# AP - 111

# SWMUs No. 1 (Aeration Basin) & GMW-1

# WORK PLAN

August 2018

Marathon Petroleum Company LP

## EXECUTIVE SUMMARY

The Annual Groundwater Monitoring Report for 2017 (Report) incorporates field monitoring, sampling, and inspection of active wells located on the facility. Analytical data and field notes are incorporated into this report to show any changes or discoveries of various constituents found in the groundwater collected for sampling. On February 15, 2012, Groundwater Discharge Permit GW-032 was rescinded by the Oil Conservation Division (OCD) of New Mexico. We are; however, required to continue to abate pollution of groundwater pursuant to 19.15.30 NMAC (Remediation) under case number AP-111 with remediation activities already in place under Groundwater Discharge Permit GW-032. Monitoring and field work activities conducted for 2017 followed the guidelines of the "Approval with Modifications, Annual Facility-Wide Ground Water Monitoring Report: Gallup Refinery 2013, HWB-WRG-14-006", dated May 18, 2016 from New Mexico Environmental Department Hazard Waste Bureau (NMED HWB). New monitoring wells (BW-4A, BW-4B, BW-5A, BW-5B, BW-5C, OW-53, OW-54, OW-55, OW-56, OW-57, OW-58, OW-59, and OW-60) were installed in 2016 and 2017 and have been added to the most recent Facility-Wide Ground Water Monitoring Work Plan. Although the wells were not yet included in an approved Monitoring Work Plan in 2017, groundwater samples were collected at these wells and the results are presented in the subsequent investigation reports and are also included in this Annual Monitoring Report. The well completion logs are included in Appendix H.

### GROUNDWATER MONITORING

There are 100 monitoring wells located throughout the refinery property that are subject to the ground water monitoring program. The groundwater program consists of a number of sampling locations, target analyses, and monitoring frequencies that include quarterly, semi-annual, and annual. A brief analytical summary is included below while a more detailed summary is discussed in Section 7. In addition to the monitoring wells, there are three leak detection units (LDUs) at the new API Separator (NAPIS). The monitoring wells and LDUs have been grouped as follows:

| GROUP A | GROUP B | GROUP C | GROUP D | GROUP E |
|---|---|---|---|---|
| BW-1A, 1B, 1C | GWM-1, 2, 3 | OW-13, 14, 29, 30 | PW-2, 3, 4 | MKTF-1 thru |
| BW-2A, 2B, 2C | NAPIS-1, 2, 3, KA-3 | OW-50, 52, 53, 54, | OW-1, 10 | MKTF-45 |
| BW-3A, 3B, 3C | OAPIS-1 | OW-55, 56, 57, 58 | OW-11, 12 | |
| BW-4A, 4B | East LDU, West LDU, Oil Sump LDU | RW-1, 2, 5, 6 | | |
| BW-5A, 5B, 5C | STP1-NW, STP1-SW | | | |
| MW-1, 2, 4, 5 | OW-59, 60 | | | |
| SMW-2, 4 | | | | |

## GROUP A - WELLS

There are a total of 14 boundary wells located on the western and northwestern boundary of the refinery property.

- No benzene, toluene, ethylbenzene, or total xylenes (BTEX) or methyl tert butyl ether (MTBE) constituents have been detected in any of the boundary wells, with the exception of MTBE in samples collected from BW-5B and BW-5C and toluene in BW-5B. Low concentrations of toluene and MTBE were detected in samples collected from BW-5B in December 2017. MTBE was detected in the sample collected from BW-5C in December 2017.
- Chloride exceeded the standard in BW-5C. Uranium exceed the standard in samples collected at BW-5B and BW-5C.

There are a total of six wells that monitor the groundwater in the area of the land treatment unit (LTU).

- No BTEX or MTBE have been detected in any of the MW wells in 2017.
- No concentrations of BTEX or MTBE were detected in any of the SMW wells, with the exception of SMW-2 which has had low concentrations of MTBE below the applicable standard.
- In SMW-2, chloride and sulfate were detected above the WQCC standards since 2011. Low concentrations of fluoride, chloride and sulfate have been detected in SMW-4. DRO and GRO were detected in SWM-2 above screening levels.
- Low concentrations of metals (total and dissolved) have been detected in both wells. Chromium and uranium were detected in both wells above the WQCC standards in 2017. Manganese was detected in SMW-2 above the WQCC standard in 2017.

## GROUP B - WELLS

There are 12 monitoring wells and three leak detection units (LDUs) in Group B.

### GWM-1, GWM-2, and GWM-3

- No samples have been collected from GWM-1 since the third quarter 2015 due to the detection of separate phase hydrocarbon (SPH).
- No groundwater was present in GWM-2 and GWM-3 in 2017.

### NAPIS-1, NAPIS-2, NAPIS-3, and KA-3

- BTEX and MTBE concentrations were below the applicable standards in the first and second quarters of 2017 in NAPIS-1. Separate phase hydrocarbon was detected in NAPIS-1 in the third and fourth quarters. Benzene and MTBE concentrations in NAPIS-2 have frequently exceeded the applicable standards since 2008 and remained in exceedance or slightly below exceedance level for 2017. BTEX constituents were not detected in NAPIS-3 in 2017. MTBE was detected in all four quarters of 2017 in NAPIS-3, however, none of the concentrations were above the standard. In KA-3, the benzene concentration was detected above the applicable standard in the first quarter of 2017.
- DRO was detected above applicable standards in NAPIS-2 (all four quarters), NAPIS-3 (first quarter), and KA-3 (fourth quarter). Detections of GRO above the applicable standard occurred in NAPIS-1 (third quarter), NAPIS-2 (all four quarters), NAPIS-3 (second and fourth quarter) and KA-3 (all four quarters). MRO has not been detected in any of the NAPIS or KA wells.
- Barium, iron and manganese were detected in NAPIS-2 at concentration levels exceeding the applicable standards in 2017.
- Uranium was detected in 2017 in NAPIS-3 at concentration levels exceeding the WQCC standards.

- Manganese was detected in all four quarters of 2017 above the applicable standard in KA-3.
- Bis (2-ethyhexyl) phthalate was detected in concentrations that exceeding the applicable standards in NAPIS-1, NAPIS-2, NAPIS-3, and KA-3 in 2017. Naphthalene was detected in NAPIS-2 during all four quarters. The concentrations exceed the applicable standard.

## East LDU, West LDU, and Oil Sump LDU

- No water has been detected in the Oil Sump LDU since June 2013.
- Benzene (all four quarters) and total xylenes (third quarter) were detected in the East LDU at concentration levels above the applicable standard. Low concentrations of toluene, ethyl benzene, total xylenes and MTBE were also detected. DRO and GRO were also detected above the applicable standards in all four quarters of 2017.
- In the West LDU, benzene exceeded applicable standards in all four quarters of 2017. Toluene, ethyl benzene, total xylenes, and MTBE were also detected at concentration levels below the applicable standards. DRO and GRO were also detected above the applicable standards in all four quarters of 2017.
- In 2017, chromium, iron, and manganese have been detected in concentrations exceeding applicable standards in both the East and West LDUs.
- Concentrations of the organic constituents 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene have exceeded applicable standards in both the East and West LDUs in 2017.

## OAPIS-1

- Benzene and MTBE have exceeded the applicable standards since 2013.
- Concentrations of fluoride, chloride, DRO and GRO have shown exceedances in OAPIS-1 since 2013.
- Arsenic, barium, iron, manganese and uranium concentrations exceeded applicable standards in OAPIS-1 in 2017.
- The reported concentrations of naphthalene, 1-methylnaphthalene and bis (2-ethylhexyl) phthalate exceeded applicable standards in 2017.

## STP1-NW, STP1-SW, OW-59, and OW-60

- STP1-SW remained dry in 2017.
- There were no detections of BTEX, MTBE, DRO, GRO, or MRO above applicable standards in 2017 in STP-1 NW.
- DRO and GRO was detected in the fourth quarter of 2017 in OW-59 above the applicable standards. GRO was detected below the applicable standard in OW-60.
- Sulfate and chloride concentrations exceeded the applicable standards in OW-59 and OW-60, with nitrate/nitrite exceeded in water samples collected from OW-60.
- Chloride, iron, manganese, and uranium exceeded applicable standards in STP-1-NW in 2017.
- The constituent uranium was reported to have total and dissolved concentrations that exceeded the applicable standard for OW-59 and OW-60 for the fourth quarter of 2017. The dissolved arsenic concentrations reported for the fourth quarter for OW-59 and OW-60 exceeded the applicable standard.
- The concentration of Bis (2-ethylhexyl) phthalate in OW-60 exceeded the applicable standard.

## GROUP C WELLS

Group C wells include 12 observation wells and four recovery wells.

### OW-13, OW-14, OW-29, and OW-30

- No detectable concentrations of BTEX were reported in 2017 for OW-13. Low concentrations of MTBE continue to be detected at values below the applicable standard.
- The 2017 benzene and MTBE concentrations for OW-14 were above the applicable standard for all four quarters.
- No detectable concentrations of BTEX were reported in 2017 for OW-29. The MTBE concentrations were above the applicable standard for all four quarters.
- In OW-30, benzene was reported above the applicable standard in the fourth quarter. MTBE concentrations were reported above the applicable standard in all four quarters of 2017.
- DRO was detected above the applicable standard in OW-14, OW-29, and OW-30.
- GRO was detected above the applicable standard in all four wells in all four quarters of 2017.

### OW-50, and OW-52

- BTEX, DRO, GRO, and MRO constituents have not been detected in either OW-50 or OW-52 since 2010 through 2016; however, a low concentration of MTBE was detected in both wells in 2016 and 2017 annual groundwater sampling events.
- Low concentrations of total and dissolved arsenic, barium, iron, lead, manganese, selenium, mercury and zinc have been detected in OW-50 and OW-52 in 2017.

### OW-54, OW-55, and OW-56

- In OW-54, benzene and MTBE concentrations exceeded the applicable standards during all four quarters, but toluene, ethylbenzene and total xylenes were detected at concentrations below the applicable standards. In OW-55, benzene, toluene, ethyl benzene, total xylenes and MTBE exceed applicable standards in 2017. There were no detectable concentrations of benzene and MTBE in samples collected at OW-56 that exceeded the applicable standards in 2017.
- DRO and GRO were detected above the applicable standards in all three wells in all quarters of 2017.
- Chloride concentrations for OW-54, OW-55, and OW-56 exceeded the applicable standard during all four quarters of 2017
- Iron, lead, and manganese concentrations exceeded the applicable standards in OW-54 and OW-55, while uranium only exceeded the standard in samples collected at OW-54.
- Reportable concentrations of naphthalene, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, 1-methylnaphthalene, and 1,2-dichloroethane exceeded the applicable standards in either OW-54, OW-55, and/or OW-56 in 2017.

### OW-57 and OW-58

- BTEX and MTBE was detected in both wells in 2017. Benzene concentrations exceeded the applicable standard in both OW-57 and OW-58. Toluene, ethylbenzene and total xylenes concentrations exceeded the applicable standard in OW-58. MTBE concentrations exceeded the applicable standard in OW-57 and in OW-58.
- DRO and GRO concentrations exceeded the applicable standards in both OW-57 and OW-58 in 2017.
- Barium, iron, and manganese concentrations exceeded the applicable standards in OW-57 and OW-58. Arsenic exceeded the standard in OW-57 and lead exceeded the standard in OW-58.

- Reportable concentrations of naphthalene, 1,2,4-trimethylbenzene, and 1-methylnaphthalene exceeded the applicable standards in OW-57 and/or OW-58 in 2017.

### RW-1, RW-2, RW-5, and RW-6

- No samples were collected from RW-1 in 2017 due to the presence of SPH. No samples were collected from RW-5 and RW-6 during the second, third and fourth quarters of 2017 due to the detection of SPH in the wells;
- BTEX and MTBE concentrations exceeded applicable standards in RW-2 in 2017. Benzene exceeded the applicable standard in RW-5 and benzene and total xylenes concentrations exceeded applicable standards in RW-6. Concentrations of toluene, total xylenes and ethyl benzene were detected in RW-5 and RW-6, which did not exceed applicable standards.
- Volatile organic compounds were detected in RW-2, RW-5 and RW-6 in the groundwater samples collected in 2017. 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, naphthalene, 1-methylnaphthalene and 2-methylnaphthalene were detected in concentrations exceeding the applicable standards.

## GROUP D WELLS

The Group D wells can be found within the refinery property and include three process/production (i.e., water supply) wells and four observation wells.

### PW-2, PW-3, and PW-4

- No BTEX or MTBE constituents were detected in the process wells in 2017.
- Low concentrations of arsenic, barium, iron, manganese, selenium, and zinc were detected in the wells in 2017 at concentration levels below applicable standards.
- Two organic constituents were detected at levels below applicable standards in 2017 (bis (2-ethylhexyl) phthalate and di-n-octylphthalate).

### OW-1, OW-10, OW-11, and OW-12

- BTEX was not detected in OW-1 and OW-10 in 2017. MTBE was detected in low concentrations below the applicable standard in both wells in 2017.
- Low concentrations of cations were detected in OW-1 throughout 2017 at concentration levels below the applicable standard. OW-10 had exceedances of chloride in all of 2017.
- GRO was detected in the fourth quarter in OW-1 and the second, third and fourth quarters of 2017 in OW-10. DRO and MRO was not detected in OW-1 and OW-10 in 2017.
- The 2017 metals analysis for OW-1 and OW-10 reported exceedances above the applicable standards for chromium, lead and uranium.
- BTEX and MTBE have not been detected in OW-11 and OW-12 since 2006 and remained non-detect for 2017.
- Fluoride, nitrite, and sulfate concentrations continue to exceed the applicable standards in OW-11.

treatment pond (STP1) in May 2014. Two new monitoring wells (OW-59 and OW-60) were installed in June 2017. Observation wells OW-59 and OW-60 were installed upgradient of SMW-2 and downgradient of the Aeration Basin to assess chlorides, which have been detected in the area.

### 6.2.1 GROUNDWATER MONITORING WELLS: GWM-1, GWM-2, and GWM-3

The GWM series of wells are all screened in the Chinle/Alluvium Interface stratigraphic unit. GWM-1 and GWM-2 are located on the west side of the aeration basin straddling the dike that separates AL-2 and EP-1. Downgradient from GWM-1 and GWM-2 is GWM-3 located on the northwest corner of EP-1. These wells are inspected and groundwater samples collected on a quarterly basis if sufficient water is present to support sample collection. No groundwater has been detected in GWM-2 or GWM-3 since 2013. If water is detected, NMED and OCD are notified within 24 hours of discovery. In the fourth quarter of 2015, an SPH level was detected in GWM-1 for the first time. SPH was found to be present in GMW-1 during all four quarterly gauging events in 2017 and thus no groundwater samples were collected for chemical analysis.

Quarterly inspections of the GMW wells were completed on the following dates:

| WELL ID | QTR 1 | QTR 2 | QTR 3 | QTR 4 |
|---|---|---|---|---|
| **GWM-1** | 3/16/17 | 6/2/17 | 9/8/17 | 12/4/17 |
| **GWM-2** | 3/16/17 | 6/2/17 | 9/8/17 | 12/4/17 |
| **GWM-3** | 3/16/17 | 6/2/17 | 9/8/17 | 12/4/17 |

### 6.2.2 GROUNDWATER MONITORING WELLS: NAPIS-1, NAPIS-2, NAPIS-3, and KA-3

The NAPIS groundwater monitoring wells are located east of the aeration lagoons. NAPIS-1 is an upgradient well located on the southeast side of the API separator. The NAPIS-2 monitoring well is located near the southwest corner of the API separator, and NAPIS-3 is located in the northwest corner. KA-3 is located between NAPIS-2 and NAPIS-3 on the west side of the API separator. These wells are screened in the Chinle/Alluvium Interface stratigraphic unit with three of the wells (NAPIS-2, NAPIS-3, and KA-3) installed with flush mount surface completions.

The NAPIS and KA wells are sampled on a quarterly basis. In agreement with OCD and approved by NMED, the third quarter sampling is combined with the annual sampling event. Groundwater samples were analyzed for the following parameters: VOCs, SVOCs, major cations/anions, and WQCC total and dissolved metals.

- 1-Methylnaphthalene – All four quarters; and
- Bis (2-ethylhexyl) phthalate – First, second, and fourth quarters.

### 6.2.5 STP1-NW, STP1-SW, OW-59, and OW-60

Monitoring well STP1-NW is located on the west end of the north bay (STP-1) and STP1-SW is located on the southwest corner of the south bay of STP-1. Observation wells OW-59 and OW-60, which were installed in June 2017, are located to the northwest. Ground water samples were analyzed for the following analytes: VOCs, SVOCs, DRO, GRO, MRO, major cations/anions, WQCC total and dissolved metals.

The wells were inspected and groundwater samples collected on the dates listed below in 2017. STP1-SW was found to be dry on each inspection, thus no groundwater samples were collected at STP1-SW.

| WELL ID | QTR 1 | QTR 2 | QTR 3 | QTR 4 |
|---|---|---|---|---|
| **STP1-NW** | 2/21/17 | 6/2/17 | 9/5/17 | 12/4/17 |
| **STP1-SW** | 2/21/17<br>NS | 6/2/17<br>NS | 9/5/17<br>NS | 12/4/17<br>NS |
| **OW-59** | NI | NI | 9/5/17<br>NS | 12/6/17 |
| **OW-60** | NI | NI | 9/5/17<br>NS | 12/6/17 |

NS – Well was not sampled. NI – Well not installed.

- There were no BTEX constituents detected in 2017 in STP1-NW, OW-59, and OW-60 (Table 8.14).
- Low concentrations of MTBE were detected in 2017 in STP1-NW, OW-59, and OW-60.
- There were no DRO, GRO, or MRO constituents detected in 2017 in STP1-NW. DRO and GRO was detected in the fourth quarter of 2017 in OW-59 above the applicable standards. GRO was detected below the applicable standard in OW-60.
- Chloride was detected above the applicable standard of 250 mg/L in all four quarters of 2017 in samples collected from STP1-NW and samples collected in the fourth quarter from OW-59 and OW-60.
- Nitrites and nitrates were detected at concentrations above the applicable standards in all four quarters of 2017 in STP1-NW and the fourth quarter in OW-60.
- Sulfate concentrations exceeded the applicable standard in OW-59 and OW-60.
- Low concentrations of total and dissolved metals were reported during all four quarters of 2017 (Tables 8.14.1 and 8.14.2). The constituent uranium was reported to have total and dissolved concentrations that exceeded the applicable standard for OW-59 and OW-60 for the fourth quarter of 2017. The dissolved arsenic concentrations reported for the fourth quarter for OW-59 and OW-60 exceeded the applicable standard.
- Low concentrations of 1-methynaphthalene and acetone were reported for 2017. The concentration of Bis (2-ethylhexyl) phthalate in OW-60 exceeded the applicable standard (Table 8.14.3).

The installation on July 17, 2012 of monitoring well OAPIS-1 is from a site investigation conducted according to the Investigation Work Plan Solid Waste Management Unit (SMWU) No. 1 Aeration Basin and SMWU No. 14 Old API Separator.

- No significant deviations from past analytical at OAPIS-1.

***RECOMMENDATION:*** *Continue with current inspection schedule.*

Monitor wells OW-59 and OW-60 were installed downgradient of STP1-NW. The installation of these wells is in response to elevated chlorides detected downgradient in SWM-2.

- There were no BTEX constituents detected in 2017 in STP1-NW, OW-59, and OW-60.
- Low concentrations of MTBE were detected in 2017 in STP1-NW, OW-59, and OW-60.
- Chloride was detected above the applicable standard of 250 mg/L in all four quarters of 2017.

***RECOMMENDATION:*** *Continue with current inspection schedule at STP1 wells. Wells OW-59 and OW-60 were added to the monitoring plan in March 2018.*

## 7.3 GROUP C – GROUNDWATER MONITORING

Groundwater monitoring activities from the Group C wells (northeast side of the Refinery) have shown that an MTBE and hydrocarbon plume exists in the northeastern portion of the main tank farm and extends downgradient to the north towards OW-50 and OW-52 and to the west near OW-54.

- Although concentration levels of MTBE in OW-13, which is screened in the deeper Sonsela aquifer, do not exceed the applicable standard of 0.143 mg/L, sample data indicates a steady increase of MTBE from year to year. No detectable concentrations of BTEX were reported in 2017 for OW-13.
- The 2017 benzene and MTBE concentrations for OW-14 were above the applicable standard of 0.005 mg/L and 0.143 mg/L for all four quarters. There were detectable concentrations of toluene, ethyl benzene, and total xylene.
- No detectable concentrations of BTEX were reported in 2017 for OW-29. The MTBE concentrations were above the applicable standard of 0.143 mg/L for all four quarters;
- In OW-30, the benzene concentration was reported above the applicable standard in the fourth quarter. MTBE concentrations were reported above the applicable standard in all four quarters of 2017. No detectable concentrations of toluene, ethyl benzene, and total xylenes were reported in 2017 for OW-30.
- An investigation work plan was initiated concerning OW-14 contaminant plume migration. Additional soil borings and wells were installed in the tank farm area and results are being evaluated. A new work plan was also recently submitted to replace OW-13 and evaluate for potential well completion concerns.
- BTEX, DRO, GRO, and MRO constituents have not been detected in either OW-50 or OW-52 since 2010 through 2016, however, a low concentration of MTBE was detected in both wells in 2016 and 2017 annual groundwater sampling events.
- In OW-54, benzene and MTBE concentrations exceeded the applicable standards during all four quarters. Toluene, ethylbenzene and total xylenes were detected at concentrations below the applicable standard.

# SECTION 8 DATA TABLES

8.1 BW-1A/B/C, BW-2A/B/C, BW-3A/B/C, BW-4A/4B, BW-5A/B/C

8.2 MW-1, MW-2, MW-4, MW-5

8.3 SMW-2, SMW-4

8.4 OW-11, OW-12

8.5 OW-50, OW-52

8.6 PW-2, PW-3, PW-4

8.7 GWM-1, GWM-2, GWM-3

8.8 NAPIS-1, NAPIS-2, NAPIS-3, KA-3

8.9 OAPIS-1

8.10 LEAK DETECTION UNITS (East LDU, West LDU, Oil Sump LDU)

8.11 RW-1, RW-2, RW-5, RW-6

8.12 OW-1, OW-10

8.13 OW-13, OW-14, OW-29, OW-30, OW-54, OW-55, OW-56, OW-57, OW-58

8.14 STP1-NW, STP1-SW, OW-59, OW-60

8.15 EVAPORATION PONDS EP-1 – EP-12B

8.16 STP-1 to EP-2

8-17 MKTF-1 thru MKTF-45

COMPLETE DATA TABLES ON ATTACHED CD.

