAND (GP): dark gray (7.5YR 4/1), moist, 40% cobbles, 25% fine gravel, 10% fines, 10% coarse sand, 10% medium sand, 5% fine sand, more than eight large (>6") cobbles			
113									
114									
115									
116									
117					0.1 0.0 20.7 79.2				
118						WELL GRADED GRAVEL with SAND (GW): dark gray (7.5YR 4/1), moist, 35% subrounded cobbles, 30% subrounded gravel, 10% coarse sand, 10% medium sand, 5% fine sand, 10% fines, some large cobbles			
119									
120						↓ fewer large cobbles			
121									
122									
123									

## Log of Well No. MGW1709X (cont'd)

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	Foot			
123						wet	
124							
125						WELL GRADED SAND with GRAVEL (SW): brown (7.5YR 4/2), moist, 40% medium sand, 20% fine sand, 15% coarse sand, 20% subrounded gravel, 5% fines	
126							
127							
128							
129					0.1 0.0 21.0 78.9	WELL GRADED GRAVEL with SAND (GW): grayish brown (10YR 5/2), moist, 35% fine gravel, 30% cobbles, 15% fine sand, 10% medium sand, 5% coarse sand, 5% fines	
130							
131							
132							
133							
134						▼ brown (7.5YR 4/2)	
135							
136						▼ fewer large cobbles	
137							
138							
139							
140						Bottom of boring at 140 feet. WSDOE well tag= BHM 104.	
141							

Cetco 3/8" medium  
bentonite chips

PROJECT: KCCHRL West Side LFG KCCHRL						<b>Log of Well No. MGW1710D</b>			
BORING LOCATION: West Side, KCCHRL						GROUND SURFACE ELEVATION AND DATUM: Asphalt			
DRILLING CONTRACTOR: Cascade						DATE STARTED: 9/19/12		DATE FINISHED: 9/27/12	
DRILLING METHOD: Sonic						TOTAL DEPTH (ft.): 186.0		SCREEN INTERVAL (ft.): 115-145	
DRILLING EQUIPMENT: SonicCor 50k						DEPTH TO WATER:	FIRST 40	COMPL. NA	CASING: 4" Schedule 40 PVC
SAMPLING METHOD: Sonic core						LOGGED BY: D. O'Reilly			
HAMMER WEIGHT:			DROP:			RESPONSIBLE PROFESSIONAL: J.D. Long			REG. NO. LHg 1354

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.  Surface Elevation:	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot				
0						asphalt	
1						SILT with GRAVEL and SAND (ML): reddish brown (5YR 5/2), moist, gray (7.5YR 6/1) streaks, occasional large (+6") cobble (eg @ 4, 16), 15% cobbles, 20% subrounded gravel, 5% coarse sand, 20% medium sand, 40% fines	
2							
3							
4							
5							
6							
7						very large boulder	
8							
9							
10						strong brown streaks	
11							
12							
13						SILT with GRAVEL (ML): gray (7.5YR 5/1), moist, 5% cobbles, 10% subrounded gravel, 85% fines sand lenses	
14							
15							

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.			WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample Blows/ Foot	Sample Foot	Sample Blows/ Foot					
15									
16						SILT (ML): gray (7.5YR 5/1), moist, 5% fine sand, 95% low plasticity fines			
17									
18						fine to moderate sand lenses at 18', 20'			
19									
20					0.2 0.0 20.2 79.6				
21						10% fine subrounded gravel, 5% fine sand, 85% fines			
22									
23									
24									
25									Cetco 3/8" medium bentonite chips
26						subangular boulder chunks near very large boulder			
27									
28						SILT with GRAVEL (ML): gray (7.5YR 5/1), moist, 15% subrounded gravel, 85% low plasticity fines			Cannot get around large boulder; abandon original boring, move 3 feet south
29									
30									
31						fine sand lenses at 31', 32'			
32									
33									

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.			WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	Foot					
33									
34									
35						SILT with SAND (ML): gray (7.5YR 5/1), moist, 10% medium sand, 15% fine sand, 75% low plasticity fines			4" diameter Schedule 40 PVC casing
36					0.2 0.9 19.2 79.7	subrounded gravel, 10% gravel, 5% medium sand, 10% fine sand, 75% fines			
37									
38									
39						wood fragments			
40						SILT with GRAVEL (ML): dark gray (7.5YR 4/1), moist to almost wet, 10% cobbles, 25% subrounded to subangular gravel, 10% fine sand, 55% nonplastic fines			
41									
42						increasing gravel size, sand, gradual transition to:			
43									
44						POORLY-GRADED SAND with SILT (SP-SM): dark gray (7.5YR 4/1), moist, 10% gravel, 20% coarse sand, 60% medium sand, 10% nonplastic fines			
45									
46						SILT (ML): dark gray (7.5YR 4/1), moist, 10% subrounded to subangular gravel, 10% fine sand, 80% non to low plasticity fines			
47									
48									
49									
50									
51									

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.			WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	Foot					
51									
52						some gravel fine subangular to angular quartz gravel			
53									
54									
55									
56						mostly quartz cobble (about 3.5")			
57					0.2 0.0 20.9 78.9				
58									
59						POORLY-GRADED SAND (SP): dark gray (7.5YR 4/1), moist, some quartz lithics, 5% coarse sand, 90% medium sand, 5% fine sand			
60						↓ increasing fines content with depth until:			
61									
62									
63						CLAYEY SAND with GRAVEL (SC): dark gray (7.5YR 4/1), moist, 15% subrounded to subangular gravel, 40% medium sand, 20% fine sand, 25% fines acting as cement			
64						↓ larger gravel with depth, 5% cobbles, 15% gravel, 40% medium sand, 15% fine sand, 25% fines			
65									
66						POORLY-GRADED SAND (SP): brown (7.5YR 5/4), moist, variable coarsening, 80% medium sand, 20% fine sand			
67									
68						50% coarse sand, 40% medium sand, 10% fine sand			
69									

PROJECT: KCCHRL West Side LFG  
KCCHRL

## Log of Well No. MGPW1710D (cont'd)

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.			WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	Foot					
69									
70						100% fine sand			
71						SILT (ML): light brown (7.5YR 6/3), moist, some rhythmic bedding, 100% low plasticity fines			
72									
73						POORLY-GRADED SAND (SP): brown (7.5YR 4/4), moist, 10% gravel, 10% coarse sand, 80% medium sand			
74									
75						SILT (ML): light brown (7.5YR 6/4), moist, bedding features, 100% low plasticity fines			
76					0.2 0.0 21.4 78.4				
77									
78									
79						CLAYEY SAND with GRAVEL (SC): brown (7.5YR 4/4), moist, 5% cobbles, 10% subangular gravel, 40% medium sand, 20% fine sand, 25% fines			
80									
81									
82						more gravel, less clay, some cobbles subangular, 10% cobbles, 20% gravel, 50% coarse sand, 5% medium sand, 15% fines			
83									
84									
85									
86						cobbly, 30% cobbles, 10% gravel, 45% coarse sand, 15% fines			
87									

OAKWELLV (REV. 8/2011)

PROJECT: KCCHRL West Side LFG  
KCCHRL

## Log of Well No. MGPW1710D (cont'd)

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS	
	Sample No.	Sample	Blows/ Foot	Foot				
87								
88						pink (7.5YR 7/4)		
89								
90						brown (7.5YR 5/2), 5% cobbles, 15% gravel, 50% coarse sand, 10% medium sand, 20% fines		
91								
92						POORLY-GRADED GRAVEL with SAND (GP): brown (7.5YR 4/2), moist, coarser with depth, 15% subrounded to subangular cobbles, 40% subrounded to subangular gravel, 20% coarse sand, 20% medium sand, 5% fines		
93								
94								
95					0.1 0.0 19.5 80.4			
96						25% cobbles, 35% gravel, 10% coarse sand, 25% medium sand, 5% fines		
97								
98						35% cobbles, 30% gravel, 10% coarse sand, 20% medium sand, 5% fines		
99								
100						CLAYEY GRAVEL with SAND (GC): pink (7.5YR 7/4), moist to wet, 30% cobbles, 30% gravel, 20% coarse sand, 5% medium sand, 15% fines		
101								
102						POORLY-GRADED GRAVEL with SAND (GP): brown (7.5YR 5/2), moist, 35% cobbles, 25% gravel, 10% coarse sand, 20% medium sand, 10% fines		
103								
104								
105								

OAKWELLV (REV. 8/2011)

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample Blows/ Foot	Sample Blows/ Foot	Sample Blows/ Foot			
105						CLAYEY GRAVEL with SAND (GC): pink (7.5YR 7/4), moist, brown (7.5YR 5/2) clumps, 35% subrounded to subangular cobbles, 20% subrounded to subangular gravel, 20% coarse sand, 5% medium sand, 20% fines brown (7.5YR 5/2)	
106							
107							
108							
109							
110							Tougher drilling
111							
112							20/40 Sweet Sand
113							
114					0.2 0.0 20.4 79.4	no cobbles	Sakrete All Purpose Gravel
115							
116							
117						multiple large cobbles	
118							
119							
120						35% subrounded cobbles, 20% subrounded to subangular gravel, 10% coarse sand, 15% medium sand, 20% fines	
121						few cobbles	
122							
123							

PROJECT: KCCHRL West Side LFG KCCHRL					Log of Well No. MGPW1710D (cont'd)		
DEPTH (feet)	SAMPLES				DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.		WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	OVM Reading			
123							
124					more sand, transitioning to:		
125							
126							
127					POORLY-GRADED GRAVEL with SAND and CLAY (GP-GC): brown (7.5YR 4/2), moist, some broken cobbles, 20% cobbles, 30% subrounded to subangular gravel, 20% coarse subangular sand, 20% medium sand, 10% fines		
128							
129							
130					more sand, finer gravel, more cobbles as broken chunks, 10% cobbles, 35% gravel, 20% coarse sand, 25% medium sand, 10% fines		
131							Tougher drilling
132							
133							
134							
135				0.2 0.0 20.7 79.1	rock flour @ 135', 137'		
136					brown (7.5YR 4/3)		
137							
138					more cobbles, 25% cobbles, 30% gravel, 10% coarse sand, 25% medium sand, 10% fines		
139							
140					almost wet, more gravel, 10% cobbles, 45% gravel, 15% coarse sand, 20% medium sand, 10% fines		
141							
						OAKWELLV (REV. 8/2011)	
amec						Project No. 10031	Page 8 of 11

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	Foot			
141							
142						↓ brown (7.5YR 5/4), lots of subangular to angular fragments, 10% cobbles, 35% gravel, 15% coarse sand, 30% medium sand, 10% fines	
143							
144							
145						rock flour	
146							
147							
148						POORLY-GRADED SAND (SP): strong brown (7.5YR 5/6), moist to wet, very homogenous- possibly beach sand, 100% medium sand	
149						↓ grading finer	
150							← Cetco 3/8" medium bentonite chips
151						SILT (ML): strong brown (7.5YR 4/6), moist, some bedding, 100% fines	
152						POORLY-GRADED SAND (SP): gray (7.5YR 5/1), moist to wet, some strong brown (7.5YR 4/2) streaks, 20% medium sand, 80% fine sand	
153							
154							
155							
156						↓ transition to:	
157							
158						SILT (ML): gray (7.5YR 5/1), moist to wet, 100% low plasticity fines	
159							

PROJECT: KCCHRL West Side LFG  
KCCHRL

## Log of Well No. MGPW1710D (cont'd)

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.		WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot					
159								
160								
161						POORLY-GRADED GRAVEL with SAND (GP): strong brown (7.5YR 5/6), moist, some cobble chunks, 15% subrounded cobbles, 40% subrounded gravel, 10% coarse sand, 30% medium sand, 5% fines		
162								
163						▼ brown (7.5YR 5/2)		
164								
165								Slough: drilled to 166', sloughed to 162'
166						SILT (ML): strong brown (7.5YR 4/6), moist, 100% fines		
167						POORLY-GRADED GRAVEL with SAND (GP): brown (7.5YR 5/2), moist to wet, 25% subangular to subrounded cobbles, 30% subangular to subrounded gravel, 20% coarse sand, 25% medium sand		
168								
169								
170								
171								
172						POORLY-GRADED SAND with GRAVEL (SP): brown (7.5YR 4/3), moist, 10% subrounded cobbles, 5% subrounded gravel, 25% coarse sand, 60% medium sand		
173								
174								
175						rock flour, angular chunks		
176								
177								

OAKWELLV (REV. 8/2011)

PROJECT: KCCHRL West Side LFG  
KCCHRL

## Log of Well No. MGPW1710D (cont'd)

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.		WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	Foot				
177					0.2 0.0 20.9 78.9			
178								
179						POORLY-GRADED SAND with CLAY (SP-SC): brown (7.5YR 5/2), wet, 5% gravel, 20% coarse sand, 50% medium sand, 25% low plasticity fines		Slough: drilled to 186', sloughed to 178'
180								
181								
182						POORLY-GRADED SAND with CLAY and GRAVEL (SP-SC): brown (7.5YR 5/2), wet, 5% cobbles, 15% subrounded gravel, 10% coarse sand, 40% medium sand, 15% fine sand, 15% low plasticity fines		
183								
184								
185								
186								
187								
188								
189								
190								
191								
192								
193								
194								
195								


OAKWELLV (REV. 8/2011)

PROJECT: KCCHRL West Side LFG KCCHRL						<b>Log of Well No. MGPW1710S</b>			
BORING LOCATION: West Side, KCCHRL						GROUND SURFACE ELEVATION AND DATUM: Asphalt			
DRILLING CONTRACTOR: Cascade						DATE STARTED: 8/16/12		DATE FINISHED: 8/24/12	
DRILLING METHOD: Sonic						TOTAL DEPTH (ft.): 134.0		SCREEN INTERVAL (ft.): 94-134	
DRILLING EQUIPMENT: SonicCor 50k						DEPTH TO WATER:	FIRST NA	COMPL. NA	CASING: 4" Schedule 40 PVC
SAMPLING METHOD: Sonic core						LOGGED BY: C. Jefferson and J.D. Long			
HAMMER WEIGHT:			DROP:			RESPONSIBLE PROFESSIONAL: J.D. Long			REG. NO. LHg 1354

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	Foot			
0						Surface Elevation:	
1						SILTY SAND with GRAVEL (SM): very dark grayish brown (10YR 3/2), moist, 25% fine gravel, 55% fine sand, 20% fines	2' temporary stickup before hook into LFG system
2						SILTY GRAVEL with SAND (GM): very dark grayish brown (10YR 3/2), moist, 60% fine gravel, 25% fine sand, 15% fines	Baselite Concrete
3							
4							
5						SILTY SAND with GRAVEL (SM): very dark grayish brown (10YR 3/2), moist, 20% fine gravel, 50% fine sand, 30% fines	
6						15% fine gravel, 50% fine sand, 35% fines	OVM Reading = CH4 / CO2 / O2 / BAL %s
7						SILTY SAND (SM): very dark grayish brown (10YR 3/2), moist, 10% fine gravel, 60% fine sand, 30% fines	
8						WELL-GRADED GRAVEL with SILT and SAND (GW-GM): very dark grayish brown (10YR 3/2), moist, 15% coarse gravel, 40% fine gravel, 10% medium sand, 15% fine sand, 10% fines	
9							
10						CLAY (CL): very dark gray (10YR 3/1), moist, 5% fine gravel, 95% medium plasticity fines	
11							
12						fine sand, 10% fine sand, 90% fines	
13							
14							
15							

