Western Refining Southwest LLC
A subsidiary of Marathon Petroleum Corporation

I-40 Exit 39
Jamestown, NM 87347

January 25, 2024

Mr. Ricardo Maestas, Acting Chief
New Mexico Environmental Department
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505

RE: 2024 Facility-Wide Groundwater Monitoring Work Plan
Western Refining Southwest LLC, D/B/A Marathon Gallup Refinery
EPA ID #NMD000333211

Dear Mr. Maestas:

Attached please find the 2024 Facility-Wide Groundwater Monitoring Work Plan.

If you have any questions or comments regarding the information contained herein, please do not hesitate to contact Ms. Kateri Luka at (714) 713-1218.

Certification

I certify under penalty of law that this document and all attachments were prepared under my direction of 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.

Sincerely,
Western Refining Southwest LLC, Marathon Gallup Refinery

Timothy J. Peterkoski
Director of Environment and Climate Strategy
Marathon Petroleum Company LP

Enclosure

cc: L. Andress, NMED HWB
M. Suzuki, NMED HWB
K. Luka, MPC
H. Jones, Trihydro Corporation
L. Tsinnajinnie, NMED HWB
N. Dhawan, NMED HWB
J. Moore, Marathon Gallup Refinery
L. King, EPA Region 6

WESTERN REFINING SOUTHWEST LLC

D/B/A MARATHON GALLUP REFINERY

2024 FACILITY-WIDE GROUNDWATER MONITORING WORK PLAN

JANUARY 25, 2024

Executive Summary

This 2024 Facility-Wide Groundwater Monitoring Work Plan (2024 Plan) has been prepared for the implementation of the ongoing facility-wide groundwater monitoring and monitored natural attenuation (MNA) groundwater programs at the Western Refining Southwest LLC, D/B/A Marathon Gallup Refinery (Refinery). This 2024 Plan is prepared in accordance with the Resource Conservation and Recovery Act Post-Closure Permit (NMED 2017).

The Refinery annually evaluates the facility-wide monitoring program. The 2024 Plan is presented to New Mexico Environment Department (NMED) for review. In accordance with Comment 2 from "Disapproval, 2023 Facility Wide Groundwater Monitoring Work Plan" (NMED 2023a), the Refinery will monitor in accordance with the last approved work plan. At the time of this 2024 Plan submittal, the last approved work plan was "Approval with Modifications, Revised 2022 Facility-Wide Groundwater Monitoring Work Plan" (NMED 2023b), approved by NMED in "Approval with Modifications, 2022 Facility Wide Groundwater Monitoring Work Plan" (NMED 2022a), with incorporation of comments from the "Response to Approval with Modifications, 2022 Facility-Wide Groundwater Monitoring Work Plan" (Western 2023a). NMED requests presented in "Disapproval, 2023 Facility Wide Groundwater Monitoring Work Plan" (NMED 2023a) are incorporated into this 2024 Plan, when applicable and the Refinery will also monitor in accordance with these comments for 2024. In the "RCRA Permit Reference" (Western 2023b), the Refinery requested that the groundwater work plan be submitted once every 5 years with a revised map, analytical list, and well locations for NMED review each year no later than January 31. General information regarding the facility-wide monitoring program is presented in Section 3.1. The revisions proposed for the 2024 Plan are discussed in Section 4.0.

The MNA groundwater evaluation was initiated in 2020 and a work plan was developed in 2021. The following presents the historical sequence of correspondence for the MNA Plan:

- "Natural Attenuation Assessment and Proposed Workplan for the Hydrocarbon Seep Area" (MPC 2020), submitted December 15, 2020
- "Disapproval" (NMED 2021a), received January 26, 2021
- "Response to Disapproval" (Western 2021a), submitted August 27, 2021
- "Approval with Modifications (NMED 2021b), received September 28, 2021
- "Response to Approval with Modifications" (Western 2021b), submitted December 17, 2021

Per Comment 11 provided by NMED on the Second Disapproval for the Revised 2021 Facility-Wide Groundwater Monitoring Work Plan (NMED 2021c), the Refinery is including a discussion of the MNA groundwater program in the 2024 Plan. The Refinery is using the information as the basis for the MNA groundwater program presented in this document. Information regarding the MNA program is provided in Section 3.2.