## 8.14 STP1-NW, OW-59, OW-60
### BTEX, MTBE, General Chemistry and DRO/GRO/MRO Analytical Result Summary

| STANDARDS | | | PARAMETERS | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Benzene (mg/L) | Toluene (mg/L) | Ethyl Benzene (mg/L) | Total Xylenes (mg/L) | MTBE (mg/L) | Fluoride (mg/L) | Chloride (mg/L) | Nitrite (mg/L) | Nitrate (mg/L) | Sulfate (mg/L) |
| WQCC 20NMAC 6.2.3103 | | | 0.01 | **0.75** | 0.75 | **0.62** | NE | **1.6** | **250** | NE | **10** | **600** |
| 40 CFR 141.62 MCL | | | **0.005** | 1 | **0.7** | 10 | NE | 4.0 | NE | **1** | 10 | NE |
| NMED Tap Water (MARCH 2017) | | | 0.00455 | 1.09 | 0.0149 | 0.193 | **0.143** | 1.18 | NE | 1.97 | 31.59 | NE |
| EPA RSL for Tap Water (MAY 2018) | | | 0.00046 | 0.11 | 0.0015 | 0.19 | 0.014 | 0.8 | NE | 2 | 3.2 | NE |
| NMED SSG (MARCH 2017) | | | NE | NE | NE | NE | NE | NE | NE | NE | NE | NE |
| **Well ID** | **DATE SAMPLED** | **METHOD** | | | | | | | | | | |
| STP1-NW | 12/04/17 | 8260B | <0.001 | <0.001 | <0.001 | <0.0015 | <0.001 | <0.5 | **2200** | **26** | **26** | 150 |
| | 09/05/17 | 8260B | <0.001 | <0.001 | <0.001 | <0.0015 | 0.00057 | <0.5 | **2300** | **25** | **25** | 160 |
| | 06/02/17 | 8260B | <0.001 | <0.001 | <0.001 | <0.0015 | 0.00043 | <0.1 | **2100** | **24** | **24** | 140 |
| | 02/21/17 | 8260B | <0.001 | <0.001 | <0.001 | <0.0015 | 0.00063 | <0.5 | **2000** | **24** | **24** | 140 |
| | 11/14/16 | 8260B | <0.001 | <0.001 | <0.001 | <0.0015 | 0.00036 | <0.5 | **2000** | <2.0 | **24** | 140 |
| | 09/09/16 | 8260B | <0.001 | <0.001 | <0.001 | <0.0015 | 0.0003 | <0.5 | **1800** | **26** | **26** | 150 |
| | 06/07/16 | 8260B | <0.001 | <0.001 | <0.001 | <0.0015 | 0.0006 | 0.058 | **2400** | **20** | **20** | 150 |
| | 03/02/16 | 8260B | <0.001 | <0.001 | <0.001 | <0.0015 | **0.47** | NA | NA | NA | NA | NA |
| | 10/29/15 | 8260B | <0.001 | <0.001 | <0.001 | <0.0015 | <0.001 | 0.26 | **2100** | **21** | **21** | 130 |
| | 08/11/15 | 8260B | <0.001 | <0.001 | <0.001 | <0.0015 | <0.001 | NA | NA | NA | NA | NA |
| | 06/02/15 | 8260B | <0.001 | <0.001 | <0.001 | <0.0015 | <0.001 | <0.5 | **2100** | **25** | **25** | 130 |
| | 03/10/15 | 8260B | <0.001 | <0.001 | <0.001 | <0.0015 | <0.001 | <0.1 | **2400** | **22** | **22** | 150 |
| | 11/18/14 | 8260B | <0.001 | <0.001 | <0.001 | <0.0015 | <0.001 | 0.29 | **1800** | <2.0 | **18** | 120 |
| | 09/17/14 | 8260B | <0.001 | <0.001 | <0.001 | <0.0015 | <0.001 | 0.26 | **1800** | <2.0 | **18** | 120 |
| | 06/16/14 | 8260B | <0.001 | <0.001 | <0.001 | <0.0015 | <0.001 | 0.85 | **1000** | **15** | **15** | 160 |
| OW-59 | 12/06/17 | 8260B | <0.001 | <0.001 | <0.001 | <0.0015 | 0.0094 | <0.5 | **1700** | <2 | <2 | **2600** |
| OW-60 | 12/06/17 | 8260B | <0.001 | <0.001 | <0.001 | <0.0015 | 0.00028 | 1.1 | **1700** | **14** | **14** | **780** |

**DEFINITIONS**

NE = Not established

NA = Not analyzed

Bold and highlighted values represent values above the applicable standards

**STANDARDS**

WQCC 20 NMAC 6.2.3103 - Standards for Ground Water of 10,000 mg/l TDS Concentration or Less.

a) Human Health Standards; b) Other Standards for Domestic Water

40 CFR 141.62 Detection Limits for Inorganic Contaminants

EPA Regional Screening Level (RSL) Summary Table

NMED Risk Assessment Guidance for Investigations and Remediations Table A-1

NMED Soil Screening Guidance Volume 1, Table 6-4 (groundwater), (March 2017)

**NOTES**

### 8.14.1 STP1-NW, OW-59, OW-60
### Total Metals Analytical Result Summary

| STANDARDS | | | PARAMETERS | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Arsenic (mg/L) | Barium (mg/L) | Cadmium (mg/L) | Chromium (mg/L) | Copper (mg/L) | Iron (mg/L) | Lead (mg/L) | Manganese (mg/L) | Selenium (mg/L) |
| WQCC 20NMAC 6.2.3103 | | | 0.1 | 1 | 0.01 | **0.05** | **1** | 1 | 0.05 | 0.2 | **0.05** |
| 40 CFR 141.62 MCL | | | **0.01** | **2** | **0.005** | 0.1 | 1.3 | NE | **0.015** | NE | 0.05 |
| NMED Tap Water (MARCH 2017) | | | 0.000855 | 3.28 | 0.00624 | 0.0057 | 0.7898 | **13.8** | NE | **2.02** | 0.0987 |
| EPA RSL for Tap Water (MAY 2018) | | | 0.000052 | 0.38 | 0.00092 | NE | 0.8 | 14 | 0.015 | 0.43 | 0.1 |
| **Well ID** | **DATE SAMPLED** | **METHOD** | | | | | | | | | |
| STP1-NW | 12/04/17 | 200.7/200.8 | <0.05 | 0.11 | <0.002 | <0.006 | <0.006 | 0.39 | <0.0025 | 0.011 | <0.05 |
| | 09/05/17 | 200.7/200.8 | 0.007 | 0.14 | <0.002 | 0.0038 | <0.006 | 1.9 | 0.0021 | 0.036 | 0.028 |
| | 06/02/17 | 200.7/200.8 | 0.0045 | 0.16 | <0.002 | 0.0027 | <0.006 | 3.1 | 0.0029 | 0.062 | 0.014 |
| | 02/21/17 | 200.7/200.8 | 0.0094 | 0.29 | <0.002 | 0.0042 | <0.006 | 3.1 | 0.0043 | 0.14 | 0.019 |
| | 11/14/16 | 200.7/200.8 | **0.011** | 0.24 | <0.002 | 0.0096 | 0.0049 | 11 | **0.016** | 0.31 | 0.021 |
| | 09/09/16 | 200.7/200.8 | 0.007 | 0.18 | <0.002 | <0.006 | <0.006 | 1.4 | 0.0013 | 0.029 | 0.025 |
| | 06/07/16 | 200.7/200.8 | <0.05 | 0.2 | <0.002 | <0.006 | <0.006 | 3 | 0.0031 | 0.056 | 0.021 |
| | 03/02/16 | 200.7/200.8 | <0.02 | 0.19 | <0.002 | 0.0028 | <0.006 | 3.6 | 0.0044 | 0.11 | 0.011 |
| | 10/29/15 | 200.7/200.8 | 0.0075 | 0.13 | <0.002 | <0.006 | <0.006 | 0.15 | 0.0055 | 0.032 | 0.019 |
| | 08/11/15 | 200.7/200.8 | <0.01 | 0.22 | <0.002 | <0.006 | <0.006 | 6.1 | 0.0068 | 0.11 | 0.018 |
| | 06/02/15 | 200.7/200.8 | <0.01 | 0.24 | <0.002 | 0.0066 | <0.006 | 3.2 | <0.005 | 0.095 | <0.02 |
| | 03/10/15 | 200.7/200.8 | <0.01 | 0.23 | <0.002 | <0.006 | <0.006 | 4.3 | <0.01 | 0.075 | 0.026 |
| | 11/18/14 | 200.7/200.8 | <0.01 | 0.13 | <0.002 | <0.006 | <0.006 | 0.15 | <0.001 | 0.032 | 0.024 |
| | 09/17/14 | 200.7/200.8 | <0.01 | 0.21 | <0.002 | 0.0092 | <0.006 | 6.5 | 0.0098 | 0.15 | 0.022 |
| | 06/16/14 | 200.7/200.8 | <0.01 | 0.11 | <0.002 | <0.006 | <0.006 | 0.42 | <0.01 | 0.055 | 0.028 |
| OW-59 | 12/06/17 | 200.7/200.8 | 0.0095 | 0.064 | <0.002 | <0.006 | 0.0042 | 2.1 | 0.0014 | 0.17 | <0.02 |
| OW-60 | 12/06/17 | 200.7/200.8 | <0.02 | 0.12 | <0.002 | 0.0033 | <0.006 | 3.1 | 0.002 | 0.13 | 0.021 |

**DEFINITIONS**

NE = Not established

NA = Not analyzed

Bold and highlighted values represent values above the applicable standards

**STANDARDS**

WQCC 20 NMAC 6.2.3103 - Standards for Ground Water of 10,000 mg/l TDS Concentration or Less.

a) Human Health Standards; b) Other Standards for Domestic Water

40 CFR 141.62 Detection Limits for Inorganic Contaminants

EPA Regional Screening Level (RSL) Summary Table

NMED Risk Assessment Guidance for Investigations and Remediations Table A-1

**NOTES**

## 8.14.2 STP1-NW, OW-59, OW-60
### Dissolved Metals Analytical Result Summary

| STANDARDS | | | PARAMETERS | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Arsenic (mg/L) | Barium (mg/L) | Cadmium (mg/L) | Chromium (mg/L) | Copper (mg/L) | Iron (mg/L) | Lead (mg/L) | Manganese (mg/L) | Selenium (mg/L) |
| WQCC 20NMAC 6.2.3103 | | | 0.1 | **1** | 0.01 | **0.05** | **1** | **1** | 0.05 | **0.2** | **0.05** |
| 40 CFR 141.62 MCL | | | **0.01** | 2 | **0.005** | 0.1 | 1.3 | NE | **0.015** | NE | 0.05 |
| NMED Tap Water (MARCH 2017) | | | 0.000855 | 3.28 | 0.00624 | 0.0057 | 0.7898 | 13.8 | NE | 2.02 | 0.0987 |
| EPA RSL for Tap Water (MAY 2018) | | | 0.000052 | 0.38 | 0.0092 | NE | 0.8 | 14 | 0.015 | 0.43 | 0.1 |
| **Well ID** | **DATE SAMPLED** | **METHOD** | | | | | | | | | |
| STP1-NW | 12/04/17 | 200.7/200.8 | 0.009 | 0.11 | <0.002 | <0.006 | <0.006 | 0.039 | <0.0005 | 0.00078 | 0.019 |
| | 09/05/17 | 200.7/200.8 | <0.05 | 0.11 | <0.002 | 0.0029 | <0.006 | 0.04 | <0.0025 | 0.0016 | 0.029 |
| | 06/02/17 | 200.7/200.8 | 0.0055 | 0.13 | <0.002 | <0.006 | <0.006 | 0.037 | <0.0005 | 0.00046 | 0.017 |
| | 02/21/17 | 200.7/200.8 | 0.0063 | 0.12 | <0.002 | <0.006 | <0.006 | 0.031 | <0.0025 | 0.00045 | 0.002 |
| | 11/14/16 | 200.7/200.8 | 0.0089 | 0.13 | <0.002 | <0.006 | <0.006 | 0.2 | 0.00039 | 0.0086 | 0.033 |
| | 09/09/16 | 200.7/200.8 | 0.0084 | 0.17 | <0.002 | <0.006 | <0.006 | 0.037 | <0.0005 | 0.00053 | 0.026 |
| | 06/07/16 | 200.7/200.8 | 0.0082 | 0.17 | <0.002 | <0.006 | <0.006 | 0.067 | <0.0025 | 0.0024 | 0.025 |
| | 03/02/16 | 200.7/200.8 | 0.005 | 0.14 | <0.002 | <0.006 | <0.006 | 0.13 | 0.0003 | 0.0038 | 0.015 |
| | 10/29/15 | 200.7/200.8 | <0.01 | 0.14 | <0.002 | <0.006 | <0.006 | 0.066 | <0.0025 | 0.0032 | 0.031 |
| | 08/11/15 | 200.7/200.8 | <0.01 | 0.13 | <0.002 | <0.006 | <0.006 | 0.12 | <0.0025 | 0.0039 | 0.018 |
| | 06/02/15 | 200.7/200.8 | <0.01 | 0.13 | <0.002 | <0.006 | <0.006 | 0.045 | <0.01 | <0.002 | 0.02 |
| | 03/10/15 | 200.7/200.8 | <0.05 | 0.18 | <0.002 | <0.006 | <0.006 | 0.091 | <0.001 | 0.0039 | <0.05 |
| | 11/18/14 | 200.7/200.8 | <0.01 | 0.12 | <0.002 | <0.006 | <0.006 | 0.026 | <0.001 | 0.028 | 0.023 |
| | 09/08/14 | 200.7/200.8 | <0.01 | 0.12 | <0.02 | <0.006 | <0.006 | 0.046 | <0.01 | 0.033 | 0.027 |
| OW-59 | 12/06/17 | 200.7/200.8 | **0.012** | 0.013 | <0.002 | <0.006 | <0.006 | 0.024 | <0.0025 | 0.13 | 0.023 |
| OW-60 | 12/06/17 | 200.7/200.8 | **0.013** | 0.029 | <0.002 | <0.006 | <0.006 | 0.02 | <0.0005 | 0.042 | 0.031 |

**DEFINITIONS**

NE = Not established
NA = Not analyzed
Bold and highlighted values represent values above the applicable standards

**STANDARDS**

WQCC 20 NMAC 6.2.3103 - Standards for Ground Water of 10,000 mg/l TDS Concentration or Less.
a) Human Health Standards; b) Other Standards for Domestic Water
40 CFR 141.62 Detection Limits for Inorganic Contaminants
EPA Regional Screening Level (RSL) Summary Table
NMED Risk Assessment Guidance for Investigations and Remediations Table A-1

**NOTES**

## 8.14.3 STP1-NW, OW-59, OW-60
### Semi-Volatile and Volatile Organic Compounds, Analytical Result Summary

| | | | PARAMETERS | | |
|---|---|---|---|---|---|
| STANDARDS | | | 1-Methylnaphthalene (mg/L) | Acetone (mg/L) | Bis(2-ethylhexyl) phthalate (mg/L) |
| WQCC 20NMAC 6.2.3103 | | | NE | NE | NE |
| 40 CFR 141.62 MCL | | | NE | NE | **0.006** |
| NMED Tap Water (MARCH 2017) | | | 0.0114 | **14.1** | 0.0556 |
| EPA RSL for Tap Water (MAY 2018) | | | **0.0011** | 14 | 0.0056 |
| **Well ID** | **DATE SAMPLED** | **METHOD** | | | |
| STP1-NW | 12/04/17 | 8260B | <0.004 | 0.0041 | NA |
| | 09/05/17 | 8260B | 0.00054 | 0.0058 | NA |
| | 06/02/17 | 8260B | <0.004 | 0.0031 | NA |
| | 02/21/17 | 8260B | <0.004 | <0.01 | NA |
| | 11/14/16 | 8260B | <0.004 | <0.01 | NA |
| | 09/09/16 | 8260B | <0.004 | 0.011 | NA |
| | 06/07/16 | 8260B | 0.00045 | <0.01 | NA |
| | 03/02/16 | 8260B | | 0.0038 | NA |
| | 06/02/15 | 8270C | | | <0.01 |
| | 03/10/15 | 8270C | | | <0.01 |
| | 11/18/14 | 8270C | | | 0.011 |
| OW-59 | 12/06/17 | 8260B | <0.004 | 0.0028 | <0.01 |
| OW-60 | 12/06/17 | 8260B | <0.004 | 0.0025 | **0.045** |

**DEFINITIONS**
NE = Not established
NA = Not analyzed
Bold and highlighted values represent values above the applicable standards

**STANDARDS**
WQCC 20 NMAC 6.2.3103 - Standards for Ground Water of 10,000 mg/l TDS Concentration or Less.
a) Human Health Standards; b) Other Standards for Domestic Water
40 CFR 141.62 Detection Limits for Inorganic Contaminants
EPA Regional Screening Level (RSL) Summary Table
NMED Risk Assessment Guidance for Investigations and Remediations Table A-1

**NOTES**

9.1
EASUREMENTS

| rvey [1] asing om ions ) | Total Well Depth (ft) | Depth to SPH (ft) | SPH [2] Column Thickness (ft) | Depth to Water (ft) | Ground water Elevation [3] (ft) | Corrected Water Table [4] Elevation (factor 0.8) (ft) | Screened Interval Depth Top to Bottom (ft) |
|---|---|---|---|---|---|---|---|
| S | 38.30 | ND | NA | 24.30 | NS | NA | 20 - 35 |
| S | 38.50 | ND | NA | 24.30 | NS | NA | 20 - 35 |
| S | 45.55 | ND | NA | 16.45 | NS | NA | 25 - 45 |
| S | 45.70 | ND | NA | 16.40 | NS | NA | 25 - 45 |
| S | 38.80 | ND | NA | DRY | NS | NA | 21 - 36 |
| S | 38.30 | ND | NA | DRY | NS | NA | 21 - 36 |
| S | 63.50 | ND | NA | 31.58 | NS | NA | 41 - 61 |
| S | 63.50 | ND | NA | 37.95 | NS | NA | 41 - 61 |
| S | 23.00 | ND | NA | DRY | NS | NA | 10 - 20 |
| S | 23.02 | ND | NA | DRY | NS | NA | 10 - 20 |
| S | 61.45 | ND | NA | 8.65 | NS | NA | 48 - 58 |
| S | 61.45 | ND | NA | 9.00 | NS | NA | 48 - 58 |
| S | 76.35 | ND | NA | 2.99 | NS | NA | 64.3-74.30 |
| S | 76.35 | ND | NA | 2.80 | NS | NA | 64.3-74.30 |

NM = Not Measured
ell is flushmount and located at or below ground level.
ater is at top of casing (full) under artesian flow conditions.

*and Recovery Wells", dated 9/26/12.*

*undwater Elevation)*
*vell bottom casing elevations. Resurveyed on 9/15/2014 by HEI (Hammon Enterprises Inc.).*
*016.*

## Section 10 - Table 1 Monitor Schedule for 2017

| Sampling Location ID | Frequency | Water Quality Parameters | General Monitoring and Sampling Comments. | Analytical Data Location |
|---|---|---|---|---|
| Any temporary pond containing fluid | SA | | General Chemistry to include Nitrate and Nitrite, VOCs, SVOCs, BOD, COD, E-Coli Bacteria, WQCC Metals | |
| BW-1A | A - Annual | pH, EC, DO, ORP, Temp, TDS | Major Cations/Anions, VOCs, WQCC Metals, DRO/GRO/DRO | Appendix G, Section 8.1 |
| BW-1B | A | pH, EC, DO, ORP, Temp, TDS | Same as BW-1A | Appendix G, Section 8.1 |
| BW-1C | A | pH, EC, DO, ORP, Temp, TDS | Same as BW-1A | Appendix G, Section 8.1 |
| BW-2A | A | pH, EC, DO, ORP, Temp, TDS | Same as BW-1A | Appendix G, Section 8.1 |
| BW-2B | A | pH, EC, DO, ORP, Temp, TDS | Same as BW-1A | Appendix G, Section 8.1 |
| BW-2C | A | pH, EC, DO, ORP, Temp, TDS | Same as BW-1A | Appendix G, Section 8.1 |
| BW-3A | A | pH, EC, DO, ORP, Temp, TDS | Same as BW-1A | Appendix G, Section 8.1 |
| BW-3B | A | pH, EC, DO, ORP, Temp, TDS | Same as BW-1A | Appendix G, Section 8.1 |
| BW-3C | A | pH, EC, DO, ORP, Temp, TDS | Same as BW-1A | Appendix G, Section 8.1 |
| MW-1 | Annual and every 10 years beginning 2009 per RCRA Post Closure Permit | pH, EC, DO, ORP, Temp, TDS | Major Cations/Anions, VOCs, SVOCs, GRO/DRO/MRO, WQCC Metals, Cyanide. For RCRA 10 year requirements: Gen Chem, Modified Skinner List Metals (total and dissolved) including mercury and cyanide, Modified Skinner List VOCs, SVOCs, TPH | Appendix G, Section 8.2 |
| MW-2 | Annual and every 10 years beginning 2009 per RCRA Post Closure Permit | pH, EC, DO, ORP, Temp, TDS | Same as MW-1 | Appendix G, Section 8.2 |
| MW-4 | Annual and every 10 years beginning 2009 per RCRA Post Closure Permit | pH, EC, DO, ORP, Temp, TDS | Same as MW-1 | Appendix G, Section 8.2 |
| MW-5 | Annual and every 10 years beginning 2009 per RCRA Post Closure Permit | pH, EC, DO, ORP, Temp, TDS | Same as MW-1 | Appendix G, Section 8.2 |
| OW-11 | A | pH, EC, DO, ORP, Temp, TDS | Major Cations/Anions, VOCs, WQCC Metals, GRO/DRO/MRO | Appendix G, Section 8.4 |
| OW-12 | A | pH, EC, DO, ORP, Temp, TDS | VOCs, WQCC Metals, GRO/DRO/MRO, General Chemistry | Appendix G, Section 8.4 |
| OW-50 [1] | A | pH, EC, DO, ORP, Temp, TDS | VOCs, WQCC Metals, GRO/DRO/MRO, General Chemistry, EDB | Appendix G, Section 8.5 |
| OW-52 [1] | A | pH, EC, DO, ORP, Temp, TDS | Same as OW-50 | Appendix G, Section 8.5 |
| SMW-2 | A | pH, EC, DO, ORP, Temp, TDS | Major Cations/Anions, VOCs, SVOCs, GRO/DRO/MRO, WQCC Metals, Cyanide. | Appendix G, Section 8.3 |
| SMW-4 | Annual and every 10 years beginning 2009 per RCRA Post Closure Permit | pH, EC, DO, ORP, Temp, TDS | Major Cations/Anions, VOCS, GRO/DRO/MRO, WQCC Metals, Cyanide. For RCRA 10 year requirements: Gen Chem, Modified Skinner List Metals (total and dissolved) including mercury and cyanide, Modified Skinner List VOC, SVOC, TPH | Appendix G, Section 8.3 |
| PW-2 | Every 3 years. Start 2008 | Last sampled 2017 | VOCs, SVOCs, WQCC Metals, Cyanide, Nitrates | Appendix G, Section 8.6 |
| PW-3 | A | | Same as PW-2 | Appendix G, Section 8.6 |
| PW-4 | SA | | Same as PW-2 | Appendix G, Section 8.6 |
| **NEW WELLS [4]** | | | | |
| OW-53 | Q | pH, EC, DO, ORP, Temp, TDS | VOCs, SVOCs, GRO/DRO/MRO, WQCC Metals, Major Cations/Anions Ground Water samples will not be collected if SPH is present in any of the wells. | Appendix G |
| OW-54 | Q | pH, EC, DO, ORP, Temp, TDS | Same as OW-53 | Appendix G |
| OW-55 | Q | pH, EC, DO, ORP, Temp, TDS | Same as OW-54 | Appendix G |
| OW-56 | Q | pH, EC, DO, ORP, Temp, TDS | Same as OW-55 | Appendix G |
| OW-57 | Q | pH, EC, DO, ORP, Temp, TDS | Same as OW-56 | Appendix G |
| OW-58 | Q | pH, EC, DO, ORP, Temp, TDS | Same as OW-57 | Appendix G |
| OW-59 | Q | pH, EC, DO, ORP, Temp, TDS | Same as OW-58 | Appendix G |
| OW-60 | Q | pH, EC, DO, ORP, Temp, TDS | Same as OW-59 | Appendix G |