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PROJECT: KCCHRL West Side LFG KCCHRL					Log of Well No. MGPW1710S (cont'd)		
DEPTH (feet)	SAMPLES				DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.		WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	OVM Reading			
15					minor sand and fine gravel observed, very dense clay, 5% fine gravel, 10% fine sand, 85% fines		
16							
17							
18					LEAN CLAY with GRAVEL (CL): very dark gray (10YR 3/1), moist, 5% coarse gravel, 15% fine gravel, 10% fine sand, 65% high density/ medium to low plasticity fines		
19							
20				0.3 0.5 19.9 79.3	LEAN CLAY (CL): very dark gray (10YR 3/1), moist, 2-3" gravel observed, 10% fine sand, 90% fines		
21							
22							
23					large rock, 8", broken, 10% fine gravel, 10% fine sand, 80% fines		
24							
25							Cetco 3/8" medium bentonite chips
26							
27							
28					5% fine gravel, 10% fine sand, 85% fines		
29							
30					very dark gray (10YR 3/1), very dense, 5% fine sand, 95% fines		
31							
32							
33							

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.			WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample Blows/ Foot							
33						minor gravel $\leq 1"$ , 5% fine gravel, 95% fines			
34									
35									4" diameter Schedule 40 PVC casing
36									
37						LEAN CLAY with SAND (CL): very dark gray (10YR 3/1), moist, 5% fine gravel, 15% fine sand, 80% fines			
38									
39									
40					0.2 0.0 18.5 81.3	LEAN CLAY (CL): very dark gray (10YR 3/1), moist, increasing moisture content with depth, 10% fine sand, 90% fines			
41						ORGANIC SOIL with SAND (OH): very dark brown (10YR 2/2), moist, 15% fine sand, 85% organics			
42						SILTY SAND (SM): very dark gray (10YR 3/1), moist, 65% fine sand, 35% fines			
43									
44						POORLY-GRADED SAND with SILT and GRAVEL (SP-SM): black (10YR 2/1), moist, 15% fine gravel, 75% fine sand, 10% fines			
45						LEAN CLAY with GRAVEL (CL): very dark gray (10YR 3/1), moist, 15% fine gravel, 10% fine sand, 75% fines			
46									
47						LEAN CLAY (CL): very dark gray (10YR 3/1), moist, 10% fine gravel, 10% fine sand, 80% fines			
48									
49						LEAN CLAY with GRAVEL (CL): very dark gray (10YR 3/1), moist, 15% fine gravel, 10% fine sand, 75% fines			
50						very large woody debris (cedar?)			
51									

PROJECT: KCCHRL West Side LFG  
KCCHRL


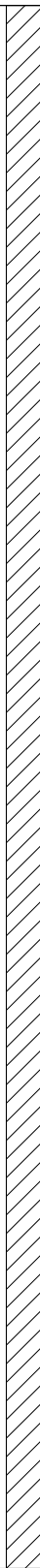

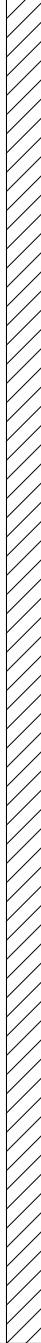

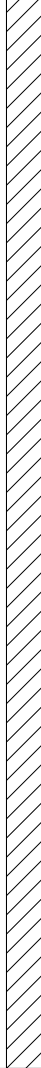

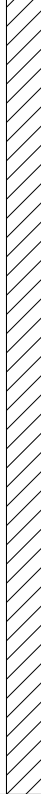

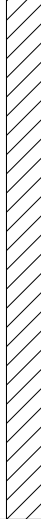
## Log of Well No. MGPW1710S (cont'd)

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS	
	Sample No.	Sample	Blows/ Foot	Foot				
51						LEAN CLAY (CL): very dark gray (10YR 3/1), moist, 10% fine gravel, 10% fine sand, 80% fines		
52								
53								
54								
55								
56						LEAN CLAY with GRAVEL (CL): very dark gray (10YR 3/1), moist, 15% fine gravel, 10% fine sand, 75% fines		
57								
58								
59						LEAN CLAY with SAND (CL): very dark gray (10YR 3/1), moist, 20% fine gravel, 20% fine sand, 60% fines		
60					0.2 0.0 18.7 81.1			
61								
62						↓ dense, 20% fine gravel, 25% fine sand, 65% fines		
63								
64								
65								
66								
67								
68								
69								

OAKWELLV (REV. 8/2011)

PROJECT: KCCHRL West Side LFG  
KCCHRL

## Log of Well No. MGPW1710S (cont'd)

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS	
	Sample No.	Sample	Blows/ Foot	Foot				
69						POORLY-GRADED SAND (SP): very dark gray (10YR 3/1), 60% medium sand, 40% fine sand, clay interbeds 4" to 6" thick		
70								
71								
72								
73						SILTY CLAY with GRAVEL (CL/ML): very dark gray (10YR 3/1), indurated, 10% rounded gravel, 5-10% fine sand, 80-85% fines		
74								
75								
76								
77						POORLY-GRADED SAND with GRAVEL (SP): dark grayish brown (2.5Y 4/2), very fine to fine sand, rounded gravel though fragmented by core		
78								
79								
80								
81						SILTY SAND with GRAVEL (SM): olive brown (2.5Y 4/3), moist, 10-15% rounded gravel, 20% coarse sand, 30% medium sand, 25% fine sand, 10% fines		
82								
83								
84								
85					0.1 0.0 20.8 79.1			
86								
87								

OAKWELLV (REV. 8/2011)

PROJECT: KCCHRL West Side LFG KCCHRL					Log of Well No. MGPW1710S (cont'd)		
DEPTH (feet)	SAMPLES				DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.		WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	OVM Reading			
87							
88							
89							
90					grades to:		
91					SILTY GRAVEL with SAND (GM): olive brown (2.5Y 4/3), moist, 20% coarse gravel, 30% fine gravel, 15% coarse sand, 20% medium sand, 20% fines		20/40 Sweet Sand
92							
93							
94							
95							
96							driller reports larger cobbles
97							
98				0.4 0.0 20.2 79.4			
99							
100							driller reports large cobbles
101					large boulder, broken up		
102							
103							
104							
105							

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample Blows/ Foot	Sample Foot	Sample Foot			
105							
106						very dark grayish brown (10YR 3/2), 40% cobbles, 40% gravel, 5% coarse sand, 5% medium sand, 5% fine sand, 5% fines	
107							
108							
109							
110					0.0 0.1 20.5 79.4	greenish gray (10Y 5/1), 10% cobbles, 55% gravel, 5% medium sand, 10% fine sand, 20% fines	
111							
112							
113							
114							Sakrete All Purpose Gravel
115						rock flour, 20% broken cobbles, 55% fine to coarse gravel, 5% coarse sand, 10% medium sand, 5% fine sand, 5% fines	
116							
117							
118							
119							
120					0.1 0.2 18.9 80.8	POORLY-GRADED GRAVEL (GP): gray (10YR 5/1), moist, 20% coarse gravel and crushed cobbles, 60% fine gravel, 10% medium sand, 5% fine sand, 5% fines	drillers add water, report large cobbles and boulders
121							
122							
123							

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	Foot			
123							
124							
125						80% cobbles, 10% gravel, 5% coarse sand, 5% medium sand	
126							
127					0.1 0.0 21.7 78.2		
128							
129							
130						considerable rock flour in core bag, 70% cobbles, 10% gravel, 10% coarse sand, 5% medium sand, 5% fine sand	
131							
132							
133							
134						Bottom of boring at 134'.	
135							
136							
137							
138							
139							
140							
141							


4" diameter Schedule 40  
PVC well screen with  
0.020 V Wire MXF

PROJECT: KCCHRL West Side LFG KCCHRL						<b>Log of Well No. MGW1711X</b>			
BORING LOCATION: West Side, KCCHRL						GROUND SURFACE ELEVATION AND DATUM: Temporary fill surface			
DRILLING CONTRACTOR: Cascade						DATE STARTED: 1/13/12		DATE FINISHED: 1/25/12	
DRILLING METHOD: Sonic						TOTAL DEPTH (ft.): 138.0		SCREEN INTERVAL (ft.): 85-125	
DRILLING EQUIPMENT: SDC390-14						DEPTH TO WATER:	FIRST 125	COMPL. NA	CASING: 4" Schedule 40 PVC
SAMPLING METHOD: Sonic core						LOGGED BY: D. O'Reilly and J.D. Long			
HAMMER WEIGHT:			DROP:			RESPONSIBLE PROFESSIONAL: J.D. Long			REG. NO. LHg 1354

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.  Surface Elevation:	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot				
0						SILTY SAND with GRAVEL (SM): dark gray (7.5YR 4/1), moist, 60 medium sand, 25 low plasticity fines, 15 fine subrounded gravel, some brown (7.5YR 4/2) mottling	2' temporary stickup before hook into LFG system
1							
2							
3							Baselite Concrete
4							
5							
6						gravel size to coarse, some subangular cobbles, no more mottling-- 55% medium sand, 30% gravel, 15% fines	OVM Reading = CH4 / CO2 / O2 / BAL %s
7							
8							
9							
10						gray (7.5YR 5/1) rock flour	
11							
12							
13							
14							
15							

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PROJECT: KCCHRL West Side LFG  
KCCHRL

## Log of Well No. MGW1711X (cont'd)

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.			WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot						
15						SILTY CLAY with GRAVEL (CL): very dark gray (7.5YR 3/1), moist, 85% moderate plasticity fines, 15% subrounded gravel, some cobbles and angular quartz chunks from Darrington Phyllite			
16									
17									
18									
19									
20					11.9 18.1 4.6 65.4				
21									
22									
23									
24									
25						as above, very dark gray silty clay with gravel			
26									
27						little gravel (5%)			
28									
29									
30						large subrounded gravel (35%)			
31					2.0 0.4 18.2 79.4				
32									
33									

OAKWELLV (REV. 8/2011)

## Log of Well No. MGW1711X (cont'd)

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.			WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	Foot					
33						SILTY SAND (SM): very dark gray (7.5YR 3/1), moist, 60% fine sand, 30% fines, 10% fine gravel			
34									
35									
36									
37									
38						CLAYEY SILT with GRAVEL (ML): very dark gray (7.5YR 3/1), moist, 70% fines, 20% large subangular cobbles, 10% fine sand in stringers			
39									
40					0.1 0.0 20.0 79.9	cobbles change to subrounded gravel			Cetco 3/8" medium bentonite chips
41									
42									
43									
44									
45						CLAYEY SILT (ML): very dark gray (7.5YR 3/1), moist, 90% fines, 10% fine sand			
46									
47						CLAYEY SILT with GRAVEL (ML): very dark gray (7.5YR 3/1), moist, 70% fines, 20% large subangular cobbles, 10% fine sand in stringers			
48									
49									
50						CLAYEY SILT with SAND and GRAVEL (ML): dark gray (7.5YR 4/1), moist, 55% fines, 15% large subangular cobbles, 30% fine sand			4" diameter Schedule 40 PVC casing
51									

PROJECT: KCCHRL West Side LFG  
KCCHRL

## Log of Well No. MGW1711X (cont'd)

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.			WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot						
51									
52									
53									
54									
55						CLAYEY SILT with GRAVEL (ML): very dark gray (7.5YR 3/1), moist, 70% fines, 20% large subangular cobbles, 10% fine sand in stringers			
56									
57									
58									
59					0.3 0.2 16.0 83.5				
60									
61									
62									
63									
64									
65						POORLY GRADED SAND (SP): black (7.5YR 2.5/1), moist, 90% medium to fine sand, 5% fines, 5% subangular gravel, sand finer with depth			
66									
67									
68									
69									

OAKWELLV (REV. 8/2011)

## Log of Well No. MGW1711X (cont'd)

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	Foot			
69							
70						very dark gray (7.5YR 3/1)	
71							
72						CLAY with GRAVEL (CL): dark gray (7.5YR 4/1), moist, 60% fines, 40% large subrounded cobbles, strong brown mottling	
73							
74							
75						POORLY GRADED SAND with GRAVEL (SP): strong brown (7.5YR 4/6), moist, 85% coarse to medium sand, 15% fine subrounded gravel	
76							
77							
78							
79					7.0 0.1 13.9 79.0		
80							
81						transition to below	20/40 Sweet Sand
82						CLAYEY SAND with GRAVEL (SC): light olive brown (2.5Y 5/4), 30-40% moist, 35% medium sand, 25% fine sand, 10% medium sand, 15% variegated brown clay, 10% fine gravel, 5% coarse gravel	
83							
84							
85						WELL GRADED SAND with GRAVEL (SW): variegated 30-35% moist, 30% medium sand, 30% fine sand, 5% coarse sand, 25% fine gravel, 5% coarse gravel, 5% fines, 65-70% gravel is rounded	
86							
87							

PROJECT: KCCHRL West Side LFG KCCHRL						Log of Well No. MGW1711X (cont'd)	
DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	Foot			
87							
88							
89					52.1 8.7 0.0 39.2		
90							
91							
92							
93							
94							
95							
96							
97							
98							
99					51.8 10.1 0.0 38.1	WELL GRADED GRAVEL with SAND (GW): yellow brown (10YR 5/6), 40% fine gravel, 10% coarse gravel, 20% medium sand, 10% coarse sand, 5% fine sand, 5% clay fines	
100							
101							
102							
103							
104							
105							

OAKWELLV (REV. 8/2011)

## Log of Well No. MGW1711X (cont'd)

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.		WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample Blows/ Foot						
105						WELL GRADED GRAVEL with CLAY and SAND (GW-GC): yellow brown (10YR 5/6), moist, 40% fine gravel, 10% coarse gravel, 20% medium sand, 10% coarse sand, 5% fine sand, 5-10% clay fines		4" diameter Schedule 40 PVC well screen with 0.020 V Wire MXF
106								
107								
108								
109					48.5 15.5 0.0 36.0	WELL GRADED GRAVEL with SAND (GW): oxidized yellow and grayish brown (2.5Y 5/2), dry, 40% fine gravel, 10% coarse gravel, 30% medium sand, 15% fine sand, 10% coarse sand, 5% fines		
110								
111								
112								
113								
114						WELL GRADED GRAVEL with CLAY and SAND (GW-GC): grayish brown (2.5Y 5/2), moist, 45% fine gravel, 15% coarse gravel, 30% medium sand, 5% coarse sand, 5% fine sand, 5-10% clay fines		
115								← Sakrete All Purpose Gravel
116								
117								
118								
119					40.0 35.0 0.0 25.0			
120						WELL GRADED GRAVEL with SAND (GW): grayish brown (2.5Y 5/2), moist, 35% fine gravel, 25% coarse gravel, 25% medium sand, 10% coarse sand, 5% fines		
121								
122								
123								

## Log of Well No. MGW1711X (cont'd)

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.		WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	Foot				
123								
124						▼ brown (7.5YR 4/2)		
125								
126						trace charcoal		
127								
128						▼ grayish brown (2.5Y 5/2)		
129								
130								
131								
132								
133								
134						WELL GRADED SAND with GRAVEL (SW): dark gray (7.5YR 4/1), moist, 35% medium sand, 20% coarse sand, 5% fine sand, 25% fine gravel, 10% coarse gravel, 5% fines, gravel subrounded		
135								
136								
137								
138						Bottom of boring at 138 feet. WSDOE well tag= BHM 102.		
139								
140								
141								

PROJECT: KCCHRL West Side LFG KCCHRL						<b>Log of Well No. MGPW1714</b>			
BORING LOCATION: West Side, KCCHRL						GROUND SURFACE ELEVATION AND DATUM: Temporary fill surface			
DRILLING CONTRACTOR: Cascade						DATE STARTED: 9/10/12		DATE FINISHED: 9/19/12	
DRILLING METHOD: Sonic						TOTAL DEPTH (ft.): 140.0		SCREEN INTERVAL (ft.): 90-130	
DRILLING EQUIPMENT: SonicCor 50k						DEPTH TO WATER:	FIRST 43	COMPL. NA	CASING: 4" Schedule 40 PVC
SAMPLING METHOD: Sonic core						LOGGED BY: D. O'Reilly and C. Jefferson			
HAMMER WEIGHT:			DROP:			RESPONSIBLE PROFESSIONAL: J.D. Long			REG. NO. LHg 1354