**Summary of EPA/NMED/RCRA Activity**

January

- Submit annual RCRA Financial Assurance Cost Estimates to HWB.
- Completion of Investigation Report for SWMUs 4 and 5.
- NMED approval of revised Investigation Report for SWMUs 1 and 14

April

- Submission of Annual Facility-Wide Ground Water Monitoring Work Plan – updates for 2017

June

- Install additional boundary monitoring wells (BW-4A,BW-4B BW-5A, BW-5B, and BW-5C)
- Install new monitoring wells (OW-59 and OW-60) near SMW-2

September

- Approval of Class 3 Permit Modification
- Submission of 2016 Annual Facility-Wide Ground Water Monitoring Report

# Hall Environmental Analysis Laboratory, Inc.

**CLIENT:** Western Refining Southwest, Gallup
**Client Sample ID:** OW-59
**Project:** 4th QTR 2017 GW Sampling
**Collection Date:** 12/6/2017 8:40:00 AM
**Lab ID:** 1712649-002 **Matrix:** AQUEOUS **Received Date:** 12/8/2017 9:35:00 AM

| Analyses | Result | MDL | PQL | Qual | Units | DF | Date Analyzed | Batch ID |
|---|---|---|---|---|---|---|---|---|
| **EPA METHOD 8015M/D: DIESEL RANGE** | | | | | | | Analyst: **TOM** | |
| Diesel Range Organics (DRO) | 0.55 | 0.36 | 1.0 | J | mg/L | 1 | 12/14/2017 9:44:11 PM | 35490 |
| Motor Oil Range Organics (MRO) | ND | 5.0 | 5.0 | | mg/L | 1 | 12/14/2017 9:44:11 PM | 35490 |
| Surr: DNOP | 110 | 0 | 77.5-161 | | %Rec | 1 | 12/14/2017 9:44:11 PM | 35490 |
| **EPA METHOD 300.0: ANIONS** | | | | | | | Analyst: **CJS** | |
| Fluoride | ND | 0.22 | 0.50 | | mg/L | 5 | 12/18/2017 11:04:38 PM | R47878 |
| Chloride | 1700 | 50 | 100 | | mg/L | 200 | 12/26/2017 11:24:33 PM | R48030 |
| Bromide | 8.6 | 0.073 | 0.50 | | mg/L | 5 | 12/18/2017 11:04:38 PM | R47878 |
| Phosphorus, Orthophosphate (As P) | ND | 1.2 | 2.5 | H | mg/L | 5 | 12/18/2017 11:04:38 PM | R47878 |
| Sulfate | 2600 | 19 | 100 | | mg/L | 200 | 12/26/2017 11:24:33 PM | R48030 |
| Nitrate+Nitrite as N | ND | 0.26 | 2.0 | | mg/L | 10 | 12/26/2017 10:22:29 PM | R48030 |
| **EPA METHOD 200.7: DISSOLVED METALS** | | | | | | | Analyst: **pmf** | |
| Barium | 0.013 | 0.00099 | 0.0020 | | mg/L | 1 | 12/28/2017 9:04:22 PM | B48091 |
| Cadmium | ND | 0.0010 | 0.0020 | | mg/L | 1 | 12/28/2017 9:04:22 PM | B48091 |
| Calcium | 220 | 0.39 | 5.0 | | mg/L | 5 | 12/27/2017 7:14:09 PM | B48056 |
| Chromium | ND | 0.0013 | 0.0060 | | mg/L | 1 | 12/28/2017 9:04:22 PM | B48091 |
| Copper | ND | 0.0032 | 0.0060 | | mg/L | 1 | 12/28/2017 9:04:22 PM | B48091 |
| Iron | 0.024 | 0.016 | 0.020 | | mg/L | 1 | 12/28/2017 9:04:22 PM | B48091 |
| Magnesium | 68 | 0.25 | 1.0 | | mg/L | 1 | 12/27/2017 7:12:03 PM | B48056 |
| Manganese | 0.13 | 0.00039 | 0.0020 | * | mg/L | 1 | 12/28/2017 9:04:22 PM | B48091 |
| Potassium | 1.0 | 0.11 | 1.0 | J | mg/L | 1 | 12/27/2017 7:12:03 PM | B48056 |
| Silver | 0.0047 | 0.0018 | 0.0050 | J | mg/L | 1 | 12/28/2017 9:04:22 PM | B48091 |
| Sodium | 2500 | 8.2 | 50 | | mg/L | 50 | 12/28/2017 9:15:34 PM | B48091 |
| Zinc | 0.011 | 0.0021 | 0.010 | | mg/L | 1 | 12/28/2017 9:04:22 PM | B48091 |
| **EPA METHOD 200.7: TOTAL METALS** | | | | | | | Analyst: **JLF** | |
| Barium | 0.064 | 0.0010 | 0.0020 | | mg/L | 1 | 12/21/2017 7:16:34 PM | 35610 |
| Cadmium | ND | 0.00058 | 0.0020 | | mg/L | 1 | 12/28/2017 2:54:13 PM | 35610 |
| Chromium | ND | 0.0018 | 0.0060 | | mg/L | 1 | 12/27/2017 4:22:58 PM | 35610 |
| Copper | 0.0042 | 0.0041 | 0.0060 | J | mg/L | 1 | 12/21/2017 7:16:34 PM | 35610 |
| Iron | 2.1 | 0.051 | 0.10 | * | mg/L | 5 | 12/27/2017 4:24:48 PM | 35610 |
| Manganese | 0.17 | 0.0011 | 0.0020 | * | mg/L | 1 | 12/27/2017 4:22:58 PM | 35610 |
| Silver | 0.0037 | 0.0012 | 0.0050 | J | mg/L | 1 | 12/28/2017 2:54:13 PM | 35610 |
| Zinc | 0.0041 | 0.0033 | 0.010 | J | mg/L | 1 | 12/27/2017 4:22:58 PM | 35610 |
| **EPA 200.8: DISSOLVED METALS** | | | | | | | Analyst: **JLF** | |
| Arsenic | 0.012 | 0.0042 | 0.010 | * | mg/L | 10 | 12/30/2017 2:06:12 PM | B48118 |
| Lead | ND | 0.00087 | 0.0025 | | mg/L | 5 | 12/28/2017 11:49:03 PM | B48088 |
| Selenium | 0.023 | 0.0076 | 0.010 | | mg/L | 10 | 12/30/2017 2:06:12 PM | B48118 |
| Uranium | 0.14 | 0.0048 | 0.025 | * | mg/L | 50 | 12/28/2017 11:55:37 PM | B48088 |

Refer to the QC Summary report and sample login checklist for flagged QC data and preservation information.

**Qualifiers:**

| | | | |
|---|---|---|---|
| * | Value exceeds Maximum Contaminant Level. | B | Analyte detected in the associated Method Blank |
| D | Sample Diluted Due to Matrix | E | Value above quantitation range |
| H | Holding times for preparation or analysis exceeded | J | Analyte detected below quantitation limits |
| ND | Not Detected at the Reporting Limit | P | Sample pH Not In Range |
| PQL | Practical Quanitative Limit | RL | Reporting Detection Limit |
| S | % Recovery outside of range due to dilution or matrix | W | Sample container temperature is out of limit as specified |

# Hall Environmental Analysis Laboratory, Inc.

**CLIENT:** Western Refining Southwest, Gallup
**Client Sample ID:** OW-59
**Project:** 4th QTR 2017 GW Sampling
**Collection Date:** 12/6/2017 8:40:00 AM
**Lab ID:** 1712649-002
**Matrix:** AQUEOUS
**Received Date:** 12/8/2017 9:35:00 AM

| Analyses | Result | MDL | PQL | Qual | Units | DF | Date Analyzed | Batch ID |
|---|---|---|---|---|---|---|---|---|
| **200.8 ICPMS METALS:TOTAL** | | | | | | | Analyst: **DBK** | |
| Arsenic | 0.0095 | 0.0021 | 0.0050 | | mg/L | 5 | 1/8/2018 8:09:54 PM | 35610 |
| Lead | 0.0014 | 0.0011 | 0.0025 | J | mg/L | 5 | 1/8/2018 8:09:54 PM | 35610 |
| Selenium | ND | 0.020 | 0.020 | | mg/L | 20 | 1/11/2018 4:41:48 PM | 35610 |
| Uranium | 0.17 | 0.0031 | 0.010 | * | mg/L | 20 | 1/11/2018 4:41:48 PM | 35610 |
| **EPA METHOD 245.1: MERCURY** | | | | | | | Analyst: **MED** | |
| Mercury | ND | 0.000037 | 0.00020 | | mg/L | 1 | 12/21/2017 1:28:20 PM | 35651 |
| **EPA METHOD 8270C: SEMIVOLATILES** | | | | | | | Analyst: **DAM** | |
| Acenaphthene | ND | 3.6 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| Acenaphthylene | ND | 3.5 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| Aniline | ND | 3.1 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| Anthracene | ND | 3.5 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| Azobenzene | ND | 4.5 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| Benz(a)anthracene | ND | 3.9 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| Benzo(a)pyrene | ND | 4.0 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| Benzo(b)fluoranthene | ND | 4.0 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| Benzo(g,h,i)perylene | ND | 4.0 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| Benzo(k)fluoranthene | ND | 4.4 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| Benzoic acid | 4.5 | 3.9 | 20 | J | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| Benzyl alcohol | ND | 4.6 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| Bis(2-chloroethoxy)methane | ND | 4.3 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| Bis(2-chloroethyl)ether | ND | 4.3 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| Bis(2-chloroisopropyl)ether | ND | 3.9 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| Bis(2-ethylhexyl)phthalate | ND | 4.8 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| 4-Bromophenyl phenyl ether | ND | 4.6 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| Butyl benzyl phthalate | ND | 4.6 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| Carbazole | ND | 4.6 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| 4-Chloro-3-methylphenol | ND | 6.3 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| 4-Chloroaniline | ND | 3.5 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| 2-Chloronaphthalene | ND | 3.7 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| 2-Chlorophenol | ND | 7.5 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| 4-Chlorophenyl phenyl ether | ND | 3.6 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| Chrysene | ND | 3.8 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| Di-n-butyl phthalate | ND | 5.0 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| Di-n-octyl phthalate | ND | 4.7 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| Dibenz(a,h)anthracene | ND | 4.6 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| Dibenzofuran | ND | 4.1 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| 1,2-Dichlorobenzene | ND | 2.0 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| 1,3-Dichlorobenzene | ND | 1.8 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |

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**Qualifiers:**

| | | | |
|---|---|---|---|
| * | Value exceeds Maximum Contaminant Level. | B | Analyte detected in the associated Method Blank |
| D | Sample Diluted Due to Matrix | E | Value above quantitation range |
| H | Holding times for preparation or analysis exceeded | J | Analyte detected below quantitation limits |
| ND | Not Detected at the Reporting Limit | P | Sample pH Not In Range |
| PQL | Practical Quanitative Limit | RL | Reporting Detection Limit |
| S | % Recovery outside of range due to dilution or matrix | W | Sample container temperature is out of limit as specified |

# Hall Environmental Analysis Laboratory, Inc.

**CLIENT:** Western Refining Southwest, Gallup
**Client Sample ID:** OW-59
**Project:** 4th QTR 2017 GW Sampling
**Collection Date:** 12/6/2017 8:40:00 AM
**Lab ID:** 1712649-002
**Matrix:** AQUEOUS
**Received Date:** 12/8/2017 9:35:00 AM

| Analyses | Result | MDL | PQL | Qual | Units | DF | Date Analyzed | Batch ID |
|---|---|---|---|---|---|---|---|---|
| **EPA METHOD 8270C: SEMIVOLATILES** | | | | | | | Analyst: **DAM** | |
| 1,4-Dichlorobenzene | ND | 2.1 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| 3,3´-Dichlorobenzidine | ND | 3.9 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| Diethyl phthalate | ND | 4.0 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| Dimethyl phthalate | ND | 3.6 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| 2,4-Dichlorophenol | ND | 5.7 | 20 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| 2,4-Dimethylphenol | ND | 2.8 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| 4,6-Dinitro-2-methylphenol | ND | 3.9 | 20 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| 2,4-Dinitrophenol | ND | 2.6 | 20 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| 2,4-Dinitrotoluene | ND | 4.0 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| 2,6-Dinitrotoluene | ND | 4.5 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| Fluoranthene | ND | 4.3 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| Fluorene | ND | 4.0 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| Hexachlorobenzene | ND | 3.8 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| Hexachlorobutadiene | ND | 1.3 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| Hexachlorocyclopentadiene | ND | 1.3 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| Hexachloroethane | ND | 1.2 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| Indeno(1,2,3-cd)pyrene | ND | 4.2 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| Isophorone | ND | 4.4 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| 1-Methylnaphthalene | ND | 3.3 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| 2-Methylnaphthalene | ND | 3.3 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| 2-Methylphenol | ND | 3.3 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| 3+4-Methylphenol | ND | 3.2 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| N-Nitrosodi-n-propylamine | ND | 4.6 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| N-Nitrosodimethylamine | ND | 3.5 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| N-Nitrosodiphenylamine | ND | 3.9 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| Naphthalene | ND | 2.9 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| 2-Nitroaniline | ND | 4.9 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| 3-Nitroaniline | ND | 4.3 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| 4-Nitroaniline | ND | 4.0 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| Nitrobenzene | ND | 3.6 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| 2-Nitrophenol | ND | 5.2 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| 4-Nitrophenol | ND | 5.5 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| Pentachlorophenol | ND | 4.9 | 20 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| Phenanthrene | ND | 4.3 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| Phenol | ND | 3.1 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| Pyrene | ND | 4.4 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| Pyridine | ND | 2.3 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| 1,2,4-Trichlorobenzene | ND | 2.1 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| 2,4,5-Trichlorophenol | ND | 5.1 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |

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**Qualifiers:**

| | | | |
|---|---|---|---|
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| ND | Not Detected at the Reporting Limit | P | Sample pH Not In Range |
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# Hall Environmental Analysis Laboratory, Inc.

**CLIENT:** Western Refining Southwest, Gallup
**Client Sample ID:** OW-59
**Project:** 4th QTR 2017 GW Sampling
**Collection Date:** 12/6/2017 8:40:00 AM
**Lab ID:** 1712649-002
**Matrix:** AQUEOUS
**Received Date:** 12/8/2017 9:35:00 AM

| Analyses | Result | MDL | PQL | Qual | Units | DF | Date Analyzed | Batch ID |
|---|---|---|---|---|---|---|---|---|
| **EPA METHOD 8270C: SEMIVOLATILES** | | | | | | | Analyst: **DAM** | |
| 2,4,6-Trichlorophenol | ND | 5.5 | 10 | | µg/L | 1 | 12/18/2017 1:55:58 PM | 35477 |
| Surr: 2-Fluorophenol | 9.12 | 0 | 15-114 | S | %Rec | 1 | 12/18/2017 1:55:58 PM | 35477 |
| Surr: Phenol-d5 | 13.7 | 0 | 15-97.9 | S | %Rec | 1 | 12/18/2017 1:55:58 PM | 35477 |
| Surr: 2,4,6-Tribromophenol | 16.7 | 0 | 15-161 | | %Rec | 1 | 12/18/2017 1:55:58 PM | 35477 |
| Surr: Nitrobenzene-d5 | 90.0 | 0 | 29.3-120 | | %Rec | 1 | 12/18/2017 1:55:58 PM | 35477 |
| Surr: 2-Fluorobiphenyl | 84.8 | 0 | 17.5-116 | | %Rec | 1 | 12/18/2017 1:55:58 PM | 35477 |
| Surr: 4-Terphenyl-d14 | 47.7 | 0 | 21-92.2 | | %Rec | 1 | 12/18/2017 1:55:58 PM | 35477 |
| **EPA METHOD 8260B: VOLATILES** | | | | | | | Analyst: **DJF** | |
| Benzene | ND | 0.062 | 1.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| Toluene | ND | 0.064 | 1.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| Ethylbenzene | ND | 0.093 | 1.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| Methyl tert-butyl ether (MTBE) | 9.4 | 0.24 | 1.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| 1,2,4-Trimethylbenzene | ND | 0.11 | 1.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| 1,3,5-Trimethylbenzene | ND | 0.087 | 1.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| 1,2-Dichloroethane (EDC) | ND | 0.40 | 1.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| 1,2-Dibromoethane (EDB) | ND | 0.13 | 1.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| Naphthalene | ND | 0.11 | 2.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| 1-Methylnaphthalene | ND | 0.16 | 4.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| 2-Methylnaphthalene | ND | 0.15 | 4.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| Acetone | 2.8 | 0.82 | 10 | J | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| Bromobenzene | ND | 0.14 | 1.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| Bromodichloromethane | ND | 0.18 | 1.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| Bromoform | ND | 0.21 | 1.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| Bromomethane | ND | 0.26 | 3.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| 2-Butanone | ND | 1.1 | 10 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| Carbon disulfide | ND | 0.40 | 10 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| Carbon Tetrachloride | ND | 0.11 | 1.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| Chlorobenzene | ND | 0.11 | 1.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| Chloroethane | ND | 0.23 | 2.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| Chloroform | ND | 0.40 | 1.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| Chloromethane | ND | 0.29 | 3.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| 2-Chlorotoluene | ND | 0.40 | 1.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| 4-Chlorotoluene | ND | 0.40 | 1.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| cis-1,2-DCE | ND | 0.20 | 1.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| cis-1,3-Dichloropropene | ND | 0.082 | 1.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| 1,2-Dibromo-3-chloropropane | ND | 1.4 | 2.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| Dibromochloromethane | ND | 0.072 | 1.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| Dibromomethane | ND | 0.091 | 1.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| 1,2-Dichlorobenzene | ND | 0.090 | 1.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |

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**Qualifiers:**

| | | | |
|---|---|---|---|
| * | Value exceeds Maximum Contaminant Level. | B | Analyte detected in the associated Method Blank |
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| ND | Not Detected at the Reporting Limit | P | Sample pH Not In Range |
| PQL | Practical Quanitative Limit | RL | Reporting Detection Limit |
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# Hall Environmental Analysis Laboratory, Inc.

**CLIENT:** Western Refining Southwest, Gallup
**Client Sample ID:** OW-59
**Project:** 4th QTR 2017 GW Sampling
**Collection Date:** 12/6/2017 8:40:00 AM
**Lab ID:** 1712649-002 **Matrix:** AQUEOUS **Received Date:** 12/8/2017 9:35:00 AM

| Analyses | Result | MDL | PQL | Qual | Units | DF | Date Analyzed | Batch ID |
|---|---|---|---|---|---|---|---|---|
| **EPA METHOD 8260B: VOLATILES** | | | | | | | Analyst: **DJF** | |
| 1,3-Dichlorobenzene | ND | 0.15 | 1.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| 1,4-Dichlorobenzene | ND | 0.40 | 1.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| Dichlorodifluoromethane | ND | 1.0 | 1.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| 1,1-Dichloroethane | ND | 0.40 | 1.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| 1,1-Dichloroethene | ND | 0.081 | 1.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| 1,2-Dichloropropane | ND | 0.10 | 1.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| 1,3-Dichloropropane | ND | 0.17 | 1.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| 2,2-Dichloropropane | ND | 0.16 | 2.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| 1,1-Dichloropropene | ND | 0.093 | 1.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| Hexachlorobutadiene | ND | 0.80 | 1.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| 2-Hexanone | ND | 0.66 | 10 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| Isopropylbenzene | ND | 0.051 | 1.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| 4-Isopropyltoluene | ND | 0.096 | 1.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| 4-Methyl-2-pentanone | ND | 0.71 | 10 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| Methylene Chloride | ND | 0.11 | 3.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| n-Butylbenzene | ND | 0.13 | 3.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| n-Propylbenzene | ND | 0.074 | 1.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| sec-Butylbenzene | ND | 0.11 | 1.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| Styrene | ND | 0.16 | 1.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| tert-Butylbenzene | ND | 0.10 | 1.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| 1,1,1,2-Tetrachloroethane | ND | 0.10 | 1.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| 1,1,2,2-Tetrachloroethane | ND | 0.14 | 2.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| Tetrachloroethene (PCE) | ND | 0.13 | 1.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| trans-1,2-DCE | ND | 0.18 | 1.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| trans-1,3-Dichloropropene | ND | 0.22 | 1.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| 1,2,3-Trichlorobenzene | ND | 0.12 | 1.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| 1,2,4-Trichlorobenzene | ND | 0.14 | 1.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| 1,1,1-Trichloroethane | ND | 0.073 | 1.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| 1,1,2-Trichloroethane | ND | 0.14 | 1.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| Trichloroethene (TCE) | ND | 0.11 | 1.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| Trichlorofluoromethane | ND | 0.18 | 1.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| 1,2,3-Trichloropropane | ND | 0.39 | 2.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| Vinyl chloride | ND | 0.18 | 1.0 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| Xylenes, Total | ND | 0.32 | 1.5 | | µg/L | 1 | 12/14/2017 12:58:33 PM | W47802 |
| Surr: 1,2-Dichloroethane-d4 | 103 | 0 | 70-130 | | %Rec | 1 | 12/14/2017 12:58:33 PM | W47802 |
| Surr: 4-Bromofluorobenzene | 109 | 0 | 70-130 | | %Rec | 1 | 12/14/2017 12:58:33 PM | W47802 |
| Surr: Dibromofluoromethane | 102 | 0 | 70-130 | | %Rec | 1 | 12/14/2017 12:58:33 PM | W47802 |
| Surr: Toluene-d8 | 100 | 0 | 70-130 | | %Rec | 1 | 12/14/2017 12:58:33 PM | W47802 |
| **EPA METHOD 8015D: GASOLINE RANGE** | | | | | | | Analyst: **AG** | |

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**Qualifiers:**

| | | | |
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| * | Value exceeds Maximum Contaminant Level. | B | Analyte detected in the associated Method Blank |
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# Hall Environmental Analysis Laboratory, Inc.

**CLIENT:** Western Refining Southwest, Gallup
**Client Sample ID:** OW-59
**Project:** 4th QTR 2017 GW Sampling
**Collection Date:** 12/6/2017 8:40:00 AM
**Lab ID:** 1712649-002 **Matrix:** AQUEOUS **Received Date:** 12/8/2017 9:35:00 AM

| Analyses | Result | MDL | PQL | Qual | Units | DF | Date Analyzed | Batch ID |
|---|---|---|---|---|---|---|---|---|
| **EPA METHOD 8015D: GASOLINE RANGE** | | | | | | | Analyst: **AG** | |
| Gasoline Range Organics (GRO) | 3.1 | 0.0097 | 0.050 | | mg/L | 1 | 12/14/2017 5:59:35 PM | R47798 |
| Surr: BFB | 99.3 | 0 | 70-130 | | %Rec | 1 | 12/14/2017 5:59:35 PM | R47798 |

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**Qualifiers:**

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DiSorbo
Environmental Consulting Firm

Western Refining SW, Inc
Gallup Refinery
Job No. WEST17020

| | |
|---|---|
| Geologist | : Tracy Payne |
| Driller | : Enviro-Drill Inc/Cohagan |
| Drilling Rig | : CME75 |
| Drilling Method | : Hollow Stem Auger 7 1/4" |
| Sampling Method | : 2' Split Spoon |
| Comments | : Hand Auger to 5 BGL |
| Total Depth | : 40' |
| Ground Water | : 26' |
| Start Date | : 06/12/2017 |
| Finish Date | : 06/12/2017 |

# WELL NO. OW-59

(Sheet 1 of 3)

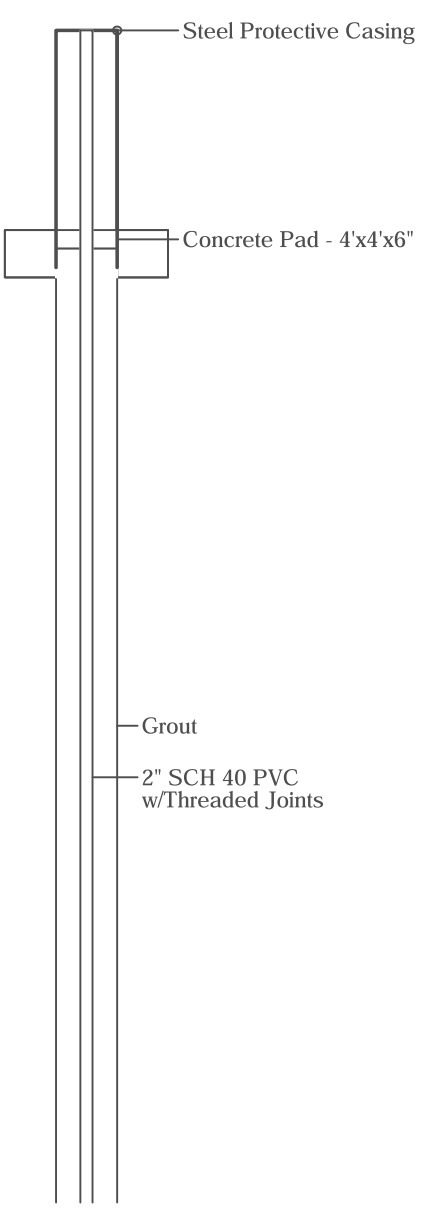
| | |
|---|---|
| Elev., TOC (ft.msl) | : 6689.73 |
| Elev., PAD (ft. msl) | : 6887.63 |
| Elev., GL (ft. msl) | : |
| Site Coordinates | : |
| N | : N1635547.14 |
| E | : W2544633.00 |

| Depth (ft.) | PID (ppm) | Saturation | Lithology | USCS | Recovery (%) | Sample | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| 0 | | | | | | | SILTY CLAY, low, firm, damp, brown, no odor, |
| 1 | 0.0 | | | CL | 100 | | |
| 2 | | | | | | | SILTY CLAY, SIMILAR TO ABOVE (STA), |
| 3 | 0.0 | | | CL | 100 | | |
| 4 | | | | | | | SILTY CLAY, STA, |
| 5 | 0.0 | | | CL | 100 | | |
| 6 | | | | | | | CLAY, high, stiff, damp, brown, no odor, |
| 7 | 2.0 | | | CH | 70 | | |
| 8 | | | | | | | SILTY CLAY, low, stiff, damp, light brown, no odor, sandy at base, |
| 9 | 1.0 | | | CL | 80 | | |
| 10 | | | | | | | SILT, low, compact, damp, brown, no odor, |
| 11 | 0.3 | | | ML | 70 | | |
| 12 | | | | | | | SILTY CLAY, low, very stiff, damp, brown, no odor, trace sand, |
| 13 | 0.5 | | | CL | | | |

Saturation
▼ Saturation

## Completion Results

Well No. OW-59





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DiSorbo
Environmental Consulting Firm

Western Refining SW, Inc
Gallup Refinery
Job No. WEST17020

| | |
|---|---|
| Geologist | : Tracy Payne |
| Driller | : Enviro-Drill Inc/Cohagan |
| Drilling Rig | : CME75 |
| Drilling Method | : Hollow Stem Auger 7 1/4" |
| Sampling Method | : 2' Split Spoon |
| Comments | : Hand Auger to 5 BGL |
| Total Depth | : 40' |
| Ground Water | : 26' |
| Start Date | : 06/12/2017 |
| Finish Date | : 06/12/2017 |

# WELL NO. OW-59

(Sheet 2 of 3)

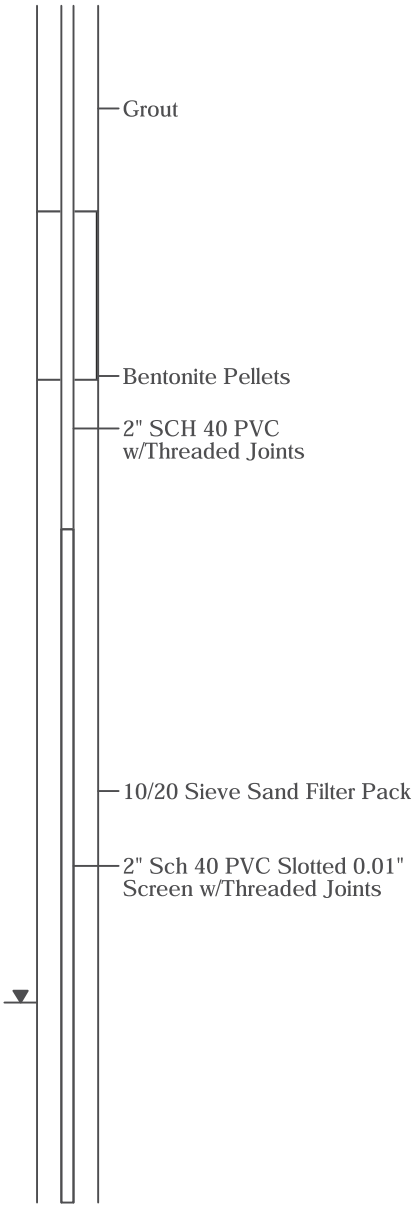
| | |
|---|---|
| Elev., TOC (ft.msl) | : 6689.73 |
| Elev., PAD (ft. msl) | : 6887.63 |
| Elev., GL (ft. msl) | : |
| Site Coordinates | : |
| N | : N1635547.14 |
| E | : W2544633.00 |

| Depth (ft.) | PID (ppm) | Saturation | Lithology | USCS | Recovery (%) | Sample | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| 13 | 0.5 | | | CL | 50 | | |
| 14 | | | | | | | SILTY CLAY, high, very stiff, damp, brown, no odor, |
| 15 | 1.3 | | | CH | 50 | | |
| 16 | | | | | | | SILTY CLAY, STA, no odor, |
| 17 | 1.7 | | | CH | 60 | | |
| 18 | | | | | | | SILTY CLAY, low to moderate, stiff, damp, brown, no odor, |
| 19 | 1.1 | | | CL | 50 | | |
| 20 | | | | | | | SANDY SILTY CLAY, low, firm to soft, damp, brown, no odor, |
| 21 | 1.2 | | | CL | 50 | | |
| 22 | | | | | | | SANDY CLAY, low, soft, damp, brown, no odor, |
| 23 | 0.2 | | | CL | 60 | | |
| 24 | | | | | | | SILTY CLAY, low, soft, damp, brown, no odor, |
| 25 | 3.3 | | | CL | 70 | | |
| 26 | | ▼ | | | | | SANDY SILT, very fine, very moist, brown, no odor, |
| 27 | 10.9 | | | ML | 80 | | |
| 28 | | | | | | | SANDY SILT, STA, very moist, no odor, |
| 29 | 11.6 | | | ML | | | |

Saturation
▼ Saturation

## Completion Results

Well No. OW-59





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Environmental Consulting Firm

Western Refining SW, Inc
Gallup Refinery
Job No. WEST17020

| | |
|---|---|
| Geologist | : Tracy Payne |
| Driller | : Enviro-Drill Inc/Cohagan |
| Drilling Rig | : CME75 |
| Drilling Method | : Hollow Stem Auger 7 1/4" |
| Sampling Method | : 2' Split Spoon |
| Comments | : Hand Auger to 5 BGL |
| Total Depth | : 40' |
| Ground Water | : 26' |
| Start Date | : 06/12/2017 |
| Finish Date | : 06/12/2017 |

# WELL NO. OW-59

(Sheet 3 of 3)

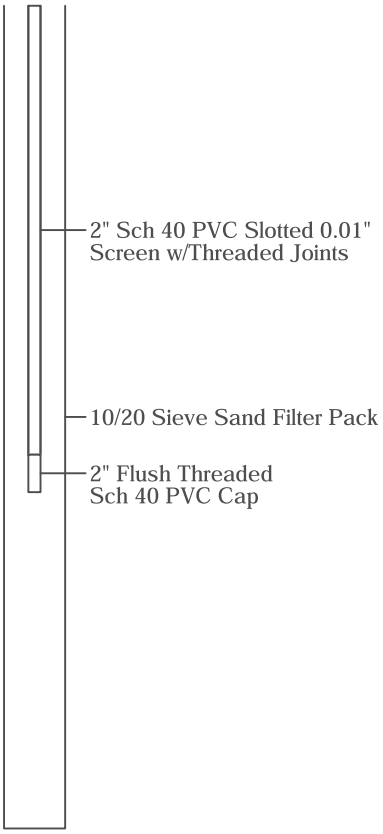
| | |
|---|---|
| Elev., TOC (ft.msl) | : 6689.73 |
| Elev., PAD (ft. msl) | : 6887.63 |
| Elev., GL (ft. msl) | : |
| Site Coordinates | : |
| N | : N1635547.14 |
| E | : W2544633.00 |

Saturation
▼ Saturation

| Depth (ft.) | PID (ppm) | Saturation | Lithology | USCS | Recovery (%) | Sample | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| 29 | 11.6 | | | ML | 80 | | |
| 30 | | | | | | | SILTY CLAY, low, firm, damp, brown, no odor, |
| 31 | 11.4 | | | CL | 90 | | |
| 32 | 14.9 | | | CL | 90 | | SILTY CLAY, STA, no odor, |
| 33 | 16.3 | | | SM | 90 | X | SILTY SAND, very fine, compact, saturated, brown, no odor, |
| 34 | | | | | | | SILTY CLAY, low, firm, damp, brown, no odor, |
| 35 | 10.5 | | | CL | 60 | | |
| 36 | | | | | | | SILTY CLAY, STA, no odor, |
| 37 | 7.3 | | | CL | 70 | | |
| 38 | | | | CH | 70 | | CLAY, high, firm, damp, brown, no odor, |
| 39 | 10.0 | | | CL | 70 | | SILTY CLAY, low, firm to soft, grey and white, no odor, trace sand and white nodules. |
| 40 | | | | | | | |
| 41 | | | | | | | |
| 42 | | | | | | | |
| 43 | | | | | | | |
| 44 | | | | | | | |
| 45 | | | | | | | |

## Completion Results

Well No. OW-59





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Jamestown, NM 87347

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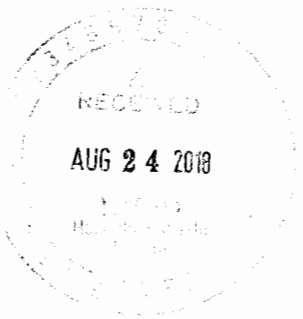
ENTERED




Sent via Federal Express Mail

August 22, 2018

Mr. John Kieling
Hazardous Waste Bureau Chief
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505-6313

**RE: INVESTIGATION WORK PLAN SMWU-1 AND GMW-1**
**WESTERN REFINING SOUTHWEST INC., GALLUP REFINERY**
**EPA ID # NMD000333211**
**HWB-WRG-17-008**

Dear Mr. Kieling:

On June 4, 2018, Western Refining Southwest Inc., Gallup Refinery (Permittee) received comments from New Mexico Environment Department (NMED) and *a Disapproval of Annual Groundwater Monitoring Report – Gallup Refinery 2016*. Pursuant to comments within the Disapproval NMED requests for the Permittee to address each comment provided by both NMED and the New Mexico Energy Minerals and Natural Resources Department (EMNRD) Oil Conservation Division (OCD). NMED Comments 2, 8, and 9 requested Permittee to prepare a Work Plan for NMED's review no later than August 30, 2018. As per request, Permittee is providing the below comments for reference and attached a Work Plan for review.

**Comment 2**

*In the Executive Summary, pages 5 and 6, the Permittee states, "[h]ydrocarbon recovery from RW-1 has shown a steady decrease from 2005 through 2016. It is common for hydrocarbon recovery to decline over time, as the readily recoverable hydrocarbons [are removed from the formation." However, in the Executive Summary, page 5, the Permittee also states, "[t]he SPH column thickness in RW-1 has increased during 2016." According to Table 9.1, Groundwater Measurements, SPH column thickness was measured as 2.50 feet on March 4, 2016 while it was measured as 4.14 feet on September 13, 2016. Although the volume of recoverable hydrocarbons is decreasing, separate phase hydrocarbon (SPH) may still be present as adsorbed phase near residual saturation levels in the soil matrix. Therefore, adsorbed SPH may be migrating through voids in the soil matrix. As a result, SPH column thickness in well RW-1 remains relatively constant with minor fluctuations and does not correlate with a decreasing trend in hydrocarbon recovery. Corrective measures implemented by the Permittee (a combination of hand-bailing and skimming with a bladder pump) is not likely to eliminate adsorbed SPH. As SPH is only observed in well RW-1 among all Group C wells, the SPH plume may be localized and limited to this area. NMED's 2014 Groundwater Monitoring Report Disapproval Comment 18, dated June 20, 2016 required the Permittee to conduct an investigation of the OW-14 contaminant source and groundwater flow direction by installing a groundwater monitoring well north of well RW-1. The investigation has been completed; however, a report has not been submitted or reviewed by NMED. Further and more advanced remediation techniques may be required to address SPH in the soil matrix. No revisions to the Report are required.*

**Permittee Response:** Permittee hereby submits this Work Plan to NMED and OCD in response to such request.

**Comment 8**

*The chloride and sulfate concentrations in the groundwater sample collected from well SMW-2 were recorded as 2,500 and 1,300 mg/L, respectively according to Table 8.3. 1, SMW-2, SMW-4 General Chemistry and DRO/GRO Analytical Result Summary. According toTable 8.15, Evaporation Ponds (EP-1 thru EP-12B) BTEX and General Chemistry Analytical Result Summary, the chloride and sulfate concentrations in the water sample collected from pond EP-2 were recorded as 3,000 and 1,600 mg/L, respectively in the August 2016 sampling event. According to Figure 10, 2016 Alluvium/Chinle Group Interface Water Elevation Map, the shortest distance between well SMW-2 and the northern perimeter of pond EP-2 is approximately 600 feet and the shallow groundwater flow direction indicates that well SMW-2 is directly positioned downgradient from pond EP-2. The comparable concentrations of chloride and sulfate and the groundwater flow direction suggest that pond EP-2 may be leaking along its northern perimeter or bottom and leaching*

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*into the shallow aquifer. The Permittee conducted an investigation of the chloride levels in well SWM-2 based on the approved work plan and indicated that the LTU was the potential source and there may be additional sources. The SMW-2 Investigation Report has not been submitted to NMED for review. Potential leakage(s) from pond EP-2 may be one of the additional sources. Propose to investigate whether wastewater is leaking from the northern perimeter or bottom of pond EP-2 through a work plan. Installation of piezometers along the northern perimeter of pond EP-2 may help to determine whether leakage is occurring. No revision to the Report is required.*

**Permittee Response:** Permittee hereby submits this Work Plan to NMED and OCD in response to such request.

**Comment 9**

*In Section 6.2.1, Groundwater Monitoring Wells (GWM-1, GWM-2, GWM-3), page 30, the Permittee states, "[i]n fourth quarter 2015, an SPH level was detected in GWM-1 and in all of 2016 and no groundwater samples were collected. Discussion for detected constituents will be for year 20l5." Discussion for detected constituents for year 2015 was included in the 2015 Report; therefore, it is not necessary to discuss them again in the 2016 Report. Remove the discussion regarding the 2015 analytical results from the 2016 Report. Instead, discuss the fact that SPH was present in well GWM-1 throughout 2016. Since it is possible that the source of SPH may be aeration lagoons AL-1 and AL-2, the Permittee must propose to install a monitoring well downgradient from well GWM-1 to evaluate the extent of SPH in the shallow aquifer. The monitoring well could also serve as a sentinel well for the eastern perimeter of pond EP-2. Propose to install a monitoring well halfway between the eastern perimeter of pond EP-2 and well GWM-1 in a work plan.*

**Permittee Response:** Permittee hereby submits this Work Plan to NMED and OCD in response to such request.

**Certification (RCRA Permit Condition Part II.C.6)**

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

If you have any questions regarding the information contained herein, please do not hesitate to contact Jessica O'Brien by telephone at (505) 722-0287 or by email at Jessica.L.Obrien@andeavor.com.

Sincerely,

Daniel J. Statile
VP and Refinery Manager
Western Refining Southwest, Inc. – Gallup Refinery

Enclosures:

cc: Kristen VanHorn, NMED HWB (via e-mail) Carl Chavez, OCD (e-doc)

# INVESTIGATION WORK PLAN
# SMW-1 & GMW-1 Areas

## Gallup Refinery
## Western Refining Southwest, Inc.
## Gallup, New Mexico

*EPA ID# NMD000333211*

**AUGUST 2018**

Scott Crouch
Senior Geologist

DiSorbo
Environmental Consulting Firm

8501 North Mopac Expy | Suite 300 | Austin, TX 78759
512.693.4190 (P) | 512.279.3118 (F) | www.disorboconsult.com

# Table of Contents



## List of Tables



## List of Figures

## Table of Contents (Continued)

## Appendices

# List of Acronyms

benzene, toluene, ethylbenzene, and xylene (BTEX)
Code of Federal Regulations (CFR)
Contract Laboratory Program (CLP)
data quality objective (DQO)
diesel range organics (DRO)
dilution attenuation factor (DAF)
Environmental Protection Agency (EPA)
investigation derived waste (IDW)
Maximum Contaminant Level (MCL)
mean sea level (msl)
monitoring well (MW)
motor oil range organics (MRO)
methyl tert butyl ether (MTBE)
New Mexico Administrative Code (NMAC)
New Mexico Environment Department (NMED)
New Mexico Oil Conservation Division (NMOCD)
photoionization detector (PID)
polynuclear aromatic hydrocarbon (PAH)
polyvinyl chloride (PVC)
quality assurance/quality control (QA/QC)
Resource Conservation and Recovery Act (RCRA)
separate-phase hydrocarbon (SPH)
semi-volatile organic compound (SVOC)
Solid Waste Management Unit (SWMU)
total petroleum hydrocarbon (TPH)
toxicity characteristic leaching procedure (TCLP)
volatile organic compound (VOC)

# Executive Summary

The Gallup Refinery, which is located 17 miles east of Gallup, New Mexico, has been in operation since the 1950s. Pursuant to the terms and conditions of the facility Resource Conservation and Recovery Act (RCRA) Post-Closure Care Permit and 20.4.1.500 New Mexico Administrative Code, this Investigation Work Plan has been prepared for the area near the on-site evaporation ponds, specifically the area near well SMW-2 and Evaporation Pond No. 2. This area was initially identified by the New Mexico Environment Department (NMED) in comment letters regarding the 2013 and 2014 Annual Wide Ground Water Monitoring Reports as requiring additional groundwater monitoring wells and again in the a comment letter on the 2016 Annual Ground Water Monitoring Report

Groundwater samples collected from monitoring well SMW-2 have shown concentrations of chloride and sulfate above screening levels. SMW-2 is down-gradient of a nearby landfarm area and potentially the on-site evaporation ponds. In response to NMED's first request for additional monitoring wells, two new observation wells (OW-59 and OW-60) were installed up-gradient of SMW-2 in September 2016. Groundwater samples collected from these new wells confirmed the presence of chloride and sulfate above screening levels in the area of the landfarm that is authorized by the New Mexico Oil Conservation Division (NMOCD). This effort will further evaluate Evaporation Pond No. 2 (EP - 2) as a potential source of the elevated concentrations of chloride and sulfate detected at well SMW-2. To accomplish this objective, two new permanent monitoring wells will be installed immediately down-gradient of EP-2.

Monitoring well GMW-1 is located on the top of the dike that forms the western boundary of the former Aeration Basin (Solid Waste Management Unit No. 1) and lies a short distance to the east of EP-2. Groundwater samples collected at GWM-1 have routinely contained low concentrations of benzene, toluene, ethylbenzene, and xylenes (BTEX), and methyl tert butyl ether (MTBE) with benzene exceeding the screening level. In September 2015, a material apparently resembling separate-phase hydrocarbons (SPH) was observed in the well for the first time. Based on the presence of this material, a new well will be installed to the west of GWM-1, halfway between the Aeration Basin and EP-2.

# Section 1
# Introduction

The Gallup Refinery is located approximately 17 miles east of Gallup, New Mexico along the north side of Interstate Highway I-40 in McKinley County. The physical address is I-40, Exit #39 Jamestown, New Mexico 87347. The Gallup Refinery is located on 810 acres. Figure 1 presents the refinery location and the regional vicinity.

The Gallup Refinery generally processes crude oil from the Four Corners area transported to the facility by pipeline or tanker truck. Various process units are operated at the facility, including crude distillation, reforming, fluidized catalytic cracking, alkylation, sulfur recovery, merox treater, and hydrotreating. Current and past operations have produced gasoline, diesel fuels, jet fuels, kerosene, propane, butane, and residual fuel.