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.  Surface Elevation:	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot				
0						CLAY with GRAVEL (CL): gray (7.5YR 5/1), moist, 5% cobbles, 10% subangular to subrounded gravel, 85% fines	
1							
2						POORLY-GRADED SAND with GRAVEL (SP): very dark gray (7.5YR 3/1), moist, 10% cobbles, 20% subrounded gravel, 20% medium sand, 50% fine sand	
3						brown (7.5YR 5/4), more cobbles, 20% cobbles, 20% gravel, 20% medium sand, 40% fine sand	
4							
5							
6							
7						silt with gravel lens	
8							
9						silt with gravel lens	
10							
11						POORLY-GRADED GRAVEL with SILT (GP): gray (7.5YR 5/1), moist, 30% cobbles, 25% subrounded to subangular gravel, 45% low plasticity fines	
12						wood chunks at 12, large (4"+) cobbles at 12, 14, 15	
13							
14							
15						SILT with GRAVEL (ML): brown (7.5YR 4/2), moist, 10% cobbles, 20% subrounded gravel, 70% moderate plasticity fines	

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.			WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	Foot					
15									
16									
17									
18						wood			
19									
20					0.0 0.0 20.4 79.6	gray (7.5YR 5/1)			drilling slows down
21									
22						brown (7.5YR 4/2)			
23						POORLY-GRADED SAND with GRAVEL (SP): brown (7.5YR 4/2), moist, 10% cobbles, 20% subrounded gravel, 60% medium sand, 10% fine sand			
24									
25						CLAY (CL): gray (7.5YR 5/1), moist, 10% gravel, 90% fines			Cetco 3/8" medium bentonite chips
26						large (6"+) granodiorite cobbles at 26, 28, and 29			
27									
28									
29									
30						indurated, few gravel, massive, 5% subangular gravel, 95% fines			
31									
32									
33									

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.			WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	Foot					
33									
34									
35						SILT with GRAVEL (ML): dark gray (7.5YR 4/1), moist, 25% cobbles, 10% subrounded gravel, 5% fine sand, 60% low plasticity fines			4" diameter Schedule 40 PVC casing
36									
37									
38					0.0 0.0 21.3 78.7				
39						no recovery			
40						SILTY SAND with GRAVEL (SM): dark gray (7.5YR 4/1), moist, 10% subrounded cobbles, 30% subrounded gravel, 10% medium sand, 30% fine sand, 20% low plasticity fines			
41									
42						fewer cobbles, more sand, 5% cobbles, 25% gravel, 5% medium sand, 40% fine sand, 15% fines			
43						POORLY-GRADED SAND with GRAVEL (SP): dark gray (7.5YR 4/1), moist to wet, 10% cobbles, 30% subrounded gravel, 5% coarse sand, 35% medium sand, 20% fine sand			
44									
45						SILT (ML): dark gray (7.5YR 4/1), moist, 100% non-plastic fines			
46									
47						SILT with GRAVEL (ML): dark gray (7.5YR 4/1), moist, 10% subrounded to subangular cobbles, 10% subrounded to subangular gravel, 80% low plasticity fines			
48									
49									
50						gravel more subangular			
51									

PROJECT: KCCHRL West Side LFG  
KCCHRL

## Log of Well No. MGPW1714 (cont'd)

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS	
	Sample No.	Sample	Blows/ Foot	Foot				
51								
52						more gravel and cobbles, 25% cobbles, 15% gravel, 60% fines		
53								
54								
55								
56								
57						fewer cobbles, 5% cobbles, 10% gravel, 85% fines		
58								
59								
60						large cobble, 7"+		
61								
62								
63						more gravel, more subangular, still dark gray fines, 5% cobbles, 20% gravel, 75% fines		
64								
65						finer gravel, occasional cobble (eg @ 66')		
66								
67								
68								
69								

OAKWELLV (REV. 8/2011)

PROJECT: KCCHRL West Side LFG KCCHRL					Log of Well No. MGPW1714 (cont'd)		
DEPTH (feet)	SAMPLES				DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS	
	Sample No.	Sample	Blows/ Foot	OVM Reading			
69							
70							
71				0.0 0.1 20 79.9	POORLY-GRADED GRAVEL with CLAY (GP-GC): dark brown (7.5YR 3/2), wet, 35% subrounded to subangular cobbles, 30% subrounded to subangular gravel, 5% fine sand, 30% moderate plasticity fines		
72							
73							
74							
75					POORLY-GRADED GRAVEL with SAND and SILT (GP-GM): brown (7.5YR 5/2), moist, 20% subrounded to subangular cobbles, 35% subrounded to subangular gravel, 10% coarse sand, 10% medium sand, 25% low plasticity fines		
76							
77							
78							
79							
80					no recovery		
81							
82							
83							
84							driller reports hard, feels like cobbles
85					less silt, smaller gravel, rock flour and angular pieces from broken boulder, 10% cobbles, 35% gravel, 20% coarse sand, 20% fine sand, 15% fines		
86							
87							

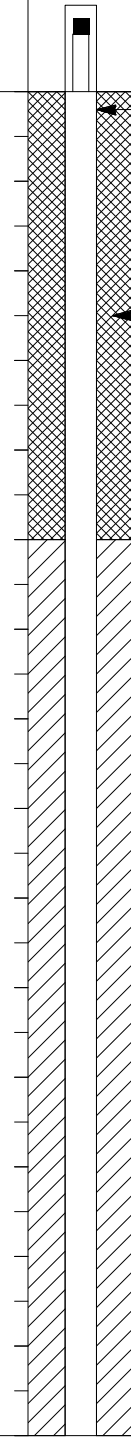
DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.		WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	Foot				
87								20/40 Sweet Sand
88						larger gravel again, still rock flour, 25% cobbles, 35% gravel, 5% coarse sand, 20% medium sand, 15% fines		
89								
90						POORLY-GRADED SAND (SP): dark brown (7.5YR 3/3), moist, sands are subangular with diverse lithics, 10% gravel, 60% coarse sand, 30% medium sand		
91								
92								
93								driller reports feeling cobbles, but none come up
94								
95						POORLY-GRADED SAND with GRAVEL (SP): dark brown (7.5YR 3/3), moist, 5% cobbles, 25% gravel, 60% coarse sand, 5% medium sand, 5% fine sand		
96								
97					0.0 0.0 21 79	large cobbles at 96', 98'		
98								
99								
100						lots of light rock flour, angular cobbles		
101								
102								
103								
104								
105								


DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.		WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	Foot				
105						POORLY-GRADED GRAVEL with SILT and SAND (GP-GM): brown (7.5YR 4/2), moist, 10% cobbles, 40% subrounded gravel, 5% medium sand, 20% fine sand, 25% fines		heat cooking fines into a mortar
106								
107						more cobbles, 30% cobbles, 25% gravel, 5% medium sand, 20% fine sand, 20% fines		
108								
109								
110						SILT with GRAVEL (ML): dark brown (7.5YR 3/3), moist, 20% subangular to subrounded gravel, 10% medium sand, 20% fine sand, 50% fines		
111								
112								
113						brown (7.5YR 4/2), more cobbles, 20% cobbles, 15% gravel, 25% fine sand, 40% fines		
114								Sakrete All Purpose Gravel
115						less cobbles, more sand, more fine subangular gravel, 20% gravel, 5% coarse sand, 10% medium sand, 25% fine sand sand, 40% fines		
116								
117						more cobbles, 20% cobbles, 15% gravel, 15% fine sand, 50% fines		
118								
119								
120					0.0 0.0 21.5 78.5	large subangular broken cobbles with rock flour, 10% coarse gravel, 20% fine gravel, 10% coarse sand, 10% fine sand, 50% fines		
121								
122						dark reddish-brown discoloration, 10% coarse gravel, 30% fine gravel, 15% coarse sand, 15% fine sand, 30% fines		
123								

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	Foot			
123							
124							
125						large subrounded to subangular cobbles, 20% coarse gravel, 15% fine gravel, 5% coarse sand, 25% fine sand, 35% fines	4" diameter Schedule 40 PVC well screen with 0.020 V Wire MXF
126							
127					0.0 0.0 21.5 78.5		
128						SILTY SAND with GRAVEL (SM): light brownish gray (10YR 6/2), moist, sand content increases, 20% coarse gravel, 15% fine gravel, 5% coarse sand, 10% medium sand, 20% fine sand, 30% fines	
129							
130							
131							
132						poorly-graded gravel	
133							
134							
135							
136							
137							
138						no broken cobbles observed 1-2", subangular gravel, 10% coarse gravel, 20% fine gravel, 5% coarse sand, 5% medium sand, 25% fine sand, 35% fines	
139							Cetco 3/8" medium bentonite chips
140						Bottom of boring.	
141							

PROJECT: KCCHRL West Side LFG KCCHRL						<b>Log of Well No. MGW1716X</b>			
BORING LOCATION: West Side, KCCHRL						GROUND SURFACE ELEVATION AND DATUM: Temporary fill surface			
DRILLING CONTRACTOR: Cascade						DATE STARTED: 2/16/12		DATE FINISHED: 2/20/12	
DRILLING METHOD: Sonic						TOTAL DEPTH (ft.): 142.0		SCREEN INTERVAL (ft.): 100-130	
DRILLING EQUIPMENT: SDC390-14						DEPTH TO WATER:	FIRST 28	COMPL. NA	CASING: 4" Schedule 40 PVC
SAMPLING METHOD: Sonic core						LOGGED BY: D.O'Reilly and J.D. Long			
HAMMER WEIGHT:			DROP:			RESPONSIBLE PROFESSIONAL: J.D. Long			REG. NO. LHg 1354

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.  Surface Elevation:	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot				
0						POORLY GRADED SAND with GRAVEL and CLAY (SP-SC): very dark grayish brown (10YR 3/2), wet, 5% coarse sand, 30% medium sand, 20% fine sand, 20% fine subrounded gravel, 5% subrounded cobbles, 20% nonplastic fines, medium induration, possible loose fill	 <p>2' temporary stickup before hook into LFG system</p> <p>Baselite Concrete</p> <p>OVM Reading = CH4 / CO2 / O2 / BAL %s</p>
1							
2							
3							
4							
5							
6							
7						organics (roots)	
8						lens of poorly graded sand with clay (SP-SC); 10% coarse sand, 45% medium sand, 20% fine sand, 20% fines, 5% fine gravel	
9							
10							
11						CLAY with GRAVEL (CL): gray (7.5YR 5/1), moist, 85% low plasticity fines, 10% fine subrounded gravel, 5% subrounded cobbles, well indurated	
12							
13							
14							
15							



Project No. 10031

OAKWELLV (REV. 8/2011)  
Page 1 of 9

## Log of Well No. MGW1716X (cont'd)

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS	
	Sample No.	Sample Blows/ Foot	Sample Blows/ Foot	Sample Blows/ Foot				
15						strong brown (7.5YR 5/6) mottling		
16								
17						dark gray (7.5YR 4/1)		
18								
19						CLAY (CL): dark gray (7.5YR 4/1), 95% low plasticity fines, 5% fine subrounded gravel, well indurated		
20					0.5 1.7 19.7 78.1			
21								
22								
23						non-plastic fines		
24								
25								
26								
27								
28						POORLY GRADED SAND with GRAVEL and SILT (SP-SM): dark gray (7.5YR 4/1), wet, 20% coarse sand, 50% medium sand, 15% non-plastic fines, 10% fine subrounded gravel, 5% cobbles, low to medium induration		
29								
30						SILT with GRAVEL (ML): dark gray (7.5YR 4/1), moist, 75% fines, 10% fine subrounded gravel, 5% subrounded cobbles, 10% fine sand		
31								
32								
33								


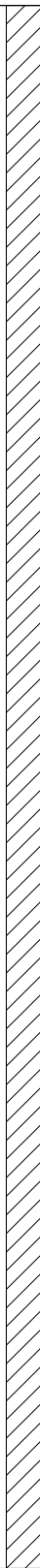

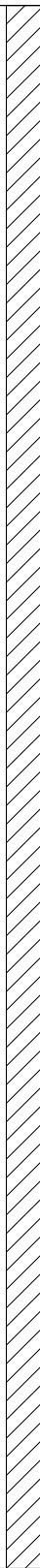

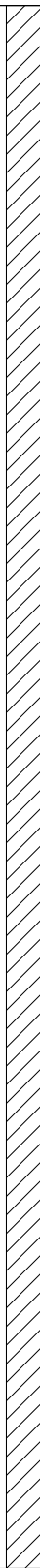

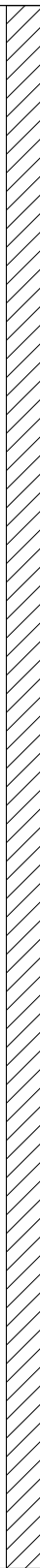

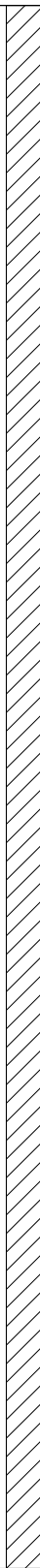

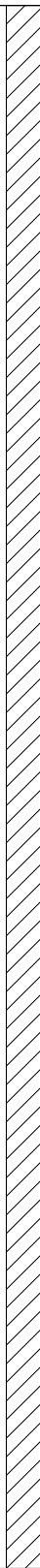

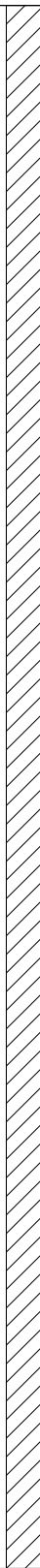

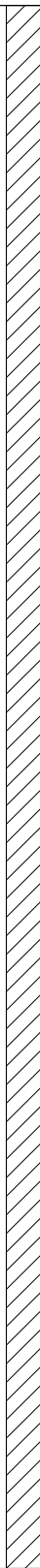

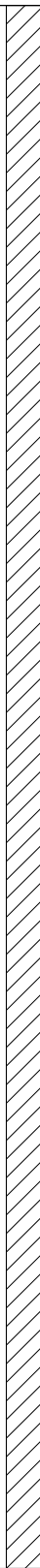

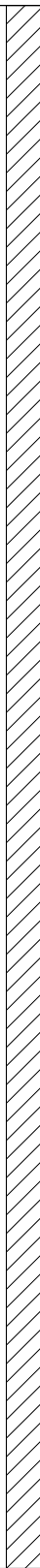
## Log of Well No. MGW1716X (cont'd)

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.			WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	Foot					
33									
34									
35						GRAVELLY SILT (ML): dark gray (7.5YR 4/1), wet, 55% fines, 30% fine subrounded gravel, 15% subrounded cobbles, 10% fine sand			
36									
37									
38						POORLY GRADED SAND with SILT (SW-SM): dark gray (7.5YR 4/1), 35% coarse sand, 35% medium sand, 10% fine sand, 10% non-plastic fines, 10% fine subrounded gravel			
39									
40					10.5 0.4 12.2 76.9				Cetco 3/8" medium bentonite chips
41									
42									
43									
44						POORLY GRADED SAND with GRAVEL (SP): dark gray (7.5YR 4/1), 25% coarse sand, 50% medium sand, 10% fine sand, 10% fine subrounded gravel, 5% subrounded cobbles			
45						more cobbles and gravel and varied color lithics in sand; 30% coarse sand, 25% medium sand, 5% fine sand, 25% fine subrounded gravel, 15% coarse subrounded gravel			
46									
47						large (6") cobble			
48						SILT dark gray (7.5YR 4/1), moist, 95% non-plastic fines, 5% fine gravel, medium induration			
49									
50									4" diameter Schedule 40 PVC casing
51									

## Log of Well No. MGW1716X (cont'd)

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS	
	Sample No.	Sample	Blows/ Foot	Foot				
51						90% non-plastic fines, 10% fine gravel, low induration		
52								
53								
54								
55								
56								
57								
58					0.5 0.3 19.1 80.1	shoots out of core tube; sample lost		
59								
60								
61								
62						CLAY with GRAVEL (CL): dark gray (7.5YR 4/1), 85% low to medium plasticity fines, 15% fine subrounded gravel		
63								
64								
65						85% low to medium plasticity fines, 5% fine subrounded gravel, 10% subrounded cobbles		
66								
67						WELL GRADED GRAVEL with SAND (GW): brown (7.5YR 4/4), 25% subrounded to subangular cobbles, 25% fine subrounded to subangular gravel, 5% coarse sand, 20% medium sand, 20% fine sand, 5% fines		
68								
69								

## Log of Well No. MGW1716X (cont'd)

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS	
	Sample No.	Sample	Blows/ Foot	Foot				
69						WELL GRADED GRAVEL with SAND and CLAY (GW-GC): brown (7.5YR 5/4), wet, 10% subrounded to subangular cobbles, 40% fine subrounded to subangular gravel, 20% medium sand, 10% fine sand, 20% medium plasticity fines with some as gray (7.5YR 5/1) concretions		
70								
71						WELL GRADED GRAVEL with SAND (GW): brown (7.5YR 5/4), moist, 10% subrounded to subangular cobbles, 40% fine subrounded to subangular gravel, 5% fine sand, 30% medium sand, 10% fine sand, 5% fines		
72								
73								
74								
75								
76								
77								
78					20.7 1.8 14.1 63.4			
79						WELL GRADED GRAVEL with SAND and CLAY (GW-GC): light olive brown (2.5Y 5/4), wet, 10% coarse gravel, 40% fine gravel, 5% coarse sand, 30% medium sand, 5% fine sand, 10% fines		
80								
81								
82								
83								
84								
85						large fractured cobbles		
86								
87								

## Log of Well No. MGW1716X (cont'd)

OAKWELLV (REV. 8/2011)

# Log of Well No. MGW1716X (cont'd)

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	Foot			
105							
106					0.3 0.0 20.9 78.8		
107							
108							
109						wet, fewer cobbles; 10% cobbles, 40% fine gravel, 10% coarse sand, 30% medium sand, 10% fine sand	
110							
111							
112							
113						WELL GRADED GRAVEL with CLAY and SAND (GW-GC): light yellowish brown (10YR 6/4), wet, 30% subrounded cobbles, 30% fine subrounded gravel, 10% coarse sand, 10% medium sand, 20% fines	
114							
115							
116							
117						grayish brown (10YR 5/2)	
118					0.3 0.0 20.6 79.1		
119						large cobble	
120						WELL GRADED GRAVEL with SAND (GW): light yellowish brown (10YR 6/4), moist, 20% subrounded cobbles, 30% fine subrounded gravel, 5% coarse sand, 30% medium sand, 5% fine sand, 10% fines	
121						grayish brown (10YR 5/2)	
122							
123							

4" diameter Schedule 40  
PVC well screen with  
0.020 V Wire MXF

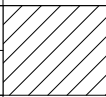
## Log of Well No. MGW1716X (cont'd)

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot				
123							
124							
125							
126							
127							
128					0.2 0.1 21.0 78.7		
129							
130						WELL GRADED GRAVEL with SAND and CLAY (GW-GC): grayish brown (10YR 5/2), moist, 15% subrounded to subangular cobbles, 35% subrounded to subangular gravel, 10% coarse sand, 20% medium sand, 5% fine sand, 15% fines	
131							
132							
133							
134						WELL GRADED GRAVEL with SAND (GW): dark grayish brown (10YR 4/2), moist, 10% subrounded cobbles, 40% fine subrounded gravel, 10% coarse sand, 20% medium sand, 15% fine sand, 5% fines, some subangular cobble chunks colocated with rock flour	
135							
136							
137						WELL GRADED SAND with GRAVEL (SW): dark yellowish brown (10YR 5/4), moist, 15% coarse sand, 40% medium sand, 15% fine sand, 10% subrounded cobbles, 20% fine subrounded gravel	
138							
139						WELL GRADED GRAVEL with SAND (GW): dark grayish brown (10YR 4/2), moist, 10% subrounded cobbles, 40% fine subrounded gravel, 10% coarse sand, 20% medium sand, 15% fine sand, 5% fines, some subangular cobble chunks colocated with rock flour	
140							
141							

← Cetco 3/8" medium  
bentonite chips

PROJECT: KCCHRL West Side LFG  
KCCHRL

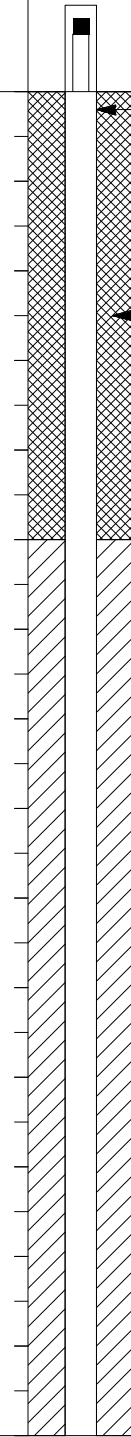
## Log of Well No. MGW1716X (cont'd)


DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	Foot			
141						WELL GRADED GRAVEL with SAND and CLAY (GW-GC): dark grayish brown (10YR 4/2), moist, 10% subrounded cobbles, 35% fine subrounded gravel, 10% coarse sand, 20% medium sand, 15% fine sand, 10% fines, some subangular cobble chunks colocated with rock flour	
142							
143						Bottom of boring at 142 feet. WSDOE well tag= BHM 105	
144							
145							
146							
147							
148							
149							
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							

OAKWELLV (REV. 8/2011)

PROJECT: KCCHRL West Side LFG KCCHRL						<b>Log of Well No. MGW1720X</b>			
BORING LOCATION: West Side, KCCHRL						GROUND SURFACE ELEVATION AND DATUM: Temporary fill surface			
DRILLING CONTRACTOR: Cascade						DATE STARTED: 2/22/12		DATE FINISHED: 2/24/12	
DRILLING METHOD: Sonic						TOTAL DEPTH (ft.): 123.0		SCREEN INTERVAL (ft.): 70-110	
DRILLING EQUIPMENT: SDC390-14						DEPTH TO WATER:	FIRST 23	COMPL. NA	CASING: 4" Schedule 40 PVC
SAMPLING METHOD: Sonic core						LOGGED BY: D.O'Reilly			
HAMMER WEIGHT:			DROP:			RESPONSIBLE PROFESSIONAL: J.D. Long			REG. NO. LHg 1354

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.  Surface Elevation:	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot				
0						CLAYEY SILT (ML): gray (7.5YR 5/1), moist, 95% low plasticity fines, 5% fine gravel, medium induration	 <p>2' temporary stickup before hook into LFG system</p> <p>Baselite Concrete</p> <p>OVM Reading = CH4 / CO2 / O2 / BAL %s</p>
1							
2							
3							
4							
5						CLAY with GRAVEL (CL): yellowish brown (10YR 5/6), 75% low plasticity fines, 15% subrounded cobbles, 10% fine subrounded gravel, low to medium induration	
6							
7							
8							
9							
10						twigs	
11							
12						CLAY with GRAVEL (CL): dark grayish brown (10YR 4/2), 75% low plasticity fines, 5% subrounded gravel, 10% fine subrounded gravel, 10% medium sand, low induration	
13							
14						lens of CLAY with SAND (CL) with twigs and branches; 50% fines, 40% medium sand, 5% cobbles, 5% fine gravel	
15							



Project No. 10031

OAKWELLV (REV. 8/2011)  
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PROJECT: KCCHRL West Side LFG  
KCCHRL

## Log of Well No. MGW1720X (cont'd)

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.			WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	Foot					
15									
16									
17						lens of CL with sand/twigs as above @ 14			
18					25.9 33.0 1.0 40.1				
19									
20									
21									
22									
23						POORLY GRADED SAND with GRAVEL and SILT very dark gray (10YR 3/1), wet, 35% coarse sand, 20% medium sand, 5% fine sand, 5% subrounded cobbles, 20% fine subrounded gravel, varied color lithics in sand, finer with depth			
24									
25									
26									
27						CLAY (CL): gray (7.5YR 5/1), moist, 90% low plasticity fines, 5% subrounded cobbles, 5% fine subrounded gravel, medium induration			
28									
29									
30									
31						large cobble with rock flour			
32						POORLY GRADED SAND with GRAVEL (SP): very dark gray (7.5YR 3/1), 25% coarse sand, 40% medium sand, 10% subrounded cobbles, 25% fine subrounded gravel			
33									

OAKWELLV (REV. 8/2011)

PROJECT: KCCHRL West Side LFG  
KCCHRL

## Log of Well No. MGW1720X (cont'd)

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS	
	Sample No.	Sample Blows/ Foot	Foot					
33								
34								
35								
36						CLAY (CL): gray (10YR 5/1), 95% low plasticity fines, 5% fine subrounded to subangular gravel, medium induration		
37								
38					5.9 4.2 10.0 79.9			
39								
40						sand lens		Cetco 3/8" medium bentonite chips
41						sand lens		
42								
43								
44						90% low plasticity fines, 10% fine subrounded to subangular gravel		
45								
46						CLAY with GRAVEL (CL): gray (10YR 5/1), 80% non plastic fines, 10% subrounded cobbles, 10% fine subrounded gravel, medium induration		
47								
48						SANDY SILT (ML): gray (10YR 5/1), 70% non plastic fines, 10% medium sand, 20% fine sand, low to medium induration		
49								
50								4" diameter Schedule 40 PVC casing
51								

OAKWELLV (REV. 8/2011)

## Log of Well No. MGW1720X (cont'd)

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.			WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	Foot					
51									
52						CLAY (CL): gray (10YR 5/1), 100% low plasticity fines, medium induration			
53									
54									
55									
56									
57									
58					0.2 0.3 19.1 80.4	POORLY GRADED GRAVEL with SAND (GP): pale brown (10YR 6/3), 40% subrounded to subangular cobbles, 35% fine subrounded to subangular gravel, 20% fine sand, 5% fines			
59									
60						WELL GRADED GRAVEL with SAND and CLAY (GW-GC): dark yellowish brown (10YR 4/4), wet, 10% subrounded cobbles, 40% fine subrounded gravel, 10% medium sand, 20% fine sand, 20% low plasticity fines			
61									
62									
63									
64									
65									
66						moist			
67									20/40 Sweet Sand
68					9.0 1.5 14.9 74.6	no recovery			
69									

# Log of Well No. MGW1720X (cont'd)

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	Foot			
69							
70							
71							
72						grayish brown (10YR 5/2)	
73							
74						large cobble	
75							
76						10% subrounded cobbles, 25% fine subrounded gravel, 10% medium sand, 20% fine sand, 35% fines	
77							
78					2.6 2.7 16.7 78.0		
79							
80						15% subrounded cobbles, 35% fine subrounded gravel, 5% coarse sand, 20% medium sand, 10% fine sand, 15% fines	
81							
82							
83						POORLY GRADED GRAVEL with SAND (GP): brown (10YR 5/3), 35% subrounded cobbles, 15% fine subrounded gravel, 25% coarse subangular sand, 20% medium subangular sand, 5% fines	
84							
85							Sakrete All Purpose Gravel
86							
87							

## Log of Well No. MGW1720X (cont'd)

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.		WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	Foot				
87								
88					0.0 0.1 20.1 79.8			
89								
90								
91								
92								
93								
94								
95						POORLY GRADED GRAVEL with CLAY and SAND (GP-GC): yellowish brown (10YR 5/6), moist (nearly wet), 45% subrounded cobbles, 15% fine subrounded gravel, 5% coarse sand, 10% medium sand, 15% fine sand, 15% low plasticity fines; some cobbles (20%) large		
96								
97								
98					0.0 0.0 20.7 79.3			
99						POORLY GRADED GRAVEL with SAND (GP): grayish brown (10YR 5/2), moist, 40% subangular to subrounded cobbles, 15% fine subrounded gravel, 35% medium sand, 10% fine sand, some cobbles chunks of larger pieces		
100								
101								
102								
103								
104								
105								

4" diameter Schedule 40  
PVC well screen with  
0.020 V Wire MXF

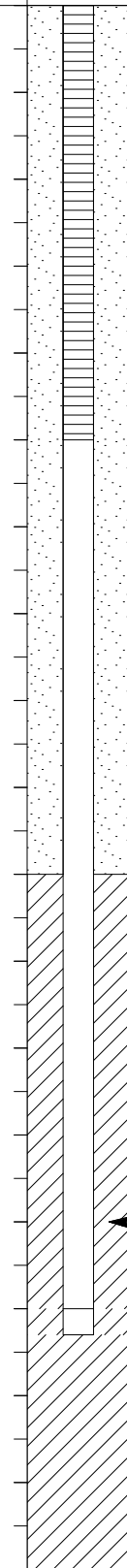
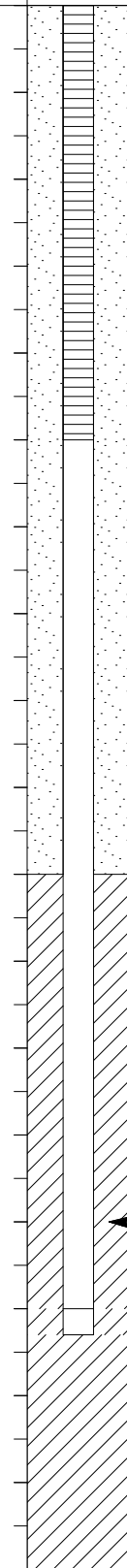
amec

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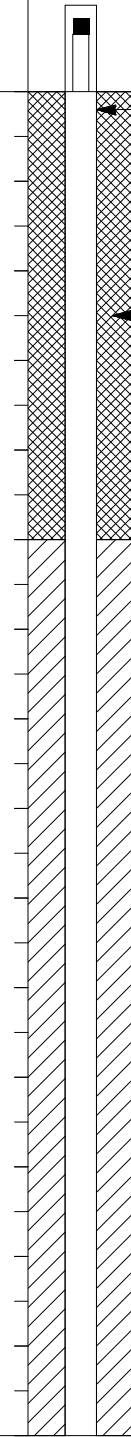
OAKWELLY (REV. 8/2011)


## Log of Well No. MGW1720X (cont'd)

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	Foot			
105						20% subangular to subrounded cobbles, 35% fine subrounded gravel, 5% coarse sand, 30% medium sand, 10% fine sand	
106							
107							
108					0.0 0.0 20.8 79.2		
109							
110						POORLY GRADED GRAVEL with SAND and CLAY (GP-GC): brownish yellow (10YR 6/6), 30% subrounded to subangular cobbles, 30% fine subrounded to subangular gravel, 15% medium sand, 10% fine sand, 15% non-plastic fines	
111							
112							
113							
114						WELL GRADED GRAVEL with SAND (GW): grayish brown (10YR 5/2), 5% subrounded cobbles, 50% fine subrounded gravel, 10% coarse sand, 30% medium sand, 5% fine sand	
115							
116							
117							
118						wet Bottom of boring at 123'. WSDOE well tag= BHM 107.	Cetco 3/8" medium bentonite chips
119							
120							
121							
122						wet Bottom of boring at 123'. WSDOE well tag= BHM 107.	
123							