This investigation work plan addresses the area up-gradient of monitoring well SMW-2 and immediately down-gradient of EP-2, and the area between the former Aeration Basin and EP-2. The purposes of this investigation are to:

- determine the source of the elevated concentrations of chloride and sulfate detected in groundwater samples collected at SMW-2; and
- evaluate the extent of SPH that has been observed in GWM-1.

The investigation activities will be conducted in accordance with Section IV.H.5 of the Post-Closure Care Permit.

# Section 2
# Background

This section presents background information for the area of the refinery property near monitoring well SMW-2 and GWM-1, including a review of historical waste management activities to identity the following:

- Type and characteristics of all waste and all contaminants handled in the subject areas;
- Known and possible sources of contamination;
- History of operations; and
- Prior investigations.

## 2.1 SMW-2 Area

Monitoring well SMW-2 is located immediately south of the closed Land Treatment Unit (LTU). This well is not included in the RCRA Permit as part of the detection or shallow monitoring well networks, but groundwater samples are routinely collected and analyzed per the Facility-Wide Ground Water Monitoring Plan. Well SMW-2 is located on the up-gradient end of the LTU. Analytical results for groundwater samples collected since 2010 are included in Table 1. Also included in Table 1 are the analytical results for groundwater samples collected in SMW-4, which is located on the north (down-gradient) end of the LTU. The results for SMW-2 provided in Table 1 indicate the detection of chloride, sulfate, manganese, and uranium at concentrations above the applicable screening levels per the RCRA Permit. Uranium was also detected in groundwater samples collected from SMW-4 at concentrations above the screening level. MTBE has been detected in groundwater samples collected at SMW-2, but has remained below the screening level (NMED, 2017).

Well SMW-2 is located down-gradient of the Central Landfarm Area, which is permitted by the New Mexico Oil Conservation Division (NMOCD) and also potentially down-gradient of the evaporation ponds (Figure 2). It is noted that the area where the NMOCD Landfarm is currently located appears to overlie former Evaporation Pond #10 (Figure 3). According to information provided in the *Inventory of Solid Waste Management Units,* cell or Evaporation Pond #10 was used for wastewater from the boiler house and water softener regeneration wastes, but did not receive process wastewater discharges through the API Separator. The process of discharging directly to Evaporation Pond #10 was replaced with the addition of a neutralization tank in 1980 (Geoscience Consultants,

Ltd., 1985a). Evaporation Pond #10 was no longer in service in 1985 based on information provided in the 1985 *Discharge Plan Application* (Geoscience Consultants, Ltd., 1985b).

A review of the boring/well completion logs for SMW-2 and SMW-4, as well as other wells in the immediate area, indicates that well SMW-4 is screened in the transmissive media (e.g., sands) that directly overlie the Chinle bedrock. A copy of the boring logs for SMW-2 and SMW-4 are included in Appendix A. The screened interval in well SMW-2 appears to include not only any transmissive materials on top of the bedrock, but also some of the upper sands. Water levels measured in the nearby wells are provided in Table 2 and a map showing the potentiometric surface measured in the shallow wells is included as Figure 2.

In response to NMED's request for additional wells in the area to evaluate the source of chloride and sulfate, two new wells (OW-59 and OW-60) were installed up-gradient of SMW-2 in September 2016. Groundwater samples collected from these new wells confirmed the presence of chloride and sulfate above screening levels up-gradient of SMW-2 and in the area of the landfarm that is authorized by the New Mexico Oil Conservation Division (NMOCD). The analyses are summarized in Table 1 and shown on Figure 3. The boring/well completion logs for OW-59 and OW-60 are included in Appendix A.

Both the chloride and sulfate concentrations increased across the OCD landfarm area, but even higher chloride concentrations are up-gradient in well STP1-NW that is east of Evaporation Pond No. 2. The sulfate concentrations observed in OW-59, at the down-gradient end of the OCD landfarm, are the highest observed in groundwater in the area. The sulfate concentrations in the groundwater sample collected at OW-59 is also higher than the historic sulfate concentrations in Evaporation Ponds 2 and 3 dating back to 2010.

## 2.2 GMW-1 Area

Monitoring well GMW-1 is located on the top of the dike that forms the western boundary of the former Aeration Basin (Solid Waste Management Unit No. 1). This well was installed in 2004 and is screened in the Chinle/Alluvial Interface zone. The boring/well completion log is included in Appendix A. The groundwater samples collected at GWM-1 have routinely detected low concentrations of BTEX and MTBE with benzene exceeding the screening level (Table 1). In September 2015, a material apparently resembling separate-phase hydrocarbons (SPH) was

observed in the well for the first time. Based on the presence of this material, a request was made for a new well to the west of GWM-1, halfway between the Aeration Basin and EP-2.

# Section 3
# Site Conditions

## 3.1 Surface Conditions

Site topographic features include high ground in the southeast gradually decreasing to a lowland fluvial plain to the northwest. Elevations on the refinery property range from 7,040 feet to 6,860 feet. Surface soils within most of the area of investigation are primarily Rehobeth silty clay loam. Rehobeth soil properties include a pH ranging from 8 to 9 standard units and salinity (naturally occurring and typically measuring up to approximately 8 mmhos/cm).

Regional surface water features include the refinery evaporation ponds and a number of small ponds (one cattle water pond and two small unnamed spring fed ponds). The site is located in the Puerco River Valley, north of the Zuni Uplift with overland flows directed northward to the tributaries of the Puerco River. The Puerco River continues to the west to the confluence with the Little Colorado River. The South Fork of the Puerco River is intermittent and retains flow only during and immediately following precipitation events.

## 3.2 Subsurface Conditions

The shallow subsurface soils consist of fluvial and alluvial deposits comprised of clay and silt with minor inter-bedded sand layers. Very low permeability bedrock (e.g., claystones and siltstones) underlie the surface soils and effectively form an aquitard. The Chinle Group, which is Upper Triassic, crops out over a large area on the southern margin of the San Juan Basin. The uppermost recognized local Formation is the Petrified Forest Formation and the Sonsela Sandstone Bed is the uppermost recognized regional aquifer. Aquifer test of the Sonsela Bed northeast of Prewitt indicated a transmissivity of greater than 100 $ft^2$/day (Stone and others, 1983). The Sonsela Sandstone's highest point occurs southeast of the site and slopes downward to the northwest as it passes under the refinery. The Sonsela Sandstone forms a water-bearing reservoir with artesian conditions throughout the central and western portions of the refinery property.

The diverse properties and complex, irregular stratigraphy of the surface soils across the site cause a wide range of hydraulic conductivity ranging from less than $10^{-2}$ cm/sec for gravel like sands immediately overlying the Petrified Forest Formation to $10^{-8}$ cm/sec in the clay soils located near the surface (Western, 2009). Generally, shallow groundwater at the refinery follows the upper contact of

the Petrified Forest Formation with prevailing flow from the southeast to the northwest, although localized areas may have varying flow directions (Figure 2). Fluid level measurements for wells in the immediate area are included in Table 2.

# Section 4
# Scope of Services

The site investigation of groundwater will be conducted to determine the source of elevated chloride and sulfate concentrations detected in groundwater samples collected at SMW-2. An additional monitoring well will be installed to the west of GWM-1 to delineate SPH on the west side of the former Aeration Basin. The investigation will commence upon approval of this investigation work plan by NMED.

## 4.1 SMW-2 Investigation

An investigation of groundwater conditions in the area near SMW-2 is proposed to determine the source of chloride and sulfate detected in groundwater samples collected at SMW-2. Two new shallow monitoring wells are proposed north and northwest of EP-2 (Figure 4). One well will be located near existing well MW-4, which is completed in the Sonsela aquifer, and a second well north of EP-2, approximately halfway between MW-4 and OW-60.

Each well will be screened in the upper-most saturated interval(s) with a maximum screen length of 10 feet. Due to concerns over the construction of SMW-2 using a 20-foot well screen, which possibly allows cross-communication between separate zones (upper sands vs. Chinle/alluvial Interface), care will be taken to avoid screening across intervals that may not otherwise be in hydraulic communication.

## 4.2 Installation of Well near GMW-1

A new shallow monitoring well will be installed to the west of GWM-1, approximately halfway between the former Aeration Basin and EP-2 (Figure 4). The well will be screened just above the Chinle bedrock in the Chinle/Alluvial Interface zone.

## 4.3 Soil Sample Field Screening and Logging

Samples obtained from the soil borings will be screened in the field on 2.0 foot intervals for evidence of contaminants. Field screening results will be recorded on the exploratory boring logs. Field screening results will be used to aid in the possible selection of soil samples for laboratory analysis. The primary screening methods include: (1) visual examination, (2) olfactory examination, and (3) headspace vapor screening for volatile organic compounds.

Visual screening includes examination of soil samples for evidence of staining caused by petroleum-related compounds or other substances that may cause staining of natural soils such as elemental sulfur or cyanide compounds. Headspace vapor screening targets volatile organic compounds and involves placing a soil sample in a plastic sample bag or a foil sealed container allowing space for ambient air. The container will be sealed and then shaken gently to expose the soil to the air trapped in the container. The sealed container will be allowed to rest for a minimum of 5 minutes while vapors equilibrate. Vapors present within the sample bag's headspace will then be measured by inserting the probe of the instrument in a small opening in the bag or through the foil. The maximum value and the ambient air temperature will be recorded on the field boring or test pit log for each sample.

The monitoring instruments will be calibrated each day to the manufacturer's standard for instrument operation. A photoionization detector (PID) equipped with a 10.6 or higher electron volt (eV) lamp or a combustible gas indicator may be used for VOC field screening. Field screening results may be site- and boring-specific and the results may vary with instrument type, the media screened, weather conditions, moisture content, soil type, and type of contaminant, therefore, all conditions capable of influencing the results of field screening will be recorded on the field logs.

Although the borings are being drilled at locations outside known areas of concern, Western will collect soil samples for laboratory analysis if screening indicates the potential for site impacts. The physical characteristics of the samples (such as mineralogy, ASTM soil classification, moisture content, texture, color, presence of stains or odors, and/or field screening results), depth where each sample was obtained, method of sample collection, and other observations will be recorded in the field log by a qualified geologist or engineer. Detailed logs of each boring will be completed in the field by a qualified engineer or geologist. Additional information, such as the presence of water-bearing zones and any unusual or noticeable conditions encountered during drilling, will be recorded on the logs.

Quality Assurance/Quality Control (QA/QC) samples will be collected to monitor the validity of the soil sample collection procedures as follows:

- Field duplicates will be collected at a rate of 10 percent; and
- Equipment blanks will be collected from all sampling apparatus at a frequency of one per day.

### 4.3.1 Drilling Activities

Soil borings will be drilled using hollow-stem augers. The drilling equipment will be properly decontaminated before drilling each boring. The NMED will be notified as early as practicable if conditions arise or are encountered that do not allow the advancement of borings to the specified depths or at planned sampling locations. Appropriate actions (e.g., installation of protective surface casing or relocation of borings to a less threatening location) will be taken to minimize any negative impacts from investigative borings. Slotted (0.01 inch) PVC well screen will be placed at the bottom of the borings and will extend for 10 feet. A 10/20 sand filter pack will be installed to two feet over the top of the well screen.

## 4.4 Groundwater Sample Collection

Groundwater samples will be collected from the new monitoring wells within 24 hours of the completion of well purging using disposal bailers. Alternatively, well sampling may also be conducted in accordance with the NMED's Position Paper *Use of Low-Flow and other Non-Traditional Sampling Techniques for RCRA Compliant Groundwater Monitoring* (October 30, 2001, as updated). Sample collection methods will be documented in the field monitoring reports. The samples will be transferred to the appropriate, clean, laboratory-prepared containers provided by the analytical laboratory. Sample handling and chain-of-custody procedures will be in accordance with the procedures presented below in Section 4.4.1.

Groundwater samples intended for metals analysis will be submitted to the laboratory as both total and dissolved metals samples. QA/QC samples will be collected to monitor the validity of the groundwater sample collection procedures as follows:

- Field duplicate water samples will be obtained at a frequency of ten percent, with a minimum, of one duplicate sample per sampling event;
- Equipment rinsate blanks will be obtained for chemical analysis at the rate of ten percent or a minimum of one rinsate blank per sampling day. Equipment rinsate blanks will be collected at a rate of one per sampling day if disposable sampling equipment is used. Rinsate samples will be generated by rinsing deionized water through unused or decontaminated sampling equipment. The rinsate sample will be placed in the appropriate sample container and submitted with the groundwater samples to the analytical laboratory for the appropriate analyses; and

- Trip blanks will accompany laboratory sample bottles and shipping and storage containers intended for VOC analyses. Trip blanks will consist of a sample of analyte-free deionized water prepared by the laboratory and placed in an appropriate sample container. The trip blank will be prepared by the analytical laboratory prior to the sampling event and will be kept with the shipping containers and placed with other water samples obtained from the site each day. Trip blanks will be analyzed at a frequency of one for each shipping container of groundwater samples to be analyzed for VOCs.

### 4.4.1 Sample Handling

At a minimum, the following procedures will be used at all times when collecting samples during investigation, corrective action, and monitoring activities:

1. Neoprene, nitrile, or other protective gloves will be worn when collecting samples. New disposable gloves will be used to collect each sample;
2. All samples collected of each medium for chemical analysis will be transferred into clean sample containers supplied by the project analytical laboratory with the exception of soil, rock, and sediment samples obtained in Encore® samplers. Sample container volumes and preservation methods will be in accordance with the most recent standard EPA and industry accepted practices for use by accredited analytical laboratories. Sufficient sample volume will be obtained for the laboratory to complete the method-specific QC analyses on a laboratory-batch basis; and
3. Sample labels and documentation will be completed for each sample following procedures discussed below. Immediately after the samples are collected, they will be stored in a cooler with ice or other appropriate storage method until they are delivered to the analytical laboratory. Standard chain-of-custody procedures, as described below, will be followed for all samples collected. All samples will be submitted to the laboratory soon enough to allow the laboratory to conduct the analyses within the method holding times.

Chain-of-custody and shipment procedures will include the following:

1. Chain-of-custody forms will be completed at the end of each sampling day, prior to the transfer of samples off site.
2. Individual sample containers will be packed to prevent breakage and transported in a sealed cooler with ice or other suitable coolant or other EPA or industry-wide accepted

method. The drainage hole at the bottom of the cooler will be sealed and secured in case of sample container leakage. Temperature blanks will be included with each shipping container.

3. Each cooler or other container will be delivered directly to the analytical laboratory.
4. Glass bottles will be separated in the shipping container by cushioning material to prevent breakage.
5. Plastic containers will be protected from possible puncture during shipping using cushioning material.
6. The chain-of-custody form and sample request form will be shipped inside the sealed storage container to be delivered to the laboratory.
7. Chain-of-custody seals will be used to seal the sample-shipping container in conformance with EPA protocol.
8. Signed and dated chain-of-custody seals will be applied to each cooler prior to transport of samples from the site.
9. Upon receipt of the samples at the laboratory, the custody seals will be broken, the chain-of-custody form will be signed as received by the laboratory, and the conditions of the samples will be recorded on the form. The original chain-of-custody form will remain with the laboratory and copies will be returned to the relinquishing party.
10. Copies of all chain-of-custody forms generated as part of sampling activities will be maintained on-site.

## 4.5 Collection and Management of Investigation Derived Waste

Drill cuttings, excess sample material and decontamination fluids, and all other investigation derived waste (IDW) associated with soil borings will be contained and characterized using methods based on the boring location, boring depth, drilling method, and type of contaminants suspected or encountered. All purged groundwater and decontamination water will be characterized prior to disposal unless it is disposed in the refinery wastewater treatment system upstream of the API Separator. An IDW management plan is included as Appendix B.

Field equipment requiring calibration will be calibrated to known standards, in accordance with the manufacturers' recommended schedules and procedures. At a minimum, calibration checks will be conducted daily, or at other intervals approved by the Department, and the instruments will be recalibrated, if necessary. Calibration measurements will be recorded in the daily field logs. If field

equipment becomes inoperable, its use will be discontinued until the necessary repairs are made. In the interim, a properly calibrated replacement instrument will be used.

## 4.6 Documentation of Field Activities

Daily field activities, including observations and field procedures, will be recorded in a field log book. Copies of the completed forms will be maintained in a bound and sequentially numbered field file for reference during field activities. Indelible ink will be used to record all field activities. Photographic documentation of field activities will be performed, as appropriate. The daily record of field activities will include the following:

1. Site or unit designation;
2. Date;
3. Time of arrival and departure;
4. Field investigation team members including subcontractors and visitors;
5. Weather conditions;
6. Daily activities and times conducted;
7. Observations;
8. Record of samples collected with sample designations and locations specified;
9. Photographic log, as appropriate;
10. Field monitoring data, including health and safety monitoring;
11. Equipment used and calibration records, if appropriate;
12. List of additional data sheets and maps completed;
13. An inventory of the waste generated and the method of storage or disposal; and
14. Signature of personnel completing the field record.

## 4.7 Chemical Analyses

All samples collected for laboratory analysis will be submitted to an accredited laboratory. The laboratory will use the most recent standard EPA and industry-accepted analytical methods for target analytes as the testing methods for each medium sampled. Chemical analyses will be performed in accordance with the most recent EPA standard analytical methodologies and extraction methods.

Groundwater and soil samples will be analyzed by the following methods:

- SW-846 Method 8260 for volatile organic compounds;
- SW-846 Method 8270 for semi-volatile organic compounds; and

- SW-846 Method 8015B gasoline range (C5-C10), diesel range (>C10-C28), and motor oil range (>C28-C36) organics.

Groundwater and soil samples will also be analyzed for the following Skinner List metals and iron and manganese using the indicated analytical methods shown. The groundwater samples collected for metals analysis will be analyzed for total and dissolved concentrations. Groundwater samples will also be analyzed for major cations (calcium, magnesium, sodium, and potassium) and anions (e.g., carbonate, bicarbonate, sulfate, fluoride and chloride).

Inorganic Analytical Methods

| Analyte | Analytical Method |
|---|---|
| Antimony | SW-846 method 6010/6020 |
| Arsenic | SW-846 method 6010/6020 |
| Barium | SW-846 method 6010/6020 |
| Beryllium | SW-846 method 6010/6020 |
| Cadmium | SW-846 method 6010/6020 |
| Chromium | SW-846 method 6010/6020 |
| Cobalt | SW-846 method 6010/6020 |
| Cyanide | SW-846 method 335.4/335.2 mod |
| Lead | SW-846 method 6010/6020 |
| Mercury | SW-846 method 7470/7471 |
| Nickel | SW-846 method 6010/6020 |
| Selenium | SW-846 method 6010/6020 |
| Silver | SW-846 method 6010/6020 |
| Vanadium | SW-846 method 6010/6020 |
| Zinc | SW-846 method 6010/6020 |
| Iron | SW-846 method 6010/6020 |
| Manganese | SW-846 method 6010/6020 |

Groundwater field measurements will be obtained for pH, specific conductance, dissolved oxygen concentrations, oxidation-reduction potential, and temperature.

## 4.8 Data Quality Objectives

The Data Quality Objectives (DQOs) were developed to ensure that newly collected data are of sufficient quality and quantity to address the project goals, including Quality Assurance/Quality

Control (QA/QC) issues (EPA, 2006). The project goals are established to determine and evaluate the presence, nature, and extent of releases of contaminants at specified SWMUs. The type of data required to meet the project goals includes chemical analyses of soil and groundwater to determine if there has been a release of contaminants.

The quantity of data is location specific and is based on the historical operations at individual locations. Method detection limits should be 20% or less of the applicable background levels, cleanup standards and screening levels.

Additional DQOs include precision, accuracy, representativeness, completeness, and comparability. Precision is a measurement of the reproducibility of measurements under a given set of circumstances and is commonly stated in terms of standard deviation or coefficient of variation (EPA, 1987). Precision is also specific to sampling activities and analytical performance. Sampling precision will be evaluated through the analyses of duplicate field samples and laboratory replicates will be utilized to assess laboratory precision.

Accuracy is a measurement in the bias of a measurement system and may include many sources of potential error, including the sampling process, field contamination, preservation, handling, sample matrix, sample preparation, and analysis techniques (EPA, 1987). An evaluation of the accuracy will be performed by reviewing the results of field/trip blanks, matrix spikes, and laboratory QC samples.

Representativeness is an expression of the degree to which the data accurately and precisely represent the true environmental conditions. Sample locations and the number of samples have been selected to ensure the data is representative of actual environmental conditions. Based on SWMU specific conditions, this may include either biased (i.e., judgmental) locations/depths or unbiased (systematic grid samples) locations. In addition, sample collection techniques (e.g., field monitoring and decontamination of sampling equipment) will be utilized to help ensure representative results.

Completeness is defined as the percentage of measurements taken that are actually valid measurements, considering field QA and laboratory QC problems. EPA Contract Laboratory Program (CLP) data has been found to be 80-85% complete on a nationwide basis and this has been extrapolated to indicate that Level III, IV, and V analytical techniques will generate data that are approximately 80% complete (EPA, 1987). As an overall project goal, the completeness goal is 85%; however, some samples may be critical based on location or field screening results and thus a

sample-by-sample evaluation will be performed to determine if the completeness goals have been obtained.

Comparability is a qualitative parameter, which expresses the confidence with which one data set can be compared to another. Industry standard sample collection techniques and routine EPA analytical methods will be utilized to help ensure data are comparable to historical and future data. Analytical results will be reported in appropriate units for comparison to historical data and cleanup levels.

# Section 5
# References

EPA, 1987, Data Quality Objectives for Remedial Response Activities; United States Environmental Protection Agency, Office of Emergency and Remedial Response and Office of Waste Programs Enforcement, OSWER Directive 9355.0-7B, 85p.

EPA, 2006, Guidance on Systematic Planning Using the Data Quality Objectives Process, United States Environmental Protection Agency, Office of Environmental Information; EPA/240/B-06/001, p. 111.

Geoscience Consultants, Ltd, 1985a, Inventory of Solid Waste Management Units, June 14, 1985, p. 22.

Geoscience Consultants, Ltd, 1985b, Discharge Plan Application for Giant Refining Company Ciniza Refinery, Gallup New Mexico, November 21, 1985, p, 59.

NMED, 2017, Risk Assessment Guidance for Site Investigation and Remediation, New Mexico Environment Department.

Stone, W.J., Lyford, F.P., Frenzel, P.F., Mizel, N.H., and Padgett, E.T., 1983, Hydrogeology and Water Resources of San Juan Basin, New Mexico; Hydrogeologic Report 6, New Mexico Bureau of Mines and Mineral Resources, p. 70.

Western, 2009, Facility-wide Groundwater Monitoring Plan: Gallup Refinery, p. 97.

Western, 2013, Annual Ground Water Monitoring Report: Gallup Refinery - 2013, p. 225.