PROJECT: KCCHRL West Side LFG KCCHRL						<b>Log of Well No. MGW1723X</b>			
BORING LOCATION: West Side, KCCHRL						GROUND SURFACE ELEVATION AND DATUM: Temporary fill surface			
DRILLING CONTRACTOR: Cascade						DATE STARTED: 1/25/12		DATE FINISHED: 1/27/12	
DRILLING METHOD: Sonic						TOTAL DEPTH (ft.): 110.0		SCREEN INTERVAL (ft.): 50-90	
DRILLING EQUIPMENT: SDC390-14						DEPTH TO WATER: 90	FIRST 90	COMPL. NA	CASING: 4" Schedule 40 PVC
SAMPLING METHOD: Sonic core						LOGGED BY: D. O'Reilly			
HAMMER WEIGHT:				DROP:		RESPONSIBLE PROFESSIONAL: J.D. Long			REG. NO. LHg 1354

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.			
						Surface Elevation:	
0						CLAY with GRAVEL (CL): dark gray (7.5YR 4/1), moist, 80% fines, 20% subrounded cobbles	 <div style="position: absolute; top: 300px; left: 750px;">2' temporary stickup before hook into LFG system</div> <div style="position: absolute; top: 400px; left: 770px;">Baselite Concrete</div>
1							
2							
3						SILTY CLAY (CL): brown (7.5YR 4/2), moist, 90% fines, 10% subangular gravel, 15-20% of fines in form of gray (7.5YR 5/1) clay stringers	
4							
5							
6							
7						very dark gray (7.5YR 3/1), indurated	
8							
9							
10							
11							
12						WELL GRADED SAND with GRAVEL (SW): strong brown (7.5YR 6/4), moist, 30% medium sand, 25% coarse sand, 10% fine sand, 20% fine subangular gravel, 10% subangular cobbles, 5% fines	
13							
14							
15							



OAKWELLV (REV. 8/2011)

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## Log of Well No. MGW1723X (cont'd)

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.			WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	Foot					
15									
16						dark gray (7.5YR 4/1)			
17									
18					0.9 1.4 19.3 78.4	SILTY CLAY with GRAVEL (CL): very dark gray (7.5YR 3/1), moist, 85% fines, 15% subrounded gravel, indurated			
19									
20									
21									
22									
23									
24									
25									Cetco 3/8" medium bentonite chips
26						dark gray (7.5YR 4/1), some gravel subangular			
27									
28									
29									
30						siltier			
31									
32									
33									

## Log of Well No. MGW1723X (cont'd)

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample Blows/ Foot	Sample Foot	Sample Blows/ Foot			
33							
34						very dark gray (7.5YR 3/1), more gravel (25-30%)	
35							4" diameter Schedule 40 PVC casing
36							
37							
38							
39					0.1 0.2 20.8 78.9		
40							
41							
42						CLAYEY SILT with GRAVEL (ML): brown (7.5YR 4/2), moist, 60% fines, 25% subrounded gravel, 10% subangular cobbles	
43							
44						WELL GRADED SAND with GRAVEL (SW): brown (7.5YR 4/2), moist, 40% medium sand, 30% coarse sand, 10% fine sand, 10% subrounded gravel, 5% coarse gravel, trace (5%) fines as gray (7.5YR 4/1) concretions	
45							
46							20/40 Sweet Sand
47							
48							
49					17.9 2.0 12.8 67.3		
50							
51							

PROJECT: KCCHRL West Side LFG  
KCCHRL

## Log of Well No. MGW1723X (cont'd)

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.		WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	Foot				
51								
52								
53								
54						POORLY GRADED GRAVEL with SAND (GP): brown (7.5YR 5/3), moist, 30% subrounded cobbles, 30% subangular gravel, 20% coarse sand, 10% medium sand, 5% fine sand, 5% fines, bimodal gravel sizes		
55								
56								
57								
58					0.1 0.1 20.9 78.9	WELL GRADED SAND with GRAVEL (SW): brown (7.5YR 5/3), moist, 30% medium sand, 20% coarse sand, 5% fine sand, 25% subrounded gravel, 15% subangular cobbles, 5% fines		
59								
60								
61								
62								
63						rock flour		
64						WELL GRADED SAND (SW): strong brown (7.5YR 6/4), moist, 40% medium sand, 35% coarse sand, 10% fine sand, 10% subrounded gravel, 5% fines		
65								
66								
67								
68								
69								

OAKWELLV (REV. 8/2011)

## Log of Well No. MGW1723X (cont'd)

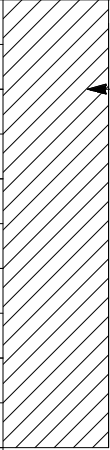
DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	Foot			
69							
70							
71						some fines as pinkish gray (7.5YR 7/2) concretions	
72							
73						WELL GRADED SAND with SILT and GRAVEL (SW-SC): grayish brown (10YR 5/2), moist, 30% medium sand, 25% fine sand, 10% coarse sand, 15% subrounded gravel, 5% coarse gravel, 15% fines as concretions	
74							
75							
76							
77							
78					0.1 0.0 21.0 78.9		
79							
80							4" diameter Schedule 40 PVC well screen with 0.020 V Wire MXF
81							
82							
83							
84						large (6") cobble dark gray (7.5YR 4/1)	Sakrete All Purpose Gravel
85							
86							
87							

PROJECT: KCCHRL West Side LFG  
KCCHRL

## Log of Well No. MGW1723X (cont'd)

DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot	Foot			
87							
88					0.1 0.0 21.0 78.9		
89							
90						WELL GRADED GRAVEL with CLAY and SAND (GW-GC): brown (7.5YR 4/2), moist, 40% subrounded cobbles, 30% subrounded gravel, 10% coarse sand, 5% medium sand, 5% fine sand, 10% fines, sand finer with depth	
91							
92							
93							
94							
95							
96						strong brown (7.5YR 4/6) mottling in sections	
97						large cobble	
98							
99					0.1 0.1 20.0 79.8	sand coarser	
100							
101							
102							
103							
104							
105							

OAKWELLV (REV. 8/2011)

PROJECT: KCCHRL West Side LFG KCCHRL						Log of Well No. MGW1723X (cont'd)	
DEPTH (feet)	SAMPLES				OVM Reading	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows/ Foot				
105						strong brown (7.5YR 4/6) mottling	 <p>Cetco 3/8" medium bentonite chips</p>
106							
107							
108							
109							
110				0.1 0.0 20.7 79.2	Bottom of boring at 110 feet. WSDOE well tag= BHM 103.		
111							
112							
113							
114							
115							
116							
117							
118							
119							
120							
121							
122							
123							

## **APPENDIX C**

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### LFG Influence Test Records

# MIGRATION WELL MGW1701X

6/24/13 thru 6/28/13

MGW1701X - valve wide open

MGW1705X - valve 1/2 turn open

MGW1701X	Time:	Bar. Press.	CH <sub>4</sub>	CO <sub>2</sub>	O <sub>2</sub>	SP	DP
6/24	7:30am	29.72	11.5	18.5	0	-17.5	0.01
	10:30am	29.74	11.8	18.9	0	-18.2	0.01
	1:30pm	29.73	11.3	17.7	0	-18	0.01
	4:30pm	29.73	11	17.3	0	-18.1	0.01
6/25	7:30am	29.73	12	19	0	-17.8	0.01
	10:30am	29.77	11.5	18.8	0	-17.8	0.01
	1:30pm	29.79	11.5	18.6	0	-17.7	0.01
	4:30pm	29.79	11.3	18.7	0	-17.2	0.01
6/26	7:30am	29.91	12	19.2	0	-18.2	0.01
	10:30am	29.93	11.5	19.3	0	-18.3	0.01
	1:30pm	29.97	11.6	19.3	0	-18.2	0.01
	4:30pm	30.02	11.6	19	0	-18.7	0.01
6/27	7:30am	30.05	12.3	20	0	-18.5	0.01
	10:30am	30.08	12.1	19.8	0	-18.5	0.01
	1:30pm	30.12	12.1	19.7	0	-18.6	0.01
	4:30pm	30.15	12.1	19.8	0	-18.9	0.01
6/28	7:30am	30.12	12.4	20	0.1	-18.1	0.02
	10:30am	30.11	11.6	18.9	0.2	-17.6	0.02
	1:30pm	30.09	11.9	18.9	0.2	-17.1	0.02
	4:30pm	30.08	11.9	18.9	0.2	-16.9	0.01

# MIGRATION WELL MGW1701X

MGW1705X	Time:	Bar. Press.	CH <sub>4</sub>	CO <sub>2</sub>	O <sub>2</sub>	SP	DP
6/24	7:30am	29.72	3.3	14.5	4.8	-2.7	0.04
	10:30am	29.74	3.9	15.3	4.2	-2.6	0.04
	1:30pm	29.73	3.6	14.4	4.4	-2.7	0.05
	4:30pm	29.73	3.4	14.3	4.3	-2.5	0.04
6/25	7:30am	29.73	3.6	14.9	3.6	-2.6	0.03
	10:30am	29.77	3.4	14.7	3.4	-2.8	0.03
	1:30pm	29.79	3.2	14.4	3.6	-2.9	0.03
	4:30pm	29.79	3.2	14.3	3.7	-2.5	0.04
6/26	7:30am	29.91	3.5	14.5	3.2	-3.6	0.04
	10:30am	29.93	3.5	14.3	3.2	-3.8	0.03
	1:30pm	29.97	3.6	14.2	3.2	-3.9	0.02
	4:30pm	30.02	3.6	14.1	3.3	-4.8	0.03
6/27	7:30am	30.05	4.4	14.6	3.1	-3.8	0.03
	10:30am	30.08	4.4	14.8	3.1	-4.1	0.03
	1:30pm	30.12	4.3	14.5	3.2	-4.2	0.02
	4:30pm	30.15	4.4	14.6	3.3	-4.4	0.04
6/28	7:30am	30.12	5.4	15.4	3.5	-3.1	0.04
	10:30am	30.11	5.1	14.3	3.6	-2.6	0.04
	1:30pm	30.09	5	14.6	3.6	-2.4	0.03
	4:30pm	30.08	5.3	14.5	3.5	-2.4	0.03

# MIGRATION WELL MGW1701X

MGPW1700	Time:	Bar. Press.	CH <sub>4</sub>	CO <sub>2</sub>	O <sub>2</sub>	SP
6/24	7:30am	29.72	0	0.4	16.9	0.6
	10:30am	29.74	0	0.4	16.6	0.7
	1:30pm	29.73	0	0.3	16.4	0.7
	4:30pm	29.73	0	0.3	16.4	0.6
6/25	7:30am	29.73	0	0.3	16.5	0.38
	10:30am	29.77	0	0.1	16.3	0.35
	1:30pm	29.79	0	0.1	16.4	0.25
	4:30pm	29.79	0	0.2	16.4	0.24
6/26	7:30am	29.91	0	0.3	20.7	-0.25
	10:30am	29.93	0	0.1	20.8	-0.39
	1:30pm	29.97	0	0	20.8	-0.56
	4:30pm	30.02	0	0.2	20.5	-0.66
6/27	7:30am	30.05	0	0.2	20.7	-0.54
	10:30am	30.05	0	0.1	20.8	-0.24
	1:30pm	30.12	0	0.1	20.6	-0.26
	4:30pm	30.15	0	0.1	20.8	-0.3
6/28	7:30am	30.12	0	0	20.5	-0.22
	10:30am	30.11	0	0	20.2	-0.17
	1:30pm	30.09	0	0	20.3	-0.19
	4:30pm	30.08	0	0	20.3	-0.08

# MIGRATION WELL MGW1701X

MGPW1703	Time:	Bar. Press.	CH <sub>4</sub>	CO <sub>2</sub>	O <sub>2</sub>	SP
6/24	7:30am	29.72	0	0.5	3.1	2.7
	10:30am	29.74	0	0.6	2.9	2.3
	1:30pm	29.73	0	0.5	3	2.2
	4:30pm	29.73	0	0.5	3.1	2.2
6/25	7:30am	29.73	0	0.6	3	1.59
	10:30am	29.77	0	0.5	3	1.17
	1:30pm	29.79	0	0.5	3.1	0.96
	4:30pm	29.79	0	0.5	3.2	1.19
6/26	7:30am	29.91	0	0.3	19.6	-0.92
	10:30am	29.93	0	0.2	20.6	-1.42
	1:30pm	29.97	0	0.2	20.7	-1.84
	4:30pm	30.02	0	0.1	20.6	-2.49
6/27	7:30am	30.05	0	0.3	20.6	-2.79
	10:30am	30.08	0	0.2	20.7	-3.17
	1:30pm	30.12	0	0.2	20.5	-3.48
	4:30pm	30.15	0	0.2	20.7	-3.82
6/28	7:30am	30.12	0	0	20.5	-2.71
	10:30am	30.11	0	0	20.4	-2.04
	1:30pm	30.09	0	0	20.4	-1.84
	4:30pm	30.08	0	0	20.3	-1.6

# MIGRATION WELL MGW1701X

**GP 33C**

	Time:	Bar. Press.	CH <sub>4</sub>	CO <sub>2</sub>	O <sub>2</sub>	SP
6/24	7:30am	29.72	0	0.3	20.5	-0.9
	10:30am	29.74	0	0.2	20.2	-1.1
	1:30pm	29.73	0	0.2	20.3	-1
	4:30pm	29.73	0	0.1	20.3	-0.9
6/25	7:30am	29.73	0	0.1	20.9	-1.13
	10:30am	29.73	0	0.2	20.4	-1.28
	1:30pm	29.79	0	0.2	20.8	-1.31
	4:30pm	29.79	0	0.1	20.7	-1.02
6/26	7:30am	29.91	0	0.2	20.8	-1.74
	10:30am	29.93	0	0.1	20.8	-1.86
	1:30pm	29.97	0	0.1	20.7	-2.04
	4:30pm	30.02	0	0	20.6	-2.32
6/27	7:30am	30.05	0	0.3	20.7	-1.82
	10:30am	30.08	0	0.1	20.8	-1.87
	1:30pm	30.12	0	0.2	20.6	-2.13
	4:30pm	30.15	0	0.1	20.7	-2.19
6/28	7:30am	30.12	0	0	20.6	-1.07
	10:30am	30.11	0	0	20.4	-0.74
	1:30pm	30.09	0	0	20.3	-0.68
	4:30pm	30.08	0	0	20.3	-0.7



# MIGRATION WELL MGW1705X

6/10/13 thru 6/14/13

MGW1705X - valve wide open

MGW1701X - valve 1/2 turn open

MGW1709X - valve 1/2 turn open

MGW1705X	Time:	Bar. Press.	CH <sub>4</sub>	CO <sub>2</sub>	O <sub>2</sub>	SP	DP
6/10	7:30am	30	5.2	16.5	4.7	-14.9	1.54
	10:30am	30	5.1	15.5	4.8	-14.9	1.49
	1:30pm	29.98	5	14.9	5	-13.8	1.49
	4:30pm	29.95	4.9	14.2	4.9	-13.9	1.39
6/11	7:30am	30	5.2	16.5	4.9	-15.5	1.4
	10:30am	30.02	5.1	15.5	5	-15.7	1.4
	1:30pm	30.03	5.1	15.4	5.1	-15.5	1.45
	4:30pm	30.05	5.2	15	5.2	-15.6	1.44
6/12	7:30am	30.12	6	15.1	5.6	-16	1.44
	10:30am	30.12	6	15.1	5.7	-16.1	1.5
	1:30pm	30.12	5.7	14.6	5.8	-15.5	1.47
	4:30pm	30.12	5.7	14.6	5.9	-15.9	1.4
6/13	7:30am	30.13	6.2	15.1	5.9	-15.4	1.37
	10:30am	30.15	5.6	14.9	5.2	-15.7	1.42
	1:30pm	30.16	5.5	14.5	5.3	-16	1.47
	4:30pm	30.16	5.7	14.5	5.4	-15.8	1.44
6/14	7:30am	30.21	6.2	15	6.1	-16	1.43
	10:30am	30.21	6	14.9	6.2	-15.8	1.43
	1:30pm	30.21	5.8	14.7	6.3	-15.4	1.46
	4:30pm	30.14	5.7	14.6	6.1	-14.9	1.42