# Tables

TABLE 1 - SWM-2 and GWM-1 AREA WATER ANALYSES
Western Refining Southwest, Inc. - Gallup Refinery

| | | Benzene (mg/L) | Toluene (mg/L) | Ethyl Benzene (mg/L) | Total Xylenes (mg/L) | MTBE (mg/L) | Fluoride (mg/L) | Chloride (mg/L) | Bromide (mg/L) | Nitrite (mg/L) | Nitrate (mg/L) | Phosphorus (mg/L) | Sulfate (mg/L) | Calcium mg/l | Magnesium (mg/l) | Potassium (mg/l) | Sodium (mg/l) | DRO (mg/L) | GRO (mg/L) | MRO (mg/L) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **WQCC 20NMAC 6.2.3103** | | 0.01 | **0.75** | 0.75 | **0.62** | NE | **1.6** | **250.0** | NE | NE | **10** | NE | **600.0** | NE | NE | NE | NE | NE | NE | NE |
| **40 CFR 141.62 MCL (JAN 2015)** | | **0.005** | 1.0 | **0.7** | 10 | NE | NE | NE | NE | **1** | 10 | NE | NE | NE | NE | NE | NE | NE | NE | NE |
| **NMED Tap Water (MARCH 2017)** | | 0.00454 | 1.09 | 0.0149 | 0.193 | **0.143** | 1.2 | NE | NE | 1.97 | 31.6 | NE | NE | NE | NE | NE | NE | 0.0398 | 0.0398 | 0.0398 |
| **EPA RSL for Tap Water (JAN 2015)** | | 4.5E-04 | 0.11 | 0.0015 | 0.019 | 0.014 | 0.08 | NE | NE | 0.2 | 3.2 | NE | NE | NE | NE | NE | NE | NE | NE | NE |
| **Well ID** | **DATE SAMPLED** | | | | | | | | | | | | | | | | | | | |
| SMW-4 | 6/28/2017 | NA | NA | NA | NA | NA | 1.1 | 63 | 0.26 | NA | 0.21 | <1.2 | 180 | 4.5 | 1.2 | 0.52 | 310 | NA | NA | NA |
| | 9/9/2016 | <0.001 | <0.001 | <0.001 | <0.0015 | <0.001 | 1.0 | 53 | <1.0 | <1.0 | <0.5 | NA | 150 | NA | NA | NA | NA | <1.0 | 0.028 | <5.0 |
| | 8/14/2015 | <0.001 | <0.001 | <0.001 | <0.0015 | <0.001 | 1.0 | 55 | NA | <1.0 | <1.0 | NA | 160 | NA | NA | NA | NA | <1.0 | <0.05 | <5.0 |
| | 9/11/2014 | <0.001 | <0.001 | <0.001 | <0.0015 | <0.001 | 1.1 | 53 | NA | <1.0 | <1.0 | NA | 150 | NA | NA | NA | NA | <1.0 | <0.05 | <5.0 |
| | 9/9/2013 | <0.001 | <0.001 | <0.001 | <0.0015 | <0.001 | 0.93 | 59 | NA | <1.0 | <1.0 | NA | 170 | NA | NA | NA | NA | <1.0 | <0.05 | <5.0 |
| | 8/24/2012 | <0.001 | <0.001 | <0.001 | <0.0015 | <0.001 | 1.0 | 58 | NA | <1.0 | <1.0 | NA | 150 | NA | NA | NA | NA | <1.0 | <0.05 | <5.0 |
| | 10/10/2011 | <0.001 | <0.001 | <0.001 | <0.0015 | <0.001 | 1.1 | 58 | NA | **1.3** | 1.3 | NA | 170 | NA | NA | NA | NA | <1.0 | <0.05 | <5.0 |
| | 7/16/2010 | <0.001 | <0.001 | <0.001 | <0.0015 | <0.001 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | <1.0 | <0.05 | NA |
| | | | | | | | | | | | | | | | | | | | | |
| SMW-2 | 6/28/2017 | NA | NA | NA | NA | NA | <0.5 | **2600** | 2.8 | <0.26 | <0.26 | <5 | **1500** | 300 | 90 | 0.75 | 2300 | NA | NA | NA |
| | 9/9/2016 | <0.001 | <0.001 | <0.001 | <0.0015 | 0.013 | <0.1 | **2500** | <2.0 | <2.0 | <0.5 | NA | **1300** | NA | NA | NA | NA | <1.0 | 1.0 | <5.0 |
| | 8/17/2015 | <0.001 | <0.001 | <0.001 | <0.0015 | 0.011 | <2.0 | **3000** | NA | <4.0 | <4.0 | NA | **1600** | NA | NA | NA | NA | <1.0 | 0.78 | <5.0 |
| | 9/11/2014 | <0.001 | <0.001 | <0.001 | <0.0015 | 0.012 | <2.0 | **2500** | NA | <2.0 | <2.0 | NA | **1400** | NA | NA | NA | NA | <1.0 | 0.23 | <5.0 |
| | 9/9/2013 | NA | NA | NA | NA | NA | <0.1 | **2500** | NA | <4.0 | <4.0 | NA | **1500** | NA | NA | NA | NA | <1.0 | 0.15 | <5.0 |
| | 8/23/2012 | <0.01 | <0.01 | <0.01 | <0.015 | 0.012 | 0.16 | **2400** | NA | <2.0 | <2.0 | NA | **1600** | NA | NA | NA | NA | <1.0 | 0.28 | <5.0 |
| | 10/12/2011 | <0.001 | <0.001 | <0.001 | <0.0015 | 0.008 | 0.22 | **2600** | NA | <10 | <10 | NA | **1600** | NA | NA | NA | NA | <1.0 | 0.36 | <5.0 |
| | 7/16/2010 | <0.001 | <0.001 | <0.001 | <0.0015 | 0.009 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | <1.0 | <0.05 | NA |
| | | | | | | | | | | | | | | | | | | | | |
| OW-59 | 6/28/2017 | <0.001 | <0.001 | <0.001 | <0.0015 | 0.007 | <0.5 | **2000** | 4 | <2.0 | <2.0 | <10 | **3000** | NA | NA | NA | NA | 0.6 | 0.2 | <5 |
| | | | | | | | | | | | | | | | | | | | | |
| OW-60 | 6/28/2017 | <0.001 | 0.0002 | <0.001 | <0.0015 | 0.0009 | <0.5 | **1600** | 2.4 | NA | 3 | <2.5 | **740** | NA | NA | NA | NA | <1.0 | <0.05 | <5 |
| | | | | | | | | | | | | | | | | | | | | |
| STP1-NW | 6/2/2017 | <0.001 | <0.001 | <0.001 | <0.0015 | 0.00043J | <0.1 | **2100** | 4.2 | 24 | 24 | <0.5 | 140 | 88 | 12 | 4.9 | 1400 | <1.0 | <0.05 | <5.0 |
| | 10/29/2015 | <0.001 | <0.001 | <0.001 | <0.0015 | <0.001 | 0.26 | **2100** | 3.66 | **21** | **21** | <0.5 | 130 | NA | NA | NA | NA | <1.0 | <0.05 | <5.0 |
| | 8/11/2015 | <0.001 | <0.001 | <0.001 | <0.0015 | <0.001 | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | <1.0 | <0.05 | <5.0 |
| | 6/2/2015 | <0.001 | <0.001 | <0.001 | <0.0015 | <0.001 | <0.5 | **2100** | NA | **25** | **25** | NA | 130 | NA | NA | NA | NA | <1.0 | <0.05 | <5.0 |
| | 3/10/2015 | <0.001 | <0.001 | <0.001 | <0.0015 | <0.001 | <0.1 | **2400** | 3.9 | **22** | **22** | <0.5 | 150 | NA | NA | NA | NA | <1.0 | <0.05 | <5.0 |
| | 11/18/2014 | <0.001 | <0.001 | <0.001 | <0.0015 | <0.001 | 0.29 | **1800** | 2.8 | <2.0 | **18** | <0.5 | 120 | NA | NA | NA | NA | <1.0 | <0.05 | <5.0 |
| | 9/17/2014 | <0.001 | <0.001 | <0.001 | <0.0015 | <0.001 | 0.26 | **1800** | 3.1 | <2.0 | **18** | <0.5 | 120 | NA | NA | NA | NA | <1.0 | <0.05 | <5.0 |
| | 6/16/2014 | <0.001 | <0.001 | <0.001 | <0.0015 | <0.001 | 0.85 | **1000** | 2.2 | **15** | **15** | <0.5 | 160 | NA | NA | NA | NA | <1.0 | <0.05 | <5.0 |
| | | | | | | | | | | | | | | | | | | | | |
| GWM-1 | 10/29/2015 | NO SAMPLES COLLECTED - HAS AN SPH LEVEL | | | | | | | | | | | | | | | | | | |
| | 9/23/2015 [1] | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | NA | 68 | <2.5 | 18 |
| | 8/24/2015 | **0.009** | 0.033 | 0.011 | 0.11 | 0.04 | **2.6** | **1100** | NA | <1.0 | <1.0 | NA | NA | NA | NA | NA | NA | 250 | 1.2 | <50 |
| | 6/2/2015 | **0.012** | 0.003 | 0.006 | 0.024 | 0.051 | **2.7** | **1100** | NA | <2.0 | <2.0 | NA | NA | NA | NA | NA | NA | 1.7 | NA | <5.0 |
| | 3/10/2015 | **0.011** | 0.002 | 0.005 | 0.021 | 0.049 | **2.2** | **1000** | NA | <0.5 | <0.5 | NA | NA | NA | NA | NA | NA | 2.4 | 0.49 | <5.0 |
| | 11/13/2014 | **0.012** | <0.005 | 0.006 | 0.023 | 0.05 | **1.8** | **1000** | NA | <1.0 | <1.0 | NA | NA | NA | NA | NA | NA | 2.3 | 0.5 | <5.0 |
| | 9/12/2014 | **0.010** | 0.003 | 0.004 | 0.016 | 0.041 | **2.4** | **910** | NA | <1.0 | <1.0 | NA | NA | NA | NA | NA | NA | 2.1 | 0.51 | <5.0 |
| | 6/5/2014 | **0.011** | 0.002 | 0.005 | 0.019 | 0.051 | **2.2** | **890** | NA | <1.0 | <1.0 | NA | NA | NA | NA | NA | NA | 3.4 | 0.56 | <5.0 |
| | 3/11/2014 | **0.009** | 0.002 | 0.004 | 0.015 | 0.039 | **2.6** | **930** | NA | <1.0 | <1.0 | NA | NA | NA | NA | NA | NA | 3.3 | 0.66 | <5.0 |
| | 11/11/2013 | **0.008** | 0.002 | 0.004 | 0.014 | 0.039 | **2.3** | **1000** | NA | **4.1** | 4.1 | NA | NA | NA | NA | NA | NA | 7.1 | 0.49 | NA |
| | | | | | | | | | | | | | | | | | | | | |
| Evap. Pond 2 | 6/28/2017 | NA | NA | NA | NA | NA | **18** | **5000** | 1.9 | NA | 1.1 | <2.5 | **1400** | 410 | 100 | 140 | 3100 | NA | NA | NA |
| Evap. Pond 3 | 6/28/2017 | NA | NA | NA | NA | NA | **16** | **7100** | 2.3 | NA | 1.1 | <2.5 | **1800** | 540 | 150 | 230 | 4300 | NA | NA | NA |

1 - SPH found in well

TABLE 2 - FLUID LEVEL MEASUREMENTS
Western Refining Southwest, Inc. - Gallup Refinery

| Date of Installation | Well ID Number | Inspection or Sample Date | Casing Diameter (Inch) | Ground Level Elevations (ft) | Well Casing Rim Elevations (ft) | Stick-up length (ft) | Well Casing Bottom Elevation (ft) | Total Well Depth ft) | Depth to SPH (ft) | SPH Column Thickness (ft) | Depth to Water (ft) | Ground water Elevation (ft) | Corrected Water Table Elevation (Factor 0.8) (ft) | Screened Interval Depth Top to Bottom (ft) | Stratigraphic unit in which screen exists |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10/15/2003 | BW-3B | 09/13/17 | 2.00 | 6,876.16 | 6,878.59 | 2.43 | 6,809.19 | 69.40 | N/A | N/A | 33.38 | 6,845.21 | N/A | 63 - 73 | Chinle/Alluvium Interface |
| 10/14/1981 | MW-1 | 09/20/17 | 5.00 | 6,876.63 | 6,878.12 | 1.49 | 6,747.29 | 130.83 | N/A | N/A | 7.02 | 6,871.10 | N/A | 117.72 - 127.72 | Sonsela Sandstone |
| 10/15/1981 | MW-2 | 09/20/17 | 5.00 | 6,878.39 | 6,880.30 | 1.91 | 6,742.82 | 137.48 | N/A | N/A | 15.64 | 6,864.66 | N/A | 112 - 122 | Sonsela Sandstone |
| 10/16/1981 | MW-4 | 09/21/17 | 5.00 | 6,879.89 | 6,881.63 | 1.74 | 6,759.91 | 121.72 | N/A | N/A | 7.56 | 6,874.07 | N/A | 101 - 121 | Sonsela Sandstone |
| 7/21/1986 | MW-5 | 09/11/17 | 4.00 | 6,880.20 | 6,882.83 | 2.63 | 6,752.00 | 130.83 | N/A | N/A | 11.22 | 6,871.61 | N/A | 115 - 125 | Sonsela Sandstone |
| 9/26/1985 | SMW-2 | 09/11/17 | 2.00 | 6,881.63 | 6,883.97 | 2.34 | 6,831.17 | 52.80 | N/A | N/A | 24.79 | 6,859.18 | N/A | 34.31 - 54.31 | Chinle/Alluvium Interface |
| 9/25/1985 | SMW-4 | 09/11/17 | 2.00 | 6,877.63 | 6,879.52 | 1.89 | 6,809.84 | 69.68 | N/A | N/A | 29.33 | 6,850.19 | N/A | 51.7 - 71.7 | Chinle/Alluvium Interface |
| 7/8/2004 | GWM-1 | 03/16/17 | 2.00 | 6,910.22 | 6,912.61 | 2.39 | 6,886.41 | 26.20 | 21.74 | 0.30 | 22.04 | 6,890.57 | 6890.81 | 17.5 - 23.5 | Chinle/Alluvium Interface |
| | | 06/02/17 | 2.00 | 6,910.22 | 6,912.61 | 2.39 | 6,886.41 | 26.20 | 21.54 | 0.44 | 21.98 | 6,890.63 | 6890.98 | 17.5 - 23.5 | Chinle/Alluvium Interface |
| | | 09/08/17 | 2.00 | 6,910.22 | 6,912.61 | 2.39 | 6,886.41 | 26.20 | 21.49 | 0.22 | 21.71 | 6,890.90 | 6891.08 | 17.5 - 23.5 | Chinle/Alluvium Interface |
| | | 12/04/17 | 2.00 | 6,910.22 | 6,912.61 | 2.39 | 6,886.41 | 26.20 | 19.70 | 1.00 | 20.70 | 6,891.91 | 6892.71 | 17.5 - 23.5 | Chinle/Alluvium Interface |
| 9/25/2005 | GWM-2 | 03/16/17 | 2.00 | 6,910.32 | 6,913.09 | 2.77 | 6,894.28 | 18.81 | N/A | N/A | DRY | DRY | N/A | 3.2 - 16.2 | Chinle/Alluvium Interface |
| | | 06/02/17 | 2.00 | 6,910.32 | 6,913.09 | 2.77 | 6,894.28 | 18.81 | N/A | N/A | DRY | DRY | N/A | 3.2 - 16.2 | Chinle/Alluvium Interface |
| | | 09/05/17 | 2.00 | 6,910.32 | 6,913.09 | 2.77 | 6,894.28 | 18.81 | N/A | N/A | DRY | DRY | N/A | 3.2 - 16.2 | Chinle/Alluvium Interface |
| | | 12/04/17 | 2.00 | 6,910.32 | 6,913.09 | 2.77 | 6,894.28 | 18.81 | N/A | N/A | DRY | DRY | N/A | 3.2 - 16.2 | Chinle/Alluvium Interface |
| 9/25/2005 | GWM-3 | 03/16/17 | 2.00 | 6,907.35 | 6,910.25 | 2.90 | 6,892.45 | 17.80 | N/A | N/A | DRY | DRY | N/A | 3 - 15 | Chinle/Alluvium Interface |
| | | 06/02/17 | 2.00 | 6,907.35 | 6,910.25 | 2.90 | 6,892.45 | 17.80 | N/A | N/A | DRY | DRY | N/A | 3 - 15 | Chinle/Alluvium Interface |
| | | 09/05/17 | 2.00 | 6,907.35 | 6,910.25 | 2.90 | 6,892.45 | 17.80 | N/A | N/A | DRY | DRY | N/A | 3 - 15 | Chinle/Alluvium Interface |
| | | 12/04/17 | 2.00 | 6,907.35 | 6,910.25 | 2.90 | 6,892.45 | 17.80 | N/A | N/A | DRY | DRY | N/A | 3 - 15 | Chinle/Alluvium Interface |
| 5/6/2014 | STP1-NW | 02/21/17 | 2.00 | 6,904.50 | 6,904.47 | -0.03 | 6,854.47 | 50.00 | N/A | N/A | 20.47 | 6,884.00 | N/A | 20 - 50 | Chinle/Alluvium Interface |
| | | 06/02/17 | 2.00 | 6,904.50 | 6,904.47 | -0.03 | 6,854.47 | 50.00 | N/A | N/A | 20.66 | 6,883.81 | N/A | 20 - 50 | Chinle/Alluvium Interface |
| | | 09/05/17 | 2.00 | 6,904.50 | 6,904.47 | -0.03 | 6,854.47 | 50.00 | N/A | N/A | 20.81 | 6,883.66 | N/A | 20 - 50 | Chinle/Alluvium Interface |
| | | 12/04/17 | 2.00 | 6,904.50 | 6,904.47 | -0.03 | 6,854.47 | 49.74 | N/A | N/A | 20.55 | 6,883.92 | N/A | 20 - 50 | Chinle/Alluvium Interface |
| 5/6/2014 | STP1-SW | 02/21/17 | 2.00 | 6,912.40 | 6,912.38 | -0.02 | 6,880.38 | 29.10 | N/A | N/A | DRY | N/A | N/A | 15 - 30 | Chinle/Alluvium Interface |
| | | 06/02/17 | 2.00 | 6,912.40 | 6,912.38 | -0.02 | 6,880.38 | 29.10 | N/A | N/A | NA | N/A | N/A | 15 - 30 | Chinle/Alluvium Interface |
| | | 09/05/17 | 2.00 | 6,912.40 | 6,912.38 | -0.02 | 6,880.38 | 29.10 | N/A | N/A | DRY | N/A | N/A | 15 - 30 | Chinle/Alluvium Interface |
| | | 12/04/17 | 2.00 | 6,912.40 | 6,912.38 | -0.02 | 6,880.38 | 29.10 | N/A | N/A | N/A | N/A | N/A | 15 - 30 | Chinle/Alluvium Interface |
| 6/29/2017 | OW-59 | 09/21/17 | 2.00 | 6,887.63 | 6,889.73 | 2.10 | 6,925.93 | 38.30 | N/A | N/A | 24.30 | 6,865.43 | N/A | 20 - 35 | Chinle/Alluvium Interface |
| | | 12/05/17 | 2.00 | 6,887.63 | 6,889.73 | 2.10 | 6,926.13 | 38.50 | N/A | N/A | 24.30 | 6,865.43 | N/A | 20 - 35 | Chinle/Alluvium Interface |

TABLE 2 - FLUID LEVEL MEASUREMENTS
Western Refining Southwest, Inc. - Gallup Refinery

| Date of Installation | Well ID Number | Inspection or Sample Date | Casing Diameter (Inch) | Ground Level Elevations (ft) | Well Casing Rim Elevations (ft) | Stick-up length (ft) | Well Casing Bottom Elevation (ft) | Total Well Depth ft) | Depth to SPH (ft) | SPH Column Thickness (ft) | Depth to Water (ft) | Ground water Elevation (ft) | Corrected Water Table Elevation (Factor 0.8) (ft) | Screened Interval Depth Top to Bottom (ft) | Stratigraphic unit in which screen exists |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6/29/2017 | OW-60 | 09/21/17 | 2.00 | 6,891.06 | 6,893.51 | 2.45 | 6,936.61 | 45.55 | N/A | N/A | 16.45 | 6,877.06 | N/A | 25 - 45 | Chinle/Alluvium Interface |
| | | 12/05/17 | 2.00 | 6,891.06 | 6,893.51 | 2.45 | 6,936.76 | 45.70 | N/A | N/A | 16.40 | 6,877.11 | N/A | 25 - 45 | Chinle/Alluvium Interface |
| 04/01/14 | MKTF-30 | 03/06/17 | 2.00 | 6,898.10 | 6,900.80 | 2.70 | 6,877.60 | 23.20 | ND | NA | 14.13 | 6,886.67 | NA | 10 - 20 | Chinle/Alluvium Interface |
| | | 06/05/17 | 2.00 | 6,898.10 | 6,900.80 | 2.70 | 6,877.60 | 23.20 | ND | NA | 13.87 | 6,886.93 | NA | 10 - 20 | Chinle/Alluvium Interface |
| | | 10/03/17 | 2.00 | 6,898.10 | 6,900.80 | 2.70 | 6,877.60 | 23.20 | ND | NA | 15.03 | 6,885.77 | NA | 10 - 20 | Chinle/Alluvium Interface |
| | | 11/20/17 | 2.00 | 6,898.10 | 6,900.80 | 2.70 | 6,877.61 | 23.19 | ND | NA | 14.91 | 6,885.89 | NA | 10 - 20 | Chinle/Alluvium Interface |
| 11/13/14 | MKTF-40 | 03/07/17 | 2.00 | 6,891.35 | 6,894.33 | 2.98 | 6,870.69 | 23.64 | ND | NA | 13.14 | 6,881.19 | NA | 5 - 20 | Chinle/Alluvium Interface |
| | | 06/05/17 | 2.00 | 6,891.35 | 6,894.33 | 2.98 | 6,870.69 | 23.64 | ND | NA | 13.29 | 6,881.04 | NA | 5 - 20 | Chinle/Alluvium Interface |
| | | 09/25/17 | 2.00 | 6,891.35 | 6,894.33 | 2.98 | 6,870.69 | 23.64 | ND | NA | 13.28 | 6,881.05 | NA | 5 - 20 | Chinle/Alluvium Interface |
| | | 11/21/17 | 2.00 | 6,891.35 | 6,894.33 | 2.98 | 6,870.71 | 23.62 | ND | NA | 13.71 | 6,880.62 | NA | 5 - 20 | Chinle/Alluvium Interface |

**DEFINITIONS:**

DTB - Depth to Bottom
DTW - Depth to Water
SPH = Separate Phase Hydrocarbons
* Wells also checked for Artesian flow conditions.

N/A = Not Available NS = Not Surveyed
Negative number in Stick up Length column indicates well is flushmount and located at or below ground level.
Depth to Water Column - if 0.00 is indicated - means water is at top of casing (full) under artesian flow conditions.
Dry indicates no water was detected.

# Figures

Map Source: DeLorme Street Atlas USA 2007 Plus.

N

0 5
SCALE IN MILES

WESTERN REFINING
GALLUP REFINERY

Mexican Springs
Coyote Canyon
Defiance
Window Rock
Window Rock
Michaels
Gamerco
Gallup
Rehoboth
Church Rock Village
Mentmore
Gallup Municipal
Fort Wingate
Crownpoint
Crownpoint
Smith Lake
Continental Divide
Thoreau
Prewitt
Lupton
Vanderwagen
Bluewater Lake
Bluewater
Mt Sedgwick
Grants-Milan
Ramah

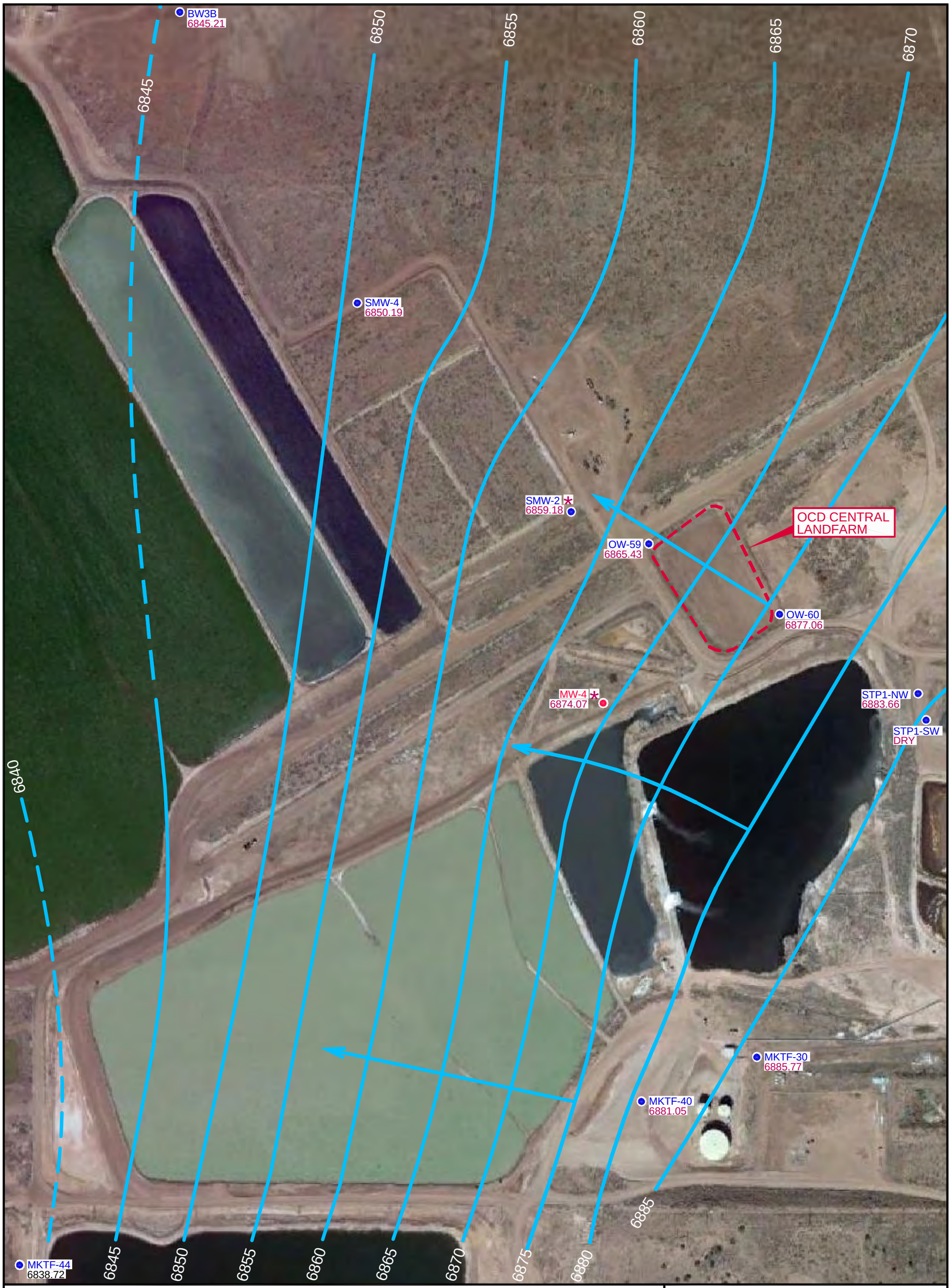
491
371
57
66
40
602
564
118
53
412

**Western Refining**
GALLUP REFINERY

PROJ. NO.: Western Refining | DATE:07/13/14 | FILE:WestRef-B198

FIGURE 1
SITE LOCATION MAP
GALLUP REFINERY

DiSorbo
Environmental Consulting Firm
8501 N. MoPac Expy.
Suite 300
Austin, Texas 78759




Aerial Map Source: Google Map, 03/18/2016.

LEGEND

MKTF-40 — MONITORING WELL LOCATION (CHINLE / ALLUVIAL) AND IDENTIFICATION NUMBER

MW-04 — MONITORING WELL LOCATION (SONSELA) AND IDENTIFICATION NUMBER

6860 — POTENTIOMETRIC CONTOUR (FT) (5 FT INTERVAL)

GROUNDWATER FLOW DIRECTION

6881.05 — WATER LEVEL ELEVATION MEASURED SEPT. 2017 (ABOVE MSL)

* DATA NOT USED IN CONTOURS

N

0 250

SCALE IN FEET

NEW MEXICO

SITE LOCATION

Western Refining
GALLUP REFINERY

PROJ. NO.:Western Refining | DATE:08/19/18 | FILE:WestRef-dB178

FIGURE 2
CHINLE / ALLUVIUM INTERFACE
POTENTIOMETRIC MAP
SEPTEMBER 2017

DiSorbo
Environmental Consulting Firm
8501 N. MoPac Expy.
Suite 300
Austin, Texas 78759


Aerial Map Source: Google Map, 03/18/2016.

N

0 300

SCALE IN FEET

LEGEND

SMW-2 MONITORING WELL LOCATION (CHINLE / ALLUVIAL) AND IDENTIFICATION NUMBER

MW-4 MONITORING WELL LOCATION (SONSELA) AND IDENTIFICATION NUMBER

2,000 CHLORIDE CONCENTRATION (mg/L)
3,000 SULFATE CONCENTRATION (mg/L)

NA NOT ANALYZED

ANALYSIS FROM JUNE 2017
EXCEPT GWM-1 (AUGUST 2017)

NEW MEXICO

SITE LOCATION

Western Refining
GALLUP REFINERY

PROJ. NO.:Western Refining | DATE:08/18/18 | FILE:WestRef-dA146

FIGURE 3

SULFATE AND CHLORIDE CONCENTRATIONS

DiSorbo
Environmental Consulting Firm
8501 N. MoPac Expy.
Suite 300
Austin, Texas 78759


Aerial Map Source: Google Map, 03/18/2016.

0 300
SCALE IN FEET

LEGEND

PROPOSED MONITORING WELL LOCATION

SMW-2 MONITORING WELL LOCATION (CHINLE / ALLUVIAL) AND IDENTIFICATION NUMBER

MW-4 MONITORING WELL LOCATION (SONSELA) AND IDENTIFICATION NUMBER

NEW MEXICO

SITE LOCATION

Western Refining
GALLUP REFINERY

PROJ. NO.:Western Refining | DATE:08/18/18 | FILE:WestRef-dA147

FIGURE 4

PROPOSED
MONITORING WELL LOCATIONS

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Environmental Consulting Firm
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Suite 300
Austin, Texas 78759

# Appendix A

# Boring Logs

Sheet: 1 OF 2
Bore Point: SW corner of Pond 1

Precision Engineering, Inc.
P.O. Box 422
Las Cruces, NM 88004
505-523-7674

File #: 03-118
Site: Ciniza
Boundry Wells

Water Elevation: Not Encountered
Boring No.: GWM-1

Log of Test Borings

Elevation: TBD
Date: 7/8/2004

| LAB # | DEPTH | BLOW COUNT | PLOT | SCALE | MATERIAL CHARACTERISTICS (MOISTURE, CONDITION, COLOR,ETC.) | %M | LL | PI | CLASS. |
|---|---|---|---|---|---|---|---|---|---|
| | 0-1.5 | | o/o/o/o/<br>o/o/o/o/<br>o/o/o/o/ | | Clay, gravelly, red-brown, wet | | | | |
| | 1.5-20.0 | | ////////// | | Clay, red-brown, wet | | | | |
| | | | ////////// | 2.5 | | | | | |
| | | | ////////// | | | | | | |
| | | | ////////// | | | | | | |
| | | | ////////// | | | | | | |
| | | | ////////// | 5.0 | | | | | |
| | | | ////////// | | | | | | |
| | | | ////////// | | | | | | |
| | | | ////////// | | | | | | |
| | | | ////////// | | | | | | |
| | | | ////////// | 7.5 | | | | | |
| | | | ////////// | | | | | | |
| | | | ////////// | | | | | | |
| | | | ////////// | | | | | | |
| | | | ////////// | | | | | | |
| | | | ////////// | 10.0 | | | | | |
| | | | ////////// | | | | | | |
| | | | ////////// | | | | | | |
| | | | ////////// | | | | | | |
| | | | ////////// | | | | | | |
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| | | | ////////// | | | | | | |
| | | | ////////// | | | | | | |
| | | | ////////// | | | | | | |
| | | | ////////// | 15.0 | | | | | |
| | | | ////////// | | | | | | |
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| | | | ////////// | | | | | | |
| | | | ////////// | | | | | | |
| | | | ////////// | | | | | | |
| | | | ////////// | 20.0 | | | | | |
| | 20-21.5 | | ////////// | | Clay, black, wet, | | | | |
| | | | ////////// | | | | | | |
| | | | ////////// | | | | | | |

SIZE & TYPE OF BORING: 4-1/4" ID Hollow Stemmed Auger — LOGGED BY: NS

C:\unzipped\Boundry Well Locations\[GWM-1.xls]Sheet1

Sheet: 2 OF 2
Bore Point: SW corner of Pond 1

Precision Engineering, Inc.
P.O. Box 422
Las Cruces, NM 88004
505-523-7674

File #: 03-118
Site: Ciniza
Boundry Wells

Water Elevation: Not Encountered
Boring No.: GWM-1

Log of Test Borings

Elevation: TBD
Date: 7/8/2004

| LAB # | DEPTH | BLOW COUNT | PLOT | SCALE | MATERIAL CHARACTERISTICS (MOISTURE, CONDITION, COLOR,ETC.) | %M | LL | PI | CLASS. |
|---|---|---|---|---|---|---|---|---|---|
| | 21.5-24.0 | | ////////// ////////// | 22.0 | Sand, gravelly | | | | |
| | 22.5-24.0 | | ////////// ////////// ////////// | | Petrified Forest Formation, Painted Desert Member, Mudstone, weathered, red-purple, reduction spots, hard, moist, blocky/crumbly | | | | |
| | 24.0 | | | 25.0 | T.D. | | | | |
| | | | | | Screened interval 18-24' | | | | |
| | | | | 30.0 | | | | | |
| | | | | 35.0 | | | | | |
| | | | | 40.0 | | | | | |
| | | | | | Clay, black, wet, | | | | |

should be 22.5'

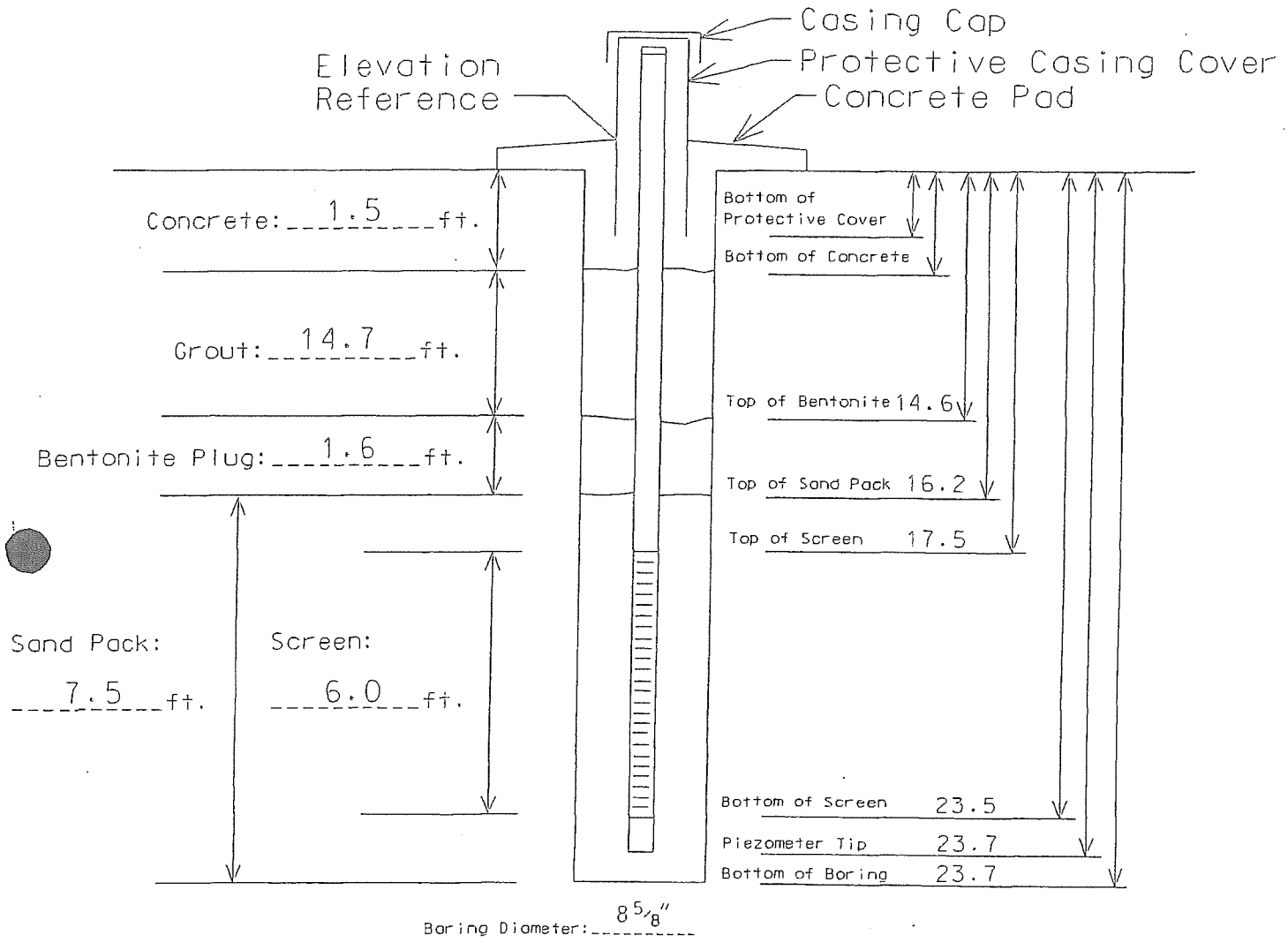
SIZE & TYPE OF BORING: 4-1/4" ID Hollow Stemmed Auger LOGGED BY: NS

PRECISION ENGINEERING, INC.

505-523-7674

# Installation Diagram

## Monitoring Well No. GWM-1




Boring Diameter: 8 5/8"

Sand Type: 20-40 SILICA

Bollards, Type/Size: NONE INSTALLED

Bentonite: 3/8" CHIPS

Screen Type/Size: 2", #10 SLOT, SCH 40 PVC

Cement/Grout: 6% BENTONITE/CEMENT

Riser Type/Size: 2", SCH 40 PVC

Water: NONE

Locking Expandable Casing Plug? YES

Site Northing: TBD

Other: ---

Bottom Cap Used? YES

Site Easting: TBD

Project #: 03-118

Project Name: POND 1 GROUNDWATER OBSERVATION

Elevation: TBD

DiSorbo
Environmental Consulting Firm

Western Refining SW, Inc
Gallup Refinery
Job No. WEST17020

| | |
|---|---|
| Geologist | : Tracy Payne |
| Driller | : Enviro-Drill Inc/Cohagan |
| Drilling Rig | : CME75 |
| Drilling Method | : Hollow Stem Auger 7 1/4" |
| Sampling Method | : 2' Split Spoon |
| Comments | : Hand Auger to 5 BGL |
| Total Depth | : 40' |
| Ground Water | : 26' |
| Start Date | : 06/12/2017 |
| Finish Date | : 06/12/2017 |

# WELL NO. OW-59

(Sheet 1 of 3)

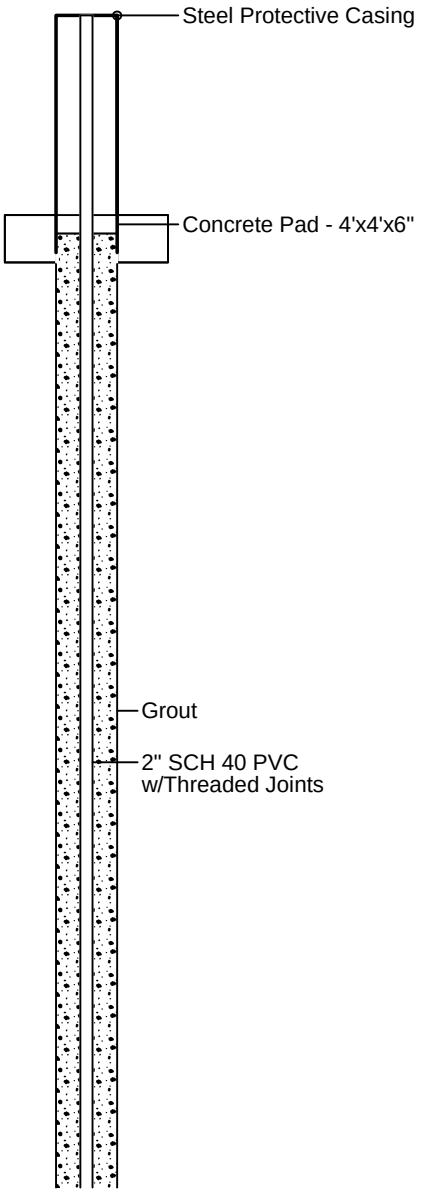
| | |
|---|---|
| Elev., TOC (ft.msl) | : 6689.73 |
| Elev., PAD (ft. msl) | : 6887.63 |
| Elev., GL (ft. msl) | : |
| Site Coordinates | : |
| N | : N1635547.14 |
| E | : W2544633.00 |

Saturation
▼ Saturation

| Depth (ft.) | PID (ppm) | Saturation | Lithology | USCS | Recovery (%) | Sample | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| 0 | 0.0 | | | CL | 100 | | SILTY CLAY, low, firm, damp, brown, no odor, |
| 2 | 0.0 | | | CL | 100 | | SILTY CLAY, SIMILAR TO ABOVE (STA), |
| 4 | 0.0 | | | CL | 100 | | SILTY CLAY, STA, |
| 6 | 2.0 | | | CH | 70 | | CLAY, high, stiff, damp, brown, no odor, |
| 8 | 1.0 | | | CL | 80 | | SILTY CLAY, low, stiff, damp, light brown, no odor, sandy at base, |
| 10 | 0.3 | | | ML | 70 | | SILT, low, compact, damp, brown, no odor, |
| 12 | 0.5 | | | CL | | | SILTY CLAY, low, very stiff, damp, brown, no odor, trace sand, |

## Completion Results

Well No. OW-59





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03-29-2018 C:\Users\cholmes\Documents\M-Tech\samples\Western Refinery\Evaporation Pond\OW-59.boi

DiSorbo
Environmental Consulting Firm

Western Refining SW, Inc
Gallup Refinery
Job No. WEST17020

| | |
|---|---|
| Geologist | : Tracy Payne |
| Driller | : Enviro-Drill Inc/Cohagan |
| Drilling Rig | : CME75 |
| Drilling Method | : Hollow Stem Auger 7 1/4" |
| Sampling Method | : 2' Split Spoon |
| Comments | : Hand Auger to 5 BGL |
| Total Depth | : 40' |
| Ground Water | : 26' |
| Start Date | : 06/12/2017 |
| Finish Date | : 06/12/2017 |

# WELL NO. OW-59

(Sheet 2 of 3)

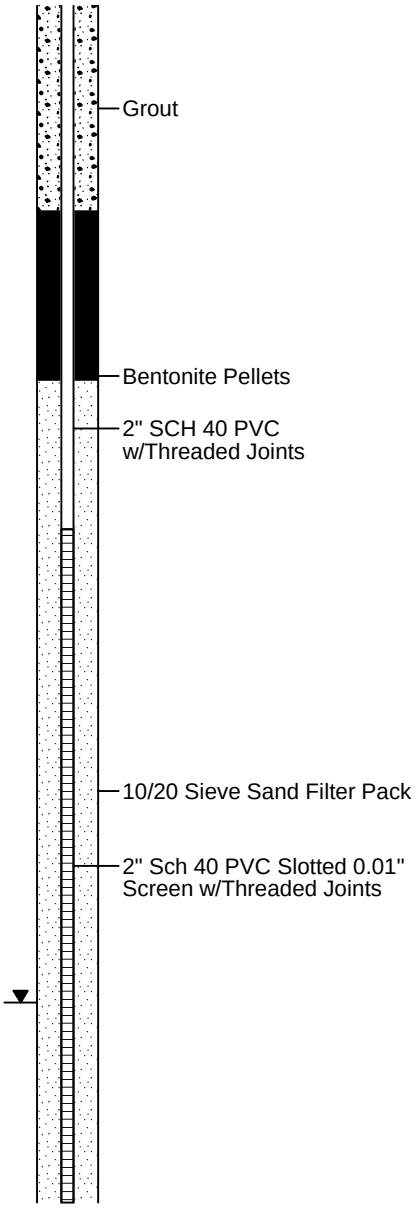
| | |
|---|---|
| Elev., TOC (ft.msl) | : 6689.73 |
| Elev., PAD (ft. msl) | : 6887.63 |
| Elev., GL (ft. msl) | : |
| Site Coordinates | : |
| N | : N1635547.14 |
| E | : W2544633.00 |

| Depth (ft.) | PID (ppm) | Saturation | Lithology | USCS | Recovery (%) | Sample | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| 13 | 0.5 | | | CL | 50 | | |
| 14 | | | | | | | SILTY CLAY, high, very stiff, damp, brown, no odor, |
| 15 | 1.3 | | | CH | 50 | | |
| 16 | | | | | | | SILTY CLAY, STA, no odor, |
| 17 | 1.7 | | | CH | 60 | | |
| 18 | | | | | | | SILTY CLAY, low to moderate, stiff, damp, brown, no odor, |
| 19 | 1.1 | | | CL | 50 | | |
| 20 | | | | | | | SANDY SILTY CLAY, low, firm to soft, damp, brown, no odor, |
| 21 | 1.2 | | | CL | 50 | | |
| 22 | | | | | | | SANDY CLAY, low, soft, damp, brown, no odor, |
| 23 | 0.2 | | | CL | 60 | | |
| 24 | | | | | | | SILTY CLAY, low, soft, damp, brown, no odor, |
| 25 | 3.3 | | | CL | 70 | | |
| 26 | | ▼ | | | | | SANDY SILT, very fine, very moist, brown, no odor, |
| 27 | 10.9 | | | ML | 80 | | |
| 28 | | | | | | | SANDY SILT, STA, very moist, no odor, |
| 29 | 11.6 | | | ML | | | |