# MIGRATION WELL MGW1705X

MGW1701X	Time:	Bar. Press.	CH <sub>4</sub>	CO <sub>2</sub>	O <sub>2</sub>	SP	DP
6/10	7:30am	30	14.4	20.6	0	-4.9	0.01
	10:30am	30	8.1	12.6	0	-1.7	0.01
	1:30pm	29.98	3.6	6.4	0.1	-0.7	0.01
	4:30pm	29.95	2.3	4.3	0.1	-0.5	0.01
6/11	7:30am	30	7.1	11.2	0	-2.5	0.01
	10:30am	30.02	7.5	11.4	0	-2.7	0.01
	1:30pm	30.03	6.6	10	0	-2.5	0.01
	4:30pm	30.05	7.9	11.7	0	-2.6	0
6/12	7:30am	30.12	14	18.1	0	-3.3	0
	10:30am	30.12	14.3	18.6	0	-3.4	0
	1:30pm	30.12	13.4	17.4	0.1	-2.8	0
	4:30pm	30.12	14.4	18.6	0.2	-3.2	0.01
6/13	7:30am	30.13	16.3	20.6	0	-3.3	0
	10:30am	30.15	15.5	20.7	0	-3.3	0.02
	1:30pm	30.16	15.7	20.4	0	-3.6	0.01
	4:30pm	30.16	16	20.7	0	-3.3	0.01
6/14	7:30am	30.21	17.2	22.6	0	-3.9	0
	10:30am	30.21	17.3	22.5	0	-3.5	0.01
	1:30pm	30.21	17.6	23.1	0.1	-2.9	0
	4:30pm	30.14	17.4	22.9	0.1	-2.3	0

# MIGRATION WELL MGW1705X

MGW1709X	Time:	Bar. Press.	CH <sub>4</sub>	CO <sub>2</sub>	O <sub>2</sub>	SP	DP
6/10	7:30am	30	3.5	12.5	8.4	-1.4	0.01
	10:30am	30	4.3	13	6.8	-1.2	0.01
	1:30pm	29.98	4.7	12.5	6.2	-0.9	0.01
	4:30pm	29.95	4.7	12.3	5.8	-0.8	0.02
6/11	7:30am	30	6.9	14.8	3.3	-2.6	0.02
	10:30am	30.02	7.1	14.4	3.3	-2.7	0.01
	1:30pm	30.03	7.6	14.5	2.8	-2.7	0.02
	4:30pm	30.05	8	14.6	2.8	-2.8	0
6/12	7:30am	30.12	9.4	15.7	2.2	-2.9	0.01
	10:30am	30.12	9.4	16	2	-2.9	0
	1:30pm	30.12	9.2	15.5	2.2	-2.6	0
	4:30pm	30.12	9	15.9	2.2	-2.7	0
6/13	7:30am	30.13	9.6	16.7	2.7	-2.7	0.01
	10:30am	30.15	8.7	16.6	1.7	-2.7	0.01
	1:30pm	30.16	8.8	16.8	1.5	-2.9	0.01
	4:30pm	30.16	9.1	16.7	1.5	-2.7	0.01
6/14	7:30am	30.21	9.3	17.4	1.6	-2.9	0
	10:30am	30.21	9.3	17.3	1.7	-2.7	0.01
	1:30pm	30.21	8.9	17.1	1.7	-2.4	0
	4:30pm	30.14	8.7	17	1.7	-1.9	0.01

# MIGRATION WELL MGW1705X

MGPW1703	Time:	Bar. Press.	CH <sub>4</sub>	CO <sub>2</sub>	O <sub>2</sub>	SP
6/10	7:30am	30	0	0.3	20.7	0.28
	10:30am	30	0	0.3	19.4	0.49
	1:30pm	29.98	0	0.3	13.3	0.91
	4:30pm	29.95	0	0.4	6.6	1.16
6/11	7:30am	30	0	0.5	11.6	-0.18
	10:30am	30.02	0	0.3	19.2	-0.44
	1:30pm	30.03	0	0.2	20.6	-0.67
	4:30pm	30.05	0	0.3	20.9	0
6/12	7:30am	30.12	0	0.2	20.8	-1.69
	10:30am	30.12	0	0.2	20.8	-1.77
	1:30pm	30.12	0	0.2	20.5	-1.54
	4:30pm	30.12	0	0.2	20.6	-1.65
6/13	7:30am	30.13	0	0.3	20.7	-1.72
	10:30am	30.15	0	0.2	20.6	-1.83
	1:30pm	30.16	0	0	20.4	-1.98
	4:30pm	30.16	0	0.1	20.6	-1.81
6/14	7:30am	30.21	0	0.4	20.6	-2.42
	10:30am	30.21	0	0.1	20.7	-2.22
	1:30pm	30.21	0	0.1	20.6	-1.89
	4:30pm	30.14	0	0.1	20.4	-1.24

# MIGRATION WELL MGW1705X

MGPW1708	Time:	Bar. Press.	CH <sub>4</sub>	CO <sub>2</sub>	O <sub>2</sub>	SP
6/10	7:30am	30	0	0.7	20.6	-1.27
	10:30am	30	0	0.6	20.3	-1.19
	1:30pm	29.98	0	0.3	20.1	-0.73
	4:30pm	29.95	0	0.6	18.9	-0.6
6/11	7:30am	30	0	0.1	19.2	-1.73
	10:30am	30.02	0	0.8	20.4	-2.01
	1:30pm	30.03	0	0.8	20.2	-2.07
	4:30pm	30.05	0	0.8	20.8	-2.12
6/12	7:30am	30.12	0	0.2	20.8	-2.33
	10:30am	30.12	0	0.2	20.7	-2.33
	1:30pm	30.12	0	0.2	20.5	-2.02
	4:30pm	30.12	0	0.2	20.7	-2.14
6/13	7:30am	30.13	0	0.2	20.7	-2.06
	10:30am	30.15	0	0.1	20.6	-2.09
	1:30pm	30.16	0	0	20.5	-2.24
	4:30pm	30.16	0	0	20.5	-2.02
6/14	7:30am	30.21	0	0.3	20.7	-2.3
	10:30am	30.21	0	0.2	20.7	-2.11
	1:30pm	30.21	0	0.1	20.6	-1.8
	4:30pm	30.14	0	0.2	20.4	-1.28

# MIGRATION WELL MGW1705X

**GP 33C**

	Time:	Bar. Press.	CH <sub>4</sub>	CO <sub>2</sub>	O <sub>2</sub>	SP
6/10	7:30am	30	0	0.1	20.9	-0.7
	10:30am	30	0	0.1	20.6	-0.54
	1:30pm	29.98	0	0	20.5	-0.3
	4:30pm	29.95	0	0	20.5	-0.19
6/11	7:30am	30	0	0.2	20.9	-1.05
	10:30am	30.02	0	0.1	21	-1.24
	1:30pm	30.03	0	0.1	20.7	-1.24
	4:30pm	30.05	0	0.1	20.9	-1.4
6/12	7:30am	30.12	0	0.2	20.8	-1.42
	10:30am	30.12	0	0.2	20.7	-1.42
	1:30pm	30.12	0	0.2	20.5	-1.2
	4:30pm	30.12	0	0	20.7	-1.28
6/13	7:30am	30.13	0	1.2	18.9	-0.61
	10:30am	30.15	0	1.1	18.9	-0.65
	1:30pm	30.16	0	1.1	18.7	-0.72
	4:30pm	30.16	0	0.7	19.6	-0.54
6/14	7:30am	30.21	0	0.3	20.8	-1.42
	10:30am	30.21	0	0.1	20.7	-1.26
	1:30pm	30.21	0	0	20.6	-1
	4:30pm	30.14	0	0.1	20.2	-0.5

# MIGRATION WELL MGW1709X

6/3/13 thru 6/7/13

MGW1709X - valve wide open

MGW1705X - valve 1/2 turn open

MGW1711X - valve 1/2 turn open

MGW1709X	Time:	Bar. Press.	CH <sub>4</sub>	CO <sub>2</sub>	O <sub>2</sub>	SP	DP
6/3	7:30am	30.1	3	11.2	9.7	-15.6	1.82
	10:30am	30.1	2.9	11	9.9	-15.7	1.89
	1:30pm	30.1	2.7	10.6	10.1	-15.2	1.87
	4:30pm	30.1	2.5	10.5	10.2	-14.8	1.89
6/4	7:30am	30.11	2.7	10.7	10.3	-15.6	1.88
	10:30am	30.11	2.8	10.1	10.6	-15.5	1.89
	1:30pm	30.1	2.3	9.9	10.6	-14.8	1.91
	4:30pm	30.08	2.2	9.8	10.8	-14.4	1.92
6/5	7:30am	30.06	2.6	10.6	10.6	-15.4	1.93
	10:30am	30.07	2.5	10.5	10.6	-15.3	1.97
	1:30pm	30.08	2.4	9.9	10.6	-14.8	1.91
	4:30pm	30.06	2.4	10.2	10.5	-14.4	2.01
6/6	7:30am	30.06	2.1	10	10.7	-15.1	1.9
	10:30am	30.06	2.3	9.5	10.8	-14.9	1.86
	1:30pm	30.04	2.4	9.5	10.8	-14.9	1.83
	4:30pm	30.02	2.3	9.8	10.7	-15.2	1.85
6/7	7:30am	30.06	2.6	10.3	10.6	-16.7	2.11
	10:30am	30.08	2.6	10.1	10.7	-16.5	2.16
	1:30pm	30.1	2.4	10	10.6	-15.6	1.97
	4:30pm	30.1	2.4	10.1	10.6	-16	2.03

# MIGRATION WELL MGW1709X

MGW1705X	Time:	Bar. Press.	CH <sub>4</sub>	CO <sub>2</sub>	O <sub>2</sub>	SP	DP
6/3	7:30am	30.1	1.5	9.4	8	-2.7	0
	10:30am	30.1	4.1	13.8	5.5	-2.2	0
	1:30pm	30.1	3.9	14.2	4.9	-1.6	0.01
	4:30pm	30.1	4	14.3	4.5	-1.2	0.01
6/4	7:30am	30.11	4.7	15.4	2.6	-1.9	0
	10:30am	30.11	4.8	14.4	2.8	-1.7	0
	1:30pm	30.1	4.3	14.4	2.7	-1.3	0.01
	4:30pm	30.08	4.4	14.6	2.6	-1	0.01
6/5	7:30am	30.06	4.9	15.6	2.7	-1.6	0.01
	10:30am	30.07	4.5	15.4	2.6	-1.7	0.01
	1:30pm	30.08	4.4	15	2.7	-1.5	0
	4:30pm	30.06	4.6	15.5	2.6	-1.1	0.01
6/6	7:30am	30.06	4.2	15.4	2.5	-1.5	0.01
	10:30am	30.06	4.5	14.6	2.6	-1.3	0.05
	1:30pm	30.04	4.4	14.7	2.5	-1.1	0.01
	4:30pm	30.02	4.5	15.3	2.5	-1	0
6/7	7:30am	30.06	4.2	15.6	3.1	-1.9	0
	10:30am	30.08	4.1	15.3	3.2	-1.9	0.01
	1:30pm	30.1	4	15.2	3.2	-1.7	0.01
	4:30pm	30.1	3.9	15.5	3.3	-1.9	0

# MIGRATION WELL MGW1709X

MGW1711X	Time:	Bar. Press.	CH <sub>4</sub>	CO <sub>2</sub>	O <sub>2</sub>	SP	DP
6/3	7:30am	30.1	1	5.5	15.9	-2.2	0.01
	10:30am	30.1	1.1	5.5	15.8	-1.9	0.01
	1:30pm	30.1	1	5.4	15.9	-1.4	0.01
	4:30pm	30.1	0.9	5.2	15.6	-0.9	0
6/4	7:30am	30.11	1.1	5.3	15.9	-1.7	0
	10:30am	30.11	1.2	5	16	-1.6	0.01
	1:30pm	30.1	1.1	5	15.9	-1	0
	4:30pm	30.08	0.8	4.9	15.8	-0.8	0
6/5	7:30am	30.06	1	5.5	15.9	-1.4	0.01
	10:30am	30.07	0.9	5.3	15.8	-1.5	0.01
	1:30pm	30.08	0.9	5	15.7	-1.3	0.01
	4:30pm	30.06	0.9	5.3	15.7	-1	0
6/6	7:30am	30.06	0.6	5.3	15.9	-1.3	0
	10:30am	30.06	0.6	5	16.2	-1.2	0
	1:30pm	30.04	0.7	4.9	16.1	-1	0
	4:30pm	30.02	0.6	5.1	16.1	-0.9	0
6/7	7:30am	30.06	0.9	5.6	16	-1.6	0.01
	10:30am	30.08	0.8	5.5	16	-1.7	0
	1:30pm	30.1	0.7	5.3	15.7	-1.5	0.01
	4:30pm	30.1	0.8	5.4	15.8	-1.6	0

# MIGRATION WELL MGW1709X

MGPW1708	Time:	Bar. Press.	CH <sub>4</sub>	CO <sub>2</sub>	O <sub>2</sub>	SP
6/3	7:30am	30.1	0	0.3	20.6	-2.4
	10:30am	30.1	0	0.2	20.8	-2
	1:30pm	30.1	0	0.2	20.6	-1.4
	4:30pm	30.1	0	0.2	20.4	-1
6/4	7:30am	30.11	0	0	20.8	-1.69
	10:30am	30.11	0	0	20.9	-1.55
	1:30pm	30.1	0	0	20.6	-1.11
	4:30pm	30.08	0	0	20.7	-0.8
6/5	7:30am	30.06	0	0.2	20.6	-1.51
	10:30am	30.07	0	0.2	20.5	-1.64
	1:30pm	30.08	0	0.1	20.4	-1.45
	4:30pm	30.06	0	0.2	20.4	-1.02
6/6	7:30am	30.06	0	0	20.8	-1.27
	10:30am	30.06	0	0	20.8	-1.22
	1:30pm	30.04	0	0	20.6	-1
	4:30pm	30.02	0	0	20.8	-0.95
6/7	7:30am	30.06	0	0.3	20.7	-1.72
	10:30am	30.08	0	0.2	20.8	-1.8
	1:30pm	30.1	0	0.2	20.6	-1.62
	4:30pm	30.1	0	0.2	20.6	-1.71

# MIGRATION WELL MGW1709X

MGPW1710S	Time:	Bar. Press.	CH <sub>4</sub>	CO <sub>2</sub>	O <sub>2</sub>	SP
6/3	7:30am	30.1	0	0.3	20.6	-1.6
	10:30am	30.1	0	0.1	20.8	-1.4
	1:30pm	30.1	0	0.1	20.8	-1
	4:30pm	30.1	0	0.2	20.5	-0.7
6/4	7:30am	30.11	0	0	20.8	-1.14
	10:30am	30.11	0	0	20.9	-1.08
	1:30pm	30.1	0	0	20.8	-0.8
	4:30pm	30.08	0	0	20.7	-0.56
6/5	7:30am	30.06	0	0.2	20.6	-1.05
	10:30am	30.07	0	0.1	20.5	-1.12
	1:30pm	30.08	0	0.1	20.4	-1
	4:30pm	30.06	0	0.1	20.4	-0.73
6/6	7:30am	30.06	0	0	20.8	-0.89
	10:30am	30.06	0	0	20.9	-0.87
	1:30pm	30.04	0	0	20.6	-0.72
	4:30pm	30.02	0	0.1	20.6	-0.71
6/7	7:30am	30.06	0	0.2	20.7	-1.2
	10:30am	30.08	0	0.2	20.6	-1.27
	1:30pm	30.1	0	0.1	20.5	-1.15
	4:30pm	30.1	0	0.2	20.6	-1.16