Saturation
▼ Saturation

## Completion Results

Well No. OW-59





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DiSorbo Consulting, LLC

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Austin, Texas 78759
512-693-4190


03-29-2018 C:\Users\cholmes\Documents\M-Tech\samples\Western Refinery\Evaporation Pond\OW-59.bor

DiSorbo
Environmental Consulting Firm

Western Refining SW, Inc
Gallup Refinery
Job No. WEST17020

| | |
|---|---|
| Geologist | : Tracy Payne |
| Driller | : Enviro-Drill Inc/Cohagan |
| Drilling Rig | : CME75 |
| Drilling Method | : Hollow Stem Auger 7 1/4" |
| Sampling Method | : 2' Split Spoon |
| Comments | : Hand Auger to 5 BGL |
| Total Depth | : 40' |
| Ground Water | : 26' |
| Start Date | : 06/12/2017 |
| Finish Date | : 06/12/2017 |

# WELL NO. OW-59

(Sheet 3 of 3)

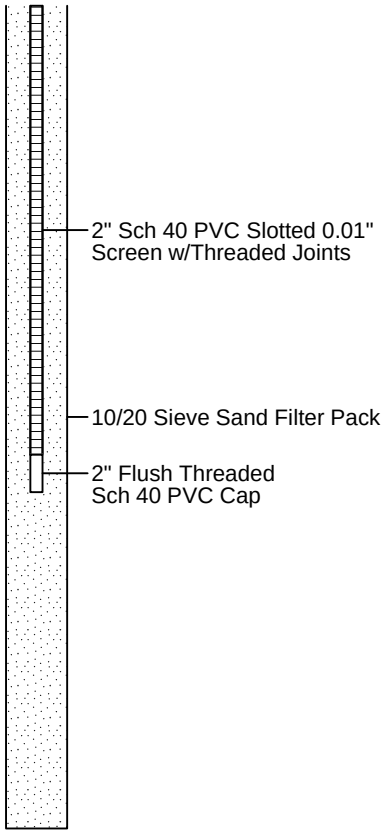
| | |
|---|---|
| Elev., TOC (ft.msl) | : 6689.73 |
| Elev., PAD (ft. msl) | : 6887.63 |
| Elev., GL (ft. msl) | : |
| Site Coordinates | : |
| N | : N1635547.14 |
| E | : W2544633.00 |

| Depth (ft.) | PID (ppm) | Saturation | Lithology | USCS | Recovery (%) | Sample | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| 29 | 11.6 | | | ML | 80 | | |
| 30 | | | | | | | SILTY CLAY, low, firm, damp, brown, no odor, |
| 31 | 11.4 | | | CL | 90 | | |
| 32 | 14.9 | | | CL | 90 | | SILTY CLAY, STA, no odor, |
| 33 | 16.3 | | | SM | 90 | | SILTY SAND, very fine, compact, saturated, brown, no odor, |
| 34 | | | | | | | SILTY CLAY, low, firm, damp, brown, no odor, |
| 35 | 10.5 | | | CL | 60 | | |
| 36 | | | | | | | SILTY CLAY, STA, no odor, |
| 37 | 7.3 | | | CL | 70 | | |
| 38 | | | | CH | 70 | | CLAY, high, firm, damp, brown, no odor, |
| 39 | 10.0 | | | CL | 70 | | SILTY CLAY, low, firm to soft, grey and white, no odor, trace sand and white nodules. |
| 40 | | | | | | | |
| 41 | | | | | | | |
| 42 | | | | | | | |
| 43 | | | | | | | |
| 44 | | | | | | | |
| 45 | | | | | | | |

Saturation
▼ Saturation

## Completion Results

Well No. OW-59





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DiSorbo
Environmental Consulting Firm

Western Refining SW, Inc
Gallup Refinery
Job No. WEST17020

| | |
|---|---|
| Geologist | : Tracy Payne |
| Driller | : Enviro-Drill Inc/Cohagan |
| Drilling Rig | : CME75 |
| Drilling Method | : Hollow Stem Auger 7 1/4" |
| Sampling Method | : 2' Split Spoon |
| Comments | : Hand Auger to 5' BGL |
| Total Depth | : 48' |
| Ground Water | : Not Encountered |
| Start Date | : 6/13/2017 |
| Finish Date | : 6/13/2017 |

# WELL NO. OW-60

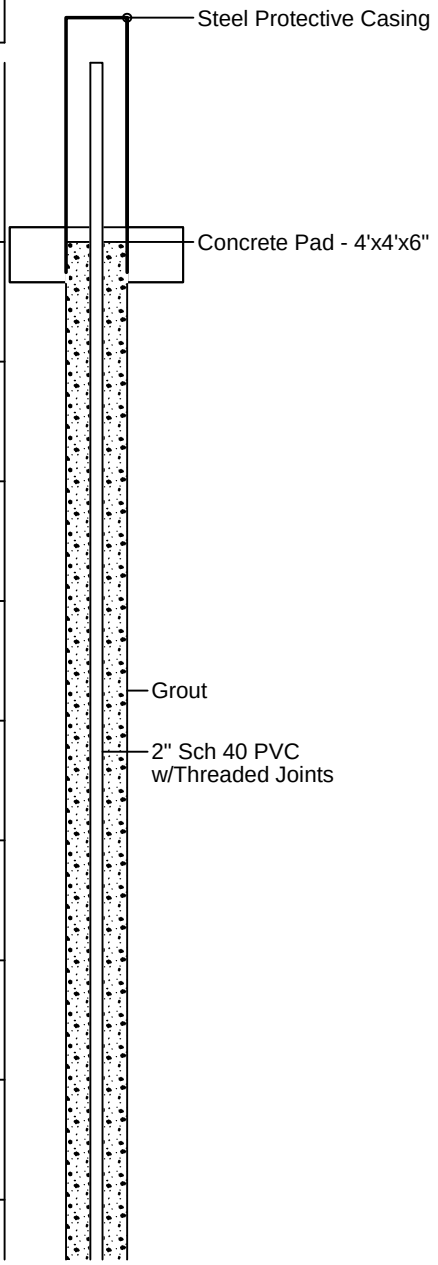
(Sheet 1 of 3)

| | |
|---|---|
| Elev., TOC (ft.msl) | : 6893.51 |
| Elev., PAD (ft. msl) | : 6891.06 |
| Elev., GL (ft. msl) | : |
| Site Coordinates | : |
| N | : N1635335.02 |
| E | : W2545018.21 |

| Depth (ft.) | PID (ppm) | Saturation | Lithology | USCS | Recovery (%) | Sample | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| 0 | | | | | | | SILTY CLAY, low, firm, damp, brown, no odor, |
| 1 | 6.5 | | | CL | 100 | | |
| 2 | | | | | | | CLAY, high, firm to stiff, damp, brown, no odor, |
| 3 | 5.8 | | | CH | 100 | | |
| 4 | | | | | | | CLAY, SIMILAR TO ABOVE (STA), no odor, |
| 5 | 6.3 | | | CH | 100 | | |
| 6 | | | | | | | CLAY, STA, no odor, |
| 7 | 8.1 | | | CH | 90 | | |
| 8 | | | | | | | CLAY, STA, no odor, |
| 9 | 9.6 | | | CH | 100 | | |
| 10 | | | | | | | SILTY CLAY, moderate, firm, damp, brown, no odor, |
| 11 | 9.1 | | | CL | 50 | | |
| 12 | | | | | | | SILTY CLAY, STA, soft, no odor, |
| 13 | 8.2 | | | CL | 50 | | |
| 14 | | | | | | | SILTY CLAY, STA, firm, no odor, |
| 15 | 7.9 | | | CL | 70 | | |
| 16 | | | | | | | SILTY CLAY, STA, no odor, |
| 17 | 8.3 | | | CL | | | |

## Completion Results

Well No. OW-60





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DiSorbo
Environmental Consulting Firm

Western Refining SW, Inc
Gallup Refinery
Job No. WEST17020

| | |
|---|---|
| Geologist | : Tracy Payne |
| Driller | : Enviro-Drill Inc/Cohagan |
| Drilling Rig | : CME75 |
| Drilling Method | : Hollow Stem Auger 7 1/4" |
| Sampling Method | : 2' Split Spoon |
| Comments | : Hand Auger to 5' BGL |
| Total Depth | : 48' |
| Ground Water | : Not Encountered |
| Start Date | : 6/13/2017 |
| Finish Date | : 6/13/2017 |

# WELL NO. OW-60

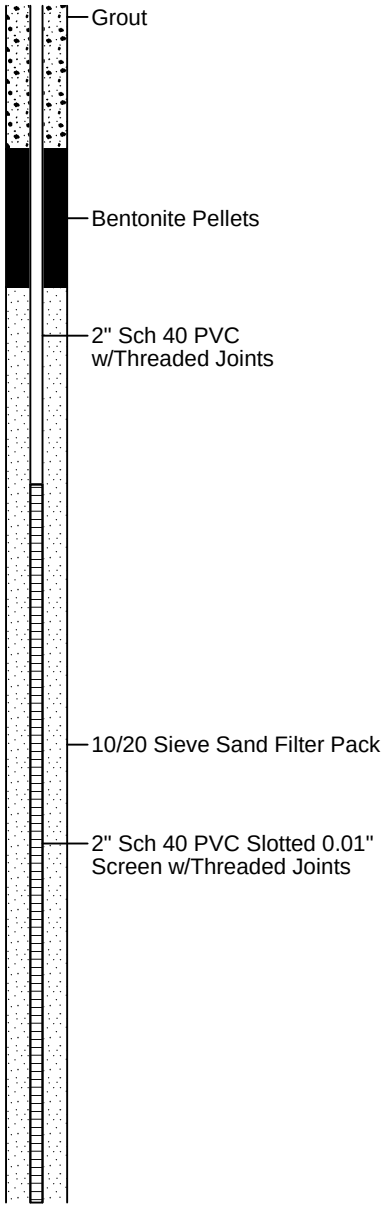
(Sheet 2 of 3)

| | |
|---|---|
| Elev., TOC (ft.msl) | : 6893.51 |
| Elev., PAD (ft. msl) | : 6891.06 |
| Elev., GL (ft. msl) | : |
| Site Coordinates | : |
| N | : N1635335.02 |
| E | : W2545018.21 |

| Depth (ft.) | PID (ppm) | Saturation | Lithology | USCS | Recovery (%) | Sample | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| 17 | 8.3 | | | CL | 70 | | |
| 18 | | | | | | | SILTY CLAY, STA, no odor, |
| 19 | 10.1 | | | CL | 50 | | |
| 20 | | | | | | | SILTY CLAY, moderate, soft, damp, brown, no odor, |
| 21 | 15.3 | | | CL | 60 | | |
| 22 | | | | | | | SILTY CLAY, STA, firm, no odor, |
| 23 | 12.1 | | | CL | 70 | | |
| 24 | | | | | | | SILTY CLAY, STA,calcareous nodules (white) present, trace gravel, no odor, |
| 25 | 11.6 | | | CL | 80 | | |
| 26 | | | | | | | SILTY CLAY, STA, tan-silt pockets throughout, no odor, |
| 27 | 10.9 | | | CL | 80 | | |
| 28 | | | | | | | CLAYEY SILT, low, soft/crumbly, damp, light brown and grey, no odor, |
| 29 | 10.5 | | | ML | 80 | | |
| 30 | | | | | | | SILTY CLAY, low, firm to crumbly, damp, light reddish brown with trace grey, no odor, |
| 31 | 11.1 | | | CL | 70 | | |
| 32 | | | | | | | SILTY CLAY, STA, no odor, |
| 33 | 15.0 | | | CL | 70 | | |
| 34 | | | | | | | SILTY CLAY, STA, no odor, |
| 35 | 12.8 | | | CL | 80 | | |
| 36 | | | | | | | SILTY CLAY, low, very stiff, crumbly, damp, light reddish brown, grey, no odor, |
| 37 | 12.7 | | | CL | | | |

## Completion Results

Well No. OW-60





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DiSorbo
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Western Refining SW, Inc
Gallup Refinery
Job No. WEST17020

| | |
|---|---|
| Geologist | : Tracy Payne |
| Driller | : Enviro-Drill Inc/Cohagan |
| Drilling Rig | : CME75 |
| Drilling Method | : Hollow Stem Auger 7 1/4" |
| Sampling Method | : 2' Split Spoon |
| Comments | : Hand Auger to 5' BGL |
| Total Depth | : 48' |
| Ground Water | : Not Encountered |
| Start Date | : 6/13/2017 |
| Finish Date | : 6/13/2017 |

# WELL NO. OW-60

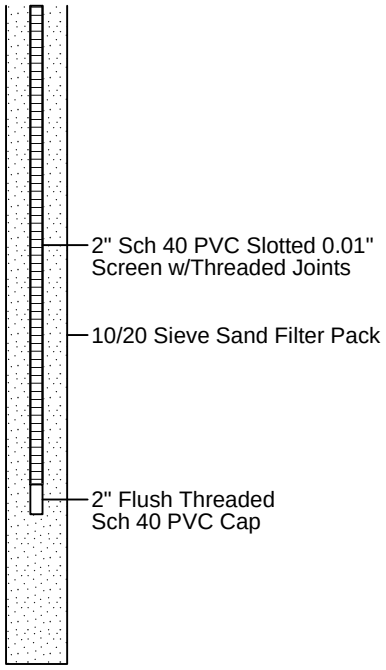
(Sheet 3 of 3)

| | |
|---|---|
| Elev., TOC (ft.msl) | : 6893.51 |
| Elev., PAD (ft. msl) | : 6891.06 |
| Elev., GL (ft. msl) | : |
| Site Coordinates | : |
| N | : N1635335.02 |
| E | : W2545018.21 |

| Depth (ft.) | PID (ppm) | Saturation | Lithology | USCS | Recovery (%) | Sample | DESCRIPTION |
|---|---|---|---|---|---|---|---|
| 37 | 12.7 | | | CL | 70 | | |
| 38 | | | | | | | SILT, low, compact to dense/stiff crumbly, damp, light grey, no odor, |
| 39 | 10.4 | | | ML | 50 | | |
| 40 | | | | | | | SILT, STA, no odor, |
| 41 | 9.9 | | | ML | 60 | | |
| 42 | | | | | | | SILT, STA, trace very fine sand, no odor, |
| 43 | 10.7 | | | ML | 60 | | |
| 44 | | | | | | | SILT, STA, no odor, |
| 45 | 10.1 | | | ML | 50 | | |
| 46 | | | | | | | SILT, STA, trace reddish brown clay with grey, no odor. |
| 47 | 9.6 | | | ML | 50 | | |
| 48 | | | | | | | |
| 49 | | | | | | | |
| 50 | | | | | | | |
| 51 | | | | | | | |
| 52 | | | | | | | |
| 53 | | | | | | | |
| 54 | | | | | | | |
| 55 | | | | | | | |
| 56 | | | | | | | |
| 57 | | | | | | | |

## Completion Results

Well No. OW-60





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WELL LOGGING FORM

Page ____ of ____

Client GIANT REFINING COMPANY Well Number SMW-2

__ ¼ __ ¼ __ ¼ __ ¼ S __ T 15 N R 15 W State New Mexico

County McKinley Contractor Fox

Spud Date 9/26/95 Completion Date

Logs Run Lith from Cores Logged By J.C. Hunter

Elevation 6882.83 Spud In (Fm.) Chinle

Remarks Drilled w/Hollow Stem Auger & Continuous Sampler. Collected samples @ 2.5 and 5.0' intervals for %$H_2O$. Comp. as SS monitor Well

| th | Litho | Recov | RUN | From | To | Sample#/Ft | Lith/Remarks |
|---|---|---|---|---|---|---|---|
| | | | | | | | SE corner of LTA Times should be 15xx, not 14xx etc |
| | | | | | | 850925 | |
| 70 0 | | | ϕ | 0 | 5 | 1415/4.0 SH/CLY | 0-1.5 SOIL |
| 5 | | | 2 | 5 | 10 | 1420/10.0 CLY 50 | |
| 10 | | | 3 | 10 | 15 | 1426/15' CLY | 1.5 - 4.0 CLAY |
| 15 | | | 4 | 15 | 20 | 1432/20' 20 | |
| 20 | | | 5 | 20 | 25 | 1438/25' CLY | 4.0 - 19.0 SANDY CLAY |
| 25 | | | 6 | 25 | 30 | 1445/27.5 50 1446/30.0 CLY 50 | |
| 30 | | | 7 | 30 | 35 | 1452/32.5 CLY 1453 35.0 50 | 19.0 - 24 SAND; gr rd (5R4/6); med gr, poor sort, qty + Vcl ca frac |
| 35 | | | 8 | 35 | 40 | 1458/37.5 1459/40.0 | 24 - 25 CLAY |
| 40 | | | | | | | 25 - 28 SAND, as above |
| | | | | | | | 28 - 33 CLAYEY SAND & CLAY |
| | | | | | | 5' | 33 - 34 SAND (WET) med rd brn (10R4/6) med gr, mod sort, qty, rnd |
| | | | | | | | 34-40 CLAY |
| | | | | | | | 9/27/95 $H_2O$ level 29'7" 9:40 |
| | | | | | | | N 120° to SMW-2 |
| | | | | | | | pH 7.1 #850926 1445 |

Consultants, Ltd

Client GIANT REFINING COMPANY Well Number SMW-4

___¼ ___¼ ___¼ ___¼ S___ T 15 N R 15 W State New Mexico

County McKinley Contractor Fox

Spud Date 9/25/85 Completion Date 9/25/85

Logs Run Lith from Cores Logged By J.C. Hunter

Elevation 6878.84 Spud In (Fm.) Chinle

Remarks Drilled w/Hollow Stem Auger & Continuous Sampler. Collected samples @ 2.5 and 5.0' intervals for %$H_2O$. Comp. as SS monitor Well

| Depth | Litho | Recov | RUN | From | To | Sample#/Ft | Lith/Remarks |
|---|---|---|---|---|---|---|---|
| | | | | | | | Between MW1- & MW-2 Depths from top of auger, ~ 1.5' AGL (typical) |
| 0 | | | | | | | |
| TTR 0830 5 | | | 1 | 0 | 5 | 0850/25: cl 0840/40 | 0-1.5' (1.5) SOIL; gry rd (10R 4/2); silty cly w/ minor sd; roots & org matter |
| 10 | | | 2 | 5 | 10 | cl 0847/10.0 | |
| 15 | | | 3 | 10 | 15 | cl 0852/15' | 1.5-9.0 (7.5') CLAY; gry rd (5R4/2) - dk rd brn (10R3/4); dense, plastic, 1-5% si |
| 20 | | | 4 | 15 | 20 | cl 0859/20' | |
| 25 | | | 5 | 20 | 25 | SD 0906/25' | 9.0-16.0 (6.0') SANDY CLAY; gry rd (10R4/ - dsky rd (5R3/4); cly w/ 15-20% f |
| 30 | | | 6 | 25 | 30 | 0913/27.5 cl 0914/30.0 snd | |
| 35 | | | 7 | 30 | 35 | 0917/32.5 cl 0920/35.0 cl | cly (bailed @ 38') gr-cr gr sd, local f grvl, poor sor |
| 40 | | | 8 | 35 | 40 | 0927/37.5 cl 0928/40.0 cl | |
| 45 | | | 9 | 40 | 45 | 0936/42.5 cl 0937/45.0 cl | (mud cuttings @ 45') |
| 50 | | | 10 | 45 | 50 | 0940/42.5 SD/cly 0941/50.0 cly | 15.0-23.0 (7.0) CLAY; gry rd (5R4/2), loc. sandy, 5-10% sd |
| TD 1000 | | | 11 | 50 | 55 | 0954/52.5 SD/cly 0955/55.0 cly | |
| 55 | | | 13 | 55 | 60 | 0959/57.5' cly 1216/60.0 SD | 23.0-24.0 (1') SAND; pale rd brn (10R5/4) - rd brn (10R4/6); f g, mod srt, loose qtz ± K-spar |
| More 10 20 | | | 14 | 60 | 65 | 1241/62.5 1242/65.0 | |
| Continued 9/30/85 @ 1100 | | | 15 | 65 | 69 | 1258/67.5 1259/69.0 | |
| | | | | | | | 24.0-33.0 (9.0) SILTY CLAY; mod rd (5R5/4 cly w/ 10-20% slt, loc f g sand |
| | | | | | | | 33.0-59 (26) CLAY; mod rd brn (10R4 loc silty-sandy |
| | | | | | | | 57.5-59.5 |
| | | | | | | | 59-61 (2') Silt (calc) mod brn (10R4/6); f g, mod srt |
| | | | | | | | 61-69 Silty Sandstone (dry) pale red (10R6/2) |
| | | | | | | | loc 1" calc cmt |

# Appendix B

# Investigation Derived Waste Management Plan

# Investigation Derived Waste (IDW) Management Plan

All IDW will be properly characterized and disposed of in accordance with all federal, State, and local rules and regulations for storage, labeling, handling, transport, and disposal of waste. The IDW may be characterized for disposal based on the known or suspected contaminants potentially present in the waste.

A dedicated decontamination area will be setup prior to any sample collection activities. The decontamination pad will be constructed so as to capture and contain all decontamination fluids (e.g., wash water and rinse water) and foreign materials washed off the sampling equipment. The fluids will be pumped directly into suitable storage containers (e.g., labeled 55-gallon drums), which will be located at satellite accumulation areas until the fluids are disposed in the refinery wastewater treatment system upstream of the API separator. The solids captured in the decontamination pad will be shoveled into 55-gallon drums and stored at the designated satellite accumulation area pending proper waste characterization for off-site disposal.

Drill cuttings generated during installation of soil borings will be placed directly into 55-gallon drums and staged in the satellite accumulation area pending results of the waste characterization sampling. The portion of soil cores, which are not retained for analytical testing, will be placed into the same 55-gallon drums used to store the associated drill cuttings.

The solids (e.g., drill cuttings and used soil cores) will be characterized by testing to determine if there are any hazardous characteristics in accordance with 40 Code of Federal Regulations (CFR) Part 261. This includes tests for ignitability, corrosivity, reactivity, and toxicity. If the materials are not characteristically hazardous, then further testing will be performed pursuant to the requirements of the facility to which the materials will be transported. Depending upon the results of analyses for individual investigation soil samples, additional analyses may include VOCs, TPH and polynuclear aromatic hydrocarbons (PAHs).