# MIGRATION WELL MGW1709X

MGPW1710D	Time:	Bar. Press.	CH <sub>4</sub>	CO <sub>2</sub>	O <sub>2</sub>	SP
6/3	7:30am	30.1	0	0.2	20.8	-2.2
	10:30am	30.1	0	0.1	20.9	-1.9
	1:30pm	30.1	0	0.1	20.8	-1.4
	4:30pm	30.1	0	0.1	20.6	-1
6/4	7:30am	30.11	0	0	20.8	-1.65
	10:30am	30.11	0	0	20.9	-1.5
	1:30pm	30.1	0	0	20.7	-1.1
	4:30pm	30.08	0	0	20.7	-0.77
6/5	7:30am	30.06	0	0.1	20.6	-1.47
	10:30am	30.07	0	0.1	20.5	-1.56
	1:30pm	30.08	0	0.1	20.4	-1.36
	4:30pm	30.06	0	0.1	20.4	-0.98
6/6	7:30am	30.06	0	0	20.8	-1.26
	10:30am	30.06	0	0	20.9	-1.22
	1:30pm	30.04	0	0	20.6	-1.01
	4:30pm	30.02	0	0	20.8	-0.98
6/7	7:30am	30.6	0	0.2	20.8	-1.66
	10:30am	30.08	0	0.1	20.9	-1.76
	1:30pm	30.1	0	0.1	20.6	-1.55
	4:30pm	30.1	0	0.1	20.6	-1.6

# MIGRATION WELL MGW1709X

GP 33C

Time:	Bar. Press.	CH <sub>4</sub>	CO <sub>2</sub>	O <sub>2</sub>	SP
7:30am	30.1	0	0.2	20.7	-1.4
10:30am	30.1	0	0.3	20.6	-1.2
1:30pm	30.1	0	0.1	20.9	-0.8
4:30pm	30.1	0	0.1	20.5	-0.4
7:30am	30.11	0	0	21	-0.93
10:30am	30.11	0	0	20.8	-0.83
1:30pm	30.1	0	0	20.4	-0.53
4:30pm	30.08	0	0	20.5	-0.28
7:30am	30.06	0	0.1	20.6	-0.98
10:30am	30.07	0	0.1	20.6	-1.04
1:30pm	30.08	0	0.1	20.4	-0.88
4:30pm	30.06	0	0.1	20.2	-0.53
7:30am	30.06	0	0	20.9	-0.8
10:30am	30.06	0	0	20.7	-0.64
1:30pm	30.04	0	0	20.2	-0.47
4:30pm	30.02	0	0	20.7	-0.52
7:30am	30.06	0	0.2	20.8	-1.12
10:30am	30.08	0	0.1	20.8	-1.15
1:30pm	30.1	0	0.1	20.4	-0.99
4:30pm	30.1	0	0.2	20.5	-1.04



# MIGRATION WELL MGW1711X

5/27/13 thru 5/31/13

MGW1711X - valve wide open

MGW1709X - valve 1/2 turn open

MGW1716X - valve 1/2 turn open

MGW1711X	Time:	Bar. Press.	CH <sub>4</sub>	CO <sub>2</sub>	O <sub>2</sub>	SP	DP
5/27	7:30am	29.89	1	5.8	15.8	-14.7	1.85
	10:30am	29.8	0.9	5.8	15.6	-14.3	1.97
	1:30pm						
	4:30pm						
5/28	7:30am	29.89	1.1	6.2	15.2	-16.7	1.98
	10:30am	29.89	0.9	6.1	15.3	-16.6	2.01
	1:30pm	29.9	0.9	6	15.2	-16.6	1.96
	4:30pm	29.9	0.9	6	15.2	-16.4	1.98
5/29	7:30am	29.76	1.2	6.1	15.1	-15.4	2.06
	10:30am	29.78	1.2	6.1	14.9	-15.9	1.96
	1:30pm	29.82	1.1	5.9	14.9	-16.6	1.95
	4:30pm	29.88	1.2	6	14.9	-17.1	1.9
5/30	7:30am	30.05	1.4	6.3	14.9	-17.9	1.96
	10:30am	30.09	1.4	6.3	14.7	-17.6	1.91
	1:30pm	30.1	1.4	6.1	14.9	-17.8	1.95
	4:30pm	30.1	1.4	6.1	14.7	-17.6	1.94
5/31	7:30am	30.28	1.8	6	14.7	-17.8	1.83
	10:30am	30.29	1.7	6.1	14.6	-17.5	1.94
	1:30pm	30.29	1.7	5.7	14.6	-17.1	1.94
	4:30pm	30.28	1.9	5.7	14.8	-16.8	1.89

# MIGRATION WELL MGW1711X

MGW1709X	Time:	Bar. Press.	CH <sub>4</sub>	CO <sub>2</sub>	O <sub>2</sub>	SP	DP
5/27	7:30am	29.89	2.3	10.5	11.2	-1	0.02
	10:30am	29.8	2.2	10.5	10.6	-0.7	0
	1:30pm						
	4:30pm						
5/28	7:30am	29.89	4.7	11.8	7.1	-3	0
	10:30am	29.89	4.7	11.6	6.9	-3	0
	1:30pm	29.9	5.2	12.1	6.4	-2.9	0.01
	4:30pm	29.9	5.5	12.5	6.4	-2.7	0.02
5/29	7:30am	29.76	4.5	12.5	7.3	-1.5	0.03
	10:30am	29.78	4.7	12.6	6.8	-2	0.02
	1:30pm	29.82	5.6	12.7	5.8	-3	0.02
	4:30pm	29.88	6.3	13.2	5	-3.6	0.01
5/30	7:30am	30.05	8.4	15.5	3.4	-4.3	0.01
	10:30am	30.09	8	15.5	3.3	-4.3	0.01
	1:30pm	30.1	7.8	15.4	3.4	-4.3	0.01
	4:30pm	30.1	7.7	15.8	3.3	-4.2	0.01
5/31	7:30am	30.28	7.4	15.3	2.8	-4.5	0.01
	10:30am	30.29	7.3	15.5	2.8	-4.2	0
	1:30pm	30.29	7.2	15.1	2.8	-3.7	0
	4:30pm	30.28	6.8	14.7	3	-3.4	0.01

# MIGRATION WELL MGW1711X

MGW1716X	Time:	Bar. Press.	CH <sub>4</sub>	CO <sub>2</sub>	O <sub>2</sub>	SP	DP
5/27	7:30am	29.89	0.1	4.4	17.8	-0.1	0.03
	10:30am	29.8	0.1	4.4	17.5	0.1	0.01
	1:30pm						
	4:30pm						
5/28	7:30am	29.89	0.3	4.4	18	-1.8	0
	10:30am	29.89	0	4	18.1	-1.8	0
	1:30pm	29.9	0	4	18	-1.8	0.02
	4:30pm	29.9	0	3.9	18.1	-1.5	0.02
5/29	7:30am	29.76	0.1	4	18	-0.6	0.01
	10:30am	29.78	0.1	3.9	18	-1.1	0.01
	1:30pm	29.82	0	3.7	18.1	-2	0.01
	4:30pm	29.88	0	3.6	18.2	-2.4	0.01
5/30	7:30am	30.05	0	3.9	18.5	-3	0.02
	10:30am	30.09	0	3.8	18.4	-2.9	0.02
	1:30pm	30.1	0	3.7	18.4	-3	0.01
	4:30pm	30.1	0	3.7	18.3	-2.9	0.02
5/31	7:30am	30.28	0	3.4	18.4	-3.1	0.02
	10:30am	30.29	0	3.4	18.2	-2.9	0.02
	1:30pm	30.29	0	3.2	18.1	-2.5	0.03
	4:30pm	30.28	0	3.2	18.2	-2.1	0.02

# MIGRATION WELL MGW1711X

MGPW1710S	Time:	Bar. Press.	CH <sub>4</sub>	CO <sub>2</sub>	O <sub>2</sub>	SP
5/27	7:30am	29.89	0	0.1	20.9	-0.1
	10:30am	29.8	0	0.2	20.6	0
	1:30pm					
	4:30pm					
5/28	7:30am	29.89	0	0.3	20.8	-1.4
	10:30am	29.89	0	0.2	20.8	-1.6
	1:30pm	29.9	0	0.2	20.8	-1.5
	4:30pm	29.9	0	0.3	20.7	-1.3
5/29	7:30am	29.76	0	0.2	20.9	-0.51
	10:30am	29.78	0	0.1	20.7	-0.89
	1:30pm	29.82	0	0.1	20.6	-1.67
	4:30pm	29.88	0	0.1	20.7	-2.02
5/30	7:30am	30.05	0	0.4	20.9	-2.2
	10:30am	30.09	0	0.2	20.7	-2.4
	1:30pm	30.1	0	0.1	21	-2.5
	4:30pm	30.1	0	0.2	20.6	-2.3
5/31	7:30am	30.28	0	0.2	20.7	-2.62
	10:30am	30.29	0	0	20.9	-2.41
	1:30pm	30.29	0	0	20.8	-2.03
	4:30pm	30.28	0	0	20.8	-1.85

# MIGRATION WELL MGW1711X

MGPW1710D	Time:	Bar. Press.	CH <sub>4</sub>	CO <sub>2</sub>	O <sub>2</sub>	SP
5/27	7:30am	29.89	0	0.1	21	-0.1
	10:30am	29.8	0	0.1	20.8	0.1
	1:30pm					
	4:30pm					
5/28	7:30am	29.89	0	0.2	21	-2
	10:30am	29.89	0	0.1	21	-2.1
	1:30pm	29.9	0	0.1	20.8	-2.1
	4:30pm	29.9	0	0.1	20.8	-1.8
5/29	7:30am	29.76	0	0.1	20.9	-0.66
	10:30am	29.78	0	0.1	20.7	-1.21
	1:30pm	29.82	0	0.1	20.7	-2.27
	4:30pm	29.88	0	0.1	20.8	-2.75
5/30	7:30am	30.05	0	0.2	21	-3.4
	10:30am	30.09	0	0.1	20.8	-3.4
	1:30pm	30.1	0	0.1	21	-3.4
	4:30pm	30.1	0	0.1	20.8	-3.2
5/31	7:30am	30.28	0	0	20.8	-3.6
	10:30am	30.29	0	0	20.8	-3.33
	1:30pm	30.29	0	0	20.7	-2.79
	4:30pm	30.28	0	0	20.8	-2.55

# MIGRATION WELL MGW1711X

MGPW1714	Time:	Bar. Press.	CH <sub>4</sub>	CO <sub>2</sub>	O <sub>2</sub>	SP
5/27	7:30am	29.89	0	0.1	21	0
	10:30am	29.8	0	0.1	20.8	0.2
	1:30pm					
	4:30pm					
5/28	7:30am	29.89	0	0.1	21	-1.8
	10:30am	29.89	0	0.1	21	-1.9
	1:30pm	29.9	0	0.1	20.8	-1.8
	4:30pm	29.9	0	0.2	20.7	-1.5
5/29	7:30am	29.76	0	0.1	20.9	-0.51
	10:30am	29.78	0	0.1	20.7	-1.07
	1:30pm	29.82	0	0.1	20.7	-2.04
	4:30pm	29.88	0	0.1	20.8	-2.49
5/30	7:30am	30.05	0	0.2	21	-3.1
	10:30am	30.09	0	0.2	20.9	-3
	1:30pm	30.1	0	0.1	20.9	-3.1
	4:30pm	30.1	0	0.1	20.9	-3
5/31	7:30am	30.28	0	0	20.9	-3.27
	10:30am	30.29	0	0	20.8	-3.03
	1:30pm	30.29	0	0	20.8	-2.46
	4:30pm	30.28	0	0	20.7	-2.24

# MIGRATION WELL MGW1711X

GP 33C

Time:	Bar. Press.	CH <sub>4</sub>	CO <sub>2</sub>	O <sub>2</sub>	SP
7:30am	29.89	0	0.2	11.4	0.2
10:30am	29.8	0	2.1	10.8	0.6
1:30pm					
4:30pm					
7:30am	29.89	0	2.2	11	-1.5
10:30am	29.89	0	2.1	11.2	-1.5
1:30pm	29.9	0	2.1	11.5	-1.5
4:30pm	29.9	0	2.1	11.4	-1.2
7:30am	29.76	0	2.1	10.4	-0.27
10:30am	29.78	0	2	10.5	-0.85
1:30pm	29.82	0	1.9	10.8	-1.74
4:30pm	29.88	0	2	11	-2.19
7:30am	30.05	0	2.6	9.8	-2.8
10:30am	30.09	0	2.7	9.4	-2.7
1:30pm	30.1	0	2.5	10.9	-2.8
4:30pm	30.1	0	2.4	11.8	-2.7
7:30am	30.28	0	2.7	9.7	-2.82
10:30am	30.29	0	2.5	11.5	-2.57
1:30pm	30.29	0	0	20.8	-1.72
4:30pm	30.28	0	0	20.8	-1.39



# MIGRATION WELL MGW1716X

6/17/13 thru 6/21/13

MGW1716X - valve wide open

MGW1711X - valve 1/2 turn open

MGW1720X - valve 1/2 turn open

MGW1716X	Time:	Bar. Press.	CH <sub>4</sub>	CO <sub>2</sub>	O <sub>2</sub>	SP	DP
6/17	7:30am	30.06	0.3	4.9	16.9	-14.8	1.34
	10:30am	30.05	0.2	4.7	17	-14.6	1.37
	1:30pm	30	0.1	4.4	16.9	-13.7	1.32
	4:30pm	29.97	0.1	4.1	16.9	-13.1	1.33
6/18	7:30am	29.99	0.6	4.5	17.1	-14.8	1.53
	10:30am	29.98	0.5	4.4	16.8	-14.4	1.36
	1:30pm	29.97	0.4	4	16.6	-14.1	1.34
	4:30pm	29.93	0.5	4	16.9	-13.7	1.28
6/19	7:30am	29.96	0.7	4.7	16.7	-14.9	1.27
	10:30am	29.96	0.7	4.5	16.6	-14.7	1.42
	1:30pm	29.96	0.6	4.4	16.4	-14.7	1.31
	4:30pm	29.97	0.6	4.3	16.5	-14.8	1.38
6/20	7:30am	30	0.8	4.7	16.4	-14.8	1.28
	10:30am	29.99	0.8	4.7	16.6	-13.1	1.23
	1:30pm	29.99	0.7	4.6	16.3	-12.9	1.16
	4:30pm	30.03	0.7	4.6	16.3	-13.5	1.26
6/21	7:30am	30.12	0.8	4.8	16.6	-13.7	1.18
	10:30am	30.13	0.7	4.6	16.6	-13.5	1.25
	1:30pm	30.14	0.6	4.4	16.5	-13.5	1.24
	4:30pm	30.14	0.6	4.4	16.5	-13.4	1.13

# MIGRATION WELL MGW1716X

MGW1711X	Time:	Bar. Press.	CH <sub>4</sub>	CO <sub>2</sub>	O <sub>2</sub>	SP	DP
6/17	7:30am	30.06	1	6.2	15.3	-2	0.04
	10:30am	30.05	0.8	5.8	15.3	-1.7	0.02
	1:30pm	30	0.8	5.5	15.3	-1.2	0.02
	4:30pm	29.97	0.8	5.2	15.3	-0.8	0.02
6/18	7:30am	29.99	1.9	5.8	15.2	-1.7	0.01
	10:30am	29.98	1.5	5.5	14.9	-1.5	0
	1:30pm	29.97	1.7	5.3	14.5	-1.1	0.02
	4:30pm	29.93	1.4	5.1	14.8	-0.9	0
6/19	7:30am	29.96	2.4	6.2	14.2	-1.7	0.01
	10:30am	29.96	2.1	5.7	14.2	-1.6	0.01
	1:30pm	29.96	2.1	5.6	14.1	-2	0.01
	4:30pm	29.97	2.1	5.5	14.1	-2	0.01
6/20	7:30am	30	2.5	5.8	13.9	-1.6	0.01
	10:30am	29.99	2.6	5.8	14	-1.5	0.01
	1:30pm	29.99	2.6	5.8	13.8	-1.7	0.01
	4:30pm	30.03	2.7	5.8	13.7	-2.3	0.01
6/21	7:30am	30.12	3.6	6	13.6	-2.4	0.01
	10:30am	30.13	3.5	5.8	13.5	-2.4	0.01
	1:30pm	30.14	3.5	5.6	13.5	-2.2	0.01
	4:30pm	30.14	3.5	5.5	13.5	-2	0.01

# MIGRATION WELL MGW1716X

MGW1720X	Time:	Bar. Press.	CH <sub>4</sub>	CO <sub>2</sub>	O <sub>2</sub>	SP	DP
6/17	7:30am	30.06	0	2	18.6	-1.1	0
	10:30am	30.05	0	1.9	18.6	-1	0.02
	1:30pm	30	0	1.7	18.5	-0.6	0.02
	4:30pm	29.97	0	1.7	18.6	-0.2	0.02
6/18	7:30am	29.99	0	1.8	18.8	-0.9	0.01
	10:30am	29.98	0	1.8	18.7	-0.9	0
	1:30pm	29.97	0	1.6	18.5	-0.6	0
	4:30pm	29.93	0	1.6	18.9	-0.5	0.01
6/19	7:30am	29.96	0	1.9	18.7	-1.1	0.01
	10:30am	29.96	0	1.8	18.6	-1	0.01
	1:30pm	29.96	0	1.7	18.4	-1.4	0.01
	4:30pm	29.97	0	1.7	18.6	-1.3	0.01
6/20	7:30am	30	0.1	2	18.4	-1	0
	10:30am	29.99	0.1	2	18.8	-0.9	0.01
	1:30pm	29.99	0	1.8	18.4	-1.1	0.01
	4:30pm	30.03	0	1.8	18.5	-1.6	0.01
6/21	7:30am	30.12	0.1	2	18.7	-1.7	0.01
	10:30am	30.13	0	1.7	18.8	-1.7	0.01
	1:30pm	30.14	0	1.7	18.5	-1.5	0.01
	4:30pm	30.14	0	1.7	18.6	-1.3	0.01

# MIGRATION WELL MGW1716X

MGPW1714	Time:	Bar. Press.	CH <sub>4</sub>	CO <sub>2</sub>	O <sub>2</sub>	SP
6/17	7:30am	30.06	0	0.1	20.6	-1.71
	10:30am	30.05	0	0.1	20.6	-1.52
	1:30pm	30	0	0.1	20.5	-1.03
	4:30pm	29.97	0	0.1	20.6	-0.6
6/18	7:30am	29.99	0	0	20.9	-1.52
	10:30am	29.98	0	0	20.8	-1.28
	1:30pm	29.97	0	0	20.4	-1.06
	4:30pm	29.93	0	0	20.8	-0.82
6/19	7:30am	29.96	0	0.2	20.7	-1.61
	10:30am	29.96	0	0.1	20.6	-1.52
	1:30pm	29.96	0	0.1	20.6	-1.56
	4:30pm	29.97	0	0.1	20.6	-1.83
6/20	7:30am	30	0	0.2	20.5	-1.5
	10:30am	29.99	0	0.2	20.8	-1.42
	1:30pm	29.99	0	0.1	20.5	-1.63
	4:30pm	30.03	0	0.1	20.4	-2.17
6/21	7:30am	30.12	0	0.2	20.8	-2.35
	10:30am	30.13	0	0.1	20.8	-2.32
	1:30pm	30.14	0	0.1	20.6	-2.11
	4:30pm	30.14	0	0.1	20.6	-1.92

# MIGRATION WELL MGW1716X

GP 30B

	Time:	Bar. Press.	CH <sub>4</sub>	CO <sub>2</sub>	O <sub>2</sub>	SP
6/17	7:30am	30.06	0	0.3	20.6	-0.48
	10:30am	30.05	0	0.4	20.2	-0.34
	1:30pm	30	0	0.4	19.7	0.07
	4:30pm	29.97	0	0.5	19.8	0.33
6/18	7:30am	29.99	0	0.8	19.7	-0.46
	10:30am	29.98	0	0.6	20.1	-0.21
	1:30pm	29.97	0	0.6	19.8	-0.07
	4:30pm	29.93	0	0.7	19.7	0.11
6/19	7:30am	29.96	0	0.4	20.5	-0.55
	10:30am	29.96	0	0.5	20	-0.43
	1:30pm	29.96	0	0.5	19.5	-0.47
	4:30pm	29.97	0	0.6	19.6	-0.7
6/20	7:30am	30	0	0.3	20.4	-0.34
	10:30am	29.99	0	0.4	20.4	-0.32
	1:30pm	29.99	0	0.5	20	-0.53
	4:30pm	30.03	0	0.3	20.2	-0.98
6/21	7:30am	30.12	0	0.8	19.9	-1.05
	10:30am	30.13	0	0.3	20.5	-0.97
	1:30pm	30.14	0	0.2	20.6	-0.72
	4:30pm	30.14	0	0.2	20.4	-0.68

# MIGRATION WELL MGW1716X

GP 33C

	Time:	Bar. Press.	CH <sub>4</sub>	CO <sub>2</sub>	O <sub>2</sub>	SP
6/17	7:30am	30.06	0	0.1	20.8	-1.26
	10:30am	30.05	0	0.1	20.7	-1.02
	1:30pm	30	0	0	20.3	-0.55
	4:30pm	29.97	0	0	20.7	-0.25
6/18	7:30am	29.99	0	0	20.9	-0.98
	10:30am	29.98	0	0	20.9	-0.69
	1:30pm	29.97	0	0	20.7	-0.53
	4:30pm	29.93	0	0	20.8	-0.36
6/19	7:30am	29.96	0	0.1	20.9	-1.08
	10:30am	29.96	0	0.1	20.7	-0.99
	1:30pm	29.96	0	0.1	20.5	-0.99
	4:30pm	29.97	0	0	20.6	-1.29
6/20	7:30am	30	0	0.1	20.7	-1.08
	10:30am	29.99	0	0.1	20.9	-1
	1:30pm	29.99	0	0.1	20.6	-1.15
	4:30pm	30.03	0	0.1	20.4	-1.41
6/21	7:30am	30.12	0	0.1	21	-1.84
	10:30am	30.13	0	0.1	20.8	-1.76
	1:30pm	30.14	0	0.1	20.6	-1.56
	4:30pm	30.14	0	0.1	20.7	-1.36

# MIGRATION WELL MGW1720X

5/27/13 thru 5/31/13

MGW1720X - valve wide open

MGW1716X - valve 1/2 turn open

MGW1723X - valve 1/2 turn open

MGW1720X	Time:	Bar. Press.	CH <sub>4</sub>	CO <sub>2</sub>	O <sub>2</sub>	SP	DP
7/1	7:30am	29.98	0	1.7	18.6	-9	1.56
	10:30am	29.97	0	1.6	18.5	-9	1.55
	1:30pm	29.98	0	1.5	18.1	-9.3	1.55
	4:30pm	29.99	0	1.6	18.5	-9.2	1.49
7/2	7:30am	30.08	0	2	19	-10.6	1.92
	10:30am	30.08	0	1.8	18.9	-10.2	1.91
	1:30pm	30.1	0	1.8	18.7	-10	1.72
	4:30pm	30.1	0	1.8	18.6	-9.9	1.74
7/3	7:30am	30.12	0	2	18.6	-10.4	1.68
	10:30am	30.12	0	1.7	18.6	-10.1	1.64
	1:30pm	30.11	0	1.7	18.7	-9.6	1.53
	4:30pm	30.09	0	1.6	18.6	-9.2	1.67
7/4	7:30am	30.1	0.1	2	18.9	-10.2	1.73
	10:30am	30.12	0	1.8	18.9	-10.1	1.76
	1:30pm	30.12	0	1.8	18.9	-9.9	1.78
	4:30pm	30.1	0	1.7	19	-9.4	1.67
7/5	7:30am	30.04	0.1	1.9	19	-9.7	1.72
	10:30am	30.04	0	1.8	18.9	-9.6	1.77
	1:30pm	30.03	0	1.8	18.1	-9.5	1.67
	4:30pm	30.02	0	1.8	19.1	-9.3	1.68

# MIGRATION WELL MGW1720X

MGW1716X	Time:	Bar. Press.	CH <sub>4</sub>	CO <sub>2</sub>	O <sub>2</sub>	SP	DP
7/1	7:30am	29.98	0.5	4.5	16.1	-1.5	0.01
	10:30am	29.97	0.7	3.9	15.6	-1	0.02
	1:30pm	29.98	0.1	3.7	15.7	-1.4	0.01
	4:30pm	29.99	0	3.6	16.1	-1.4	0
7/2	7:30am	30.08	0.2	4	16.5	-2.3	0.02
	10:30am	30.08	0	3.6	16.4	-1.9	0.01
	1:30pm	30.1	0	3.3	16.6	-2	0
	4:30pm	30.1	0	3.1	16.9	-1.7	0
7/3	7:30am	30.12	0.2	3.7	16.5	-2	0.02
	10:30am	30.11	0.2	3.3	16.5	-1.8	0.03
	1:30pm	30.11	0.2	3.1	16.7	-1.4	0.03
	4:30pm	30.09	0.2	3.2	16.4	-0.9	0.03
7/4	7:30am	30.1	0.4	3.7	16.6	-1.8	0.01
	10:30am	30.12	0.3	3.5	16.6	-1.8	0.01
	1:30pm	30.12	0.2	3.5	16.6	-1.7	0.01
	4:30pm	30.1	0.2	3.3	16.6	-1.1	0
7/5	7:30am	30.04	0.4	3.6	16.6	-1.2	0.01
	10:30am	30.04	0.2	3.4	16.5	-1.2	0
	1:30pm	30.03	0.2	3.4	16.4	-1.1	0.01
	4:30pm	30.02	0.2	3.4	16.5	-0.9	0.01

# MIGRATION WELL MGW1720X

MGW1723X	Time:	Bar. Press.	CH <sub>4</sub>	CO <sub>2</sub>	O <sub>2</sub>	SP	DP
7/1	7:30am	29.98	0	1.2	19.3	-1	0.01
	10:30am	29.97	0	2	16.4	-0.6	0.01
	1:30pm	29.98	0	1.9	16.3	-1	0
	4:30pm	29.99	0	1.8	16.6	-1	0.01
7/2	7:30am	30.08	0	1.9	18.6	-1.7	0.01
	10:30am	30.08	0	1.8	18.3	-1.4	0.01
	1:30pm	30.1	0	1.9	17.9	-1.4	0
	4:30pm	30.1	0	2	17.6	-1.2	0
7/3	7:30am	30.12	0	2.2	18.2	-1.5	0
	10:30am	30.12	0	1.8	17.8	-1.3	0
	1:30pm	30.11	0	2	17.5	-1	0
	4:30pm	30.09	0	2.2	16.8	-0.6	0
7/4	7:30am	30.1	0.1	2.2	17.9	-1.3	0.01
	10:30am	30.12	0	2	18.2	-1.4	0.01
	1:30pm	30.12	0	2.1	17.9	-1.2	0.01
	4:30pm	30.1	0	2.2	17.4	-0.7	0
7/5	7:30am	30.04	0.1	2.5	17.6	-0.9	0
	10:30am	30.04	0	2.4	17.6	-0.8	0
	1:30pm	30.03	0	2.4	17.3	-0.8	0.01
	4:30pm	30.02	0	2.5	17.4	-0.5	0.01

# MIGRATION WELL MGW1720X

MGPW1714	Time:	Bar. Press.	CH <sub>4</sub>	CO <sub>2</sub>	O <sub>2</sub>	SP
7/1	7:30am	29.98	0	0	20.7	-1.7
	10:30am	29.97	0	0	20.4	-1.28
	1:30pm	29.98	0	0	20.1	-1.59
	4:30pm	29.99	0	0	20.2	-1.61
7/2	7:30am	30.08	0	0.3	20.7	-2.6
	10:30am	30.08	0	0.1	20.7	-2.2
	1:30pm	30.1	0	0.1	20.7	-2.3
	4:30pm	30.1	0	0	20.6	-1.9
7/3	7:30am	30.12	0	0	20.7	-2.33
	10:30am	30.12	0	0	20.4	-2.08
	1:30pm	30.11	0	0	20.6	-1.69
	4:30pm	30.09	0	0	20.5	-1.22
7/4	7:30am	30.1	0	0.2	21	-2.1
	10:30am	30.12	0	0.1	20.9	-2.12
	1:30pm	30.12	0	0.1	20.9	-1.95
	4:30pm	30.1	0	0.1	21	-1.39
7/5	7:30am	30.04	0	0.1	21	-1.57
	10:30am	30.04	0	0.1	20.8	-1.47
	1:30pm	30.04	0	0.1	20.8	-1.36
	4:30pm	30.02	0	0.1	20.8	-1.08

# MIGRATION WELL MGW1720X

GP 30B

Time:	Bar. Press.	CH <sub>4</sub>	CO <sub>2</sub>	O <sub>2</sub>	SP
7:30am	29.98	0	1.1	18.9	-0.74
10:30am	29.97	0	1	18.6	-0.32
1:30pm	29.98	0	1	18.2	-0.6
4:30pm	29.99	0	1	18.5	-0.66
7:30am	30.08	0	1.3	19.2	-1.2
10:30am	30.08	0	1.2	19	-0.8
1:30pm	30.1	0	1.1	19	-1
4:30pm	30.1	0	1.2	18.7	-0.6
7:30am	30.12	0	1.3	19	-1.01
10:30am	30.12	0	0.5	19.7	-0.76
1:30pm	30.11	0	0.4	20	-0.46
4:30pm	30.09	0	0.4	19.8	-0.12
7:30am	30.1	0	1.1	19.6	-0.87
10:30am	30.12	0	1.1	19.5	-0.86
1:30pm	30.12	0	1.1	19.5	-0.69
4:30pm	30.1	0	1	19.5	-0.26
7:30am	30.04	0	1.2	19.4	-0.49
10:30am	30.04	0	1.2	19.3	-0.45
1:30pm	30.03	0	1.2	19.2	-0.35
4:30pm	30.02	0	1.2	19.2	-0.11

# MIGRATION WELL MGW1720X

GP 33C

Time:	Bar. Press.	CH <sub>4</sub>	CO <sub>2</sub>	O <sub>2</sub>	SP
7:30am	29.98	0	0.1	20.7	-1.31
10:30am	29.97	0	0	20.5	-0.87
1:30pm	29.98	0	0	20	-1.08
4:30pm	29.99	0	0.1	20.3	-1.19
7:30am	30.08	0	0.1	21	-1.6
10:30am	30.08	0	0	20.7	-1.4
1:30pm	30.1	0	0	20.7	-1.4
4:30pm	30.1	0	0	20.5	-1.2
7:30am	30.12	0	0	20.8	-1.39
10:30am	30.12	0	0	20.4	-1.47
1:30pm	30.11	0	0	20.5	-1.08
4:30pm	30.09	0	0	20.4	-0.71
7:30am	30.1	0	0.2	21	-1.47
10:30am	30.12	0	0.1	20.9	-1.49
1:30pm	30.12	0	0.1	20.8	-1.32
4:30pm	30.1	0	0.1	20.9	-0.92
7:30am	30.04	0	0.2	21	-1
10:30am	30.04	0	0.1	20.8	-0.98
1:30pm	30.03	0	0.1	20.8	-0.85
4:30pm	30.02	0	0.1	20.8	-0.63