The Refinery has created a groundwater monitoring work plan with quality assurance practices and controls, as well as standard procedures for sampling, and a schedule of activities to monitor groundwater and surface water at select locations of the Refinery. The persons responsible for the implementation and oversight of this plan are:

Director, Environment Auditing and Processes

- Tim Peterkoski

Remediation Project Manager

- Kateri Luka

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%	percent
amsl	above mean sea level
COC	constituents of concern
CVOC	chlorinated volatile organic compound
EP	evaporation pond
ft	feet/foot
ft/d	feet per day
I-40	Interstate 40
LTU	Land Treatment Unit
MKTF	Marketing Tank Farm
MNA	Monitored Natural Attenuation
MTBE	methyl tert-butyl ether
NM	New Mexico
NMED	New Mexico Environment Department
OW	observation well
RCRA	Resource Conservation and Recovery Act
SPH	separate phase hydrocarbon
STP	Sanitary Treatment Pond
SWMU	Solid Waste Management Unit
WWTP	Wastewater Treatment Plant

1.0 Introduction

This 2024 Facility-Wide Groundwater Monitoring Work Plan (2024 Plan) has been prepared for the implementation of the ongoing facility-wide groundwater monitoring and monitored natural attenuation (MNA) groundwater programs at the Western Refining Southwest LLC, D/B/A Marathon Gallup Refinery (Refinery). This 2024 Plan is prepared in accordance with the Resource Conservation and Recovery Act (RCRA) Post-Closure Permit (NMED 2017). Figure 1-1 presents the Refinery location.

The Refinery annually evaluates the facility-wide monitoring program. Annual revisions to the work plan are presented to New Mexico Environment Department (NMED) for review. In accordance with Comment 2 from “Disapproval, 2023 Facility Wide Groundwater Monitoring Work Plan” (NMED 2023a), the Refinery will monitor in accordance with the last approved work plan. At the time of this 2024 Plan submittal, the last approved work plan was “Approval with Modifications, Revised 2022 Facility-Wide Groundwater Monitoring Work Plan” (NMED 2023b), approved by NMED in “Approval with Modifications, 2022 Facility Wide Groundwater Monitoring Work Plan” (NMED 2022a), with incorporation of comments from the “Response to Approval with Modifications, 2022 Facility-Wide Groundwater Monitoring Work Plan” (Western 2023a). NMED requests presented in “Disapproval, 2023 Facility Wide Groundwater Monitoring Work Plan” (NMED 2023a) are incorporated into this 2024 Plan, when applicable and the Refinery will also monitor in accordance with these comments for 2024. In the “RCRA Permit Reference” (Western 2023b), the Refinery requested that the groundwater work plan be submitted once every 5 years with a revised map, analytical list, and well locations for NMED review each year no later than January 31. These revisions include, but are not limited to, an addition to target constituents of concern (COC) to be analyzed. General information regarding the facility-wide monitoring program is presented in Section 3.1. The revisions proposed for the 2024 Plan are discussed in Section 4.0.

The MNA groundwater evaluation was initiated in 2020 and a work plan developed in 2021. The MNA work plan was approved by NMED in “Response to Approval with Modifications Natural Attenuation Assessment and Proposed Workplan for the Hydrocarbon Seep Area” on April 5, 2022 (NMED 2022b). Per Comment 11 in the “Second Disapproval, [Revised] Facility Wide Groundwater Monitoring Work Plan – Updates for 2021” (NMED 2021c), the Refinery is including a discussion of the MNA groundwater program in the 2024 Plan. NMED requests presented in “Approval with Modifications, 2022 Monitored Natural Attenuation Report” (NMED 2023c) are incorporated into the 2024 Plan, when applicable. Information regarding the MNA program is provided in Section 3.2. Any future changes to the MNA work plan will be addressed in future Facility-Wide Groundwater Monitoring Work Plans.

1.1 Refinery Information

Built in the 1950s, the Refinery is located within a rural and sparsely populated area east of Gallup, New Mexico (NM). The nearest population centers are the Pilot Flying J Travel Center refueling plaza, the Interstate 40 (I-40) corridor, and a small cluster of residential homes located in Jamestown are on the south side of I-40 approximately 2 miles southwest of the Refinery.

The Refinery is indefinitely idled as of October 9, 2020. During operation, the Refinery was a crude oil refining and petroleum products manufacturing facility. There were no non-petroleum fuel organic chemicals, plastics, or synthetic fibers manufactured that contributed to the process flow of wastewater. The Refinery did not manufacturer lubricating oils. As a result of the processing steps, the Refinery produced a wide range of petroleum products including propane, butane, unleaded gasoline, diesel, residual fuel, and non-petroleum-fuel commercial products of fertilizer, and solid elemental sulfur.

Historically, the Refinery primarily received crude oil via two 6-inch diameter pipelines, which entered the Refinery property from the north (Four Corners Area). In addition, the Refinery also received natural gasoline feedstock via a 4-inch diameter pipeline that came in from the west along the I-40 corridor from the Western Refining Southwest LLC – Wingate Plant, which is also indefinitely idled. Crude oil and other products also arrived at the Refinery via railroad cars. These feed stocks were then stored in tanks until refined into products.

Additional background information on regulatory status, historical operations, and environmental investigations and assessments are provided in Appendix A.

1.2 Monitoring Groups

This 2024 Plan divides the Refinery into nine geographic groups for periodic monitoring. The groups were chosen to reflect site conditions and better track dissolved constituents and separate phase hydrocarbons (SPH) within the footprint of the Refinery. The groups are presented on Figure 1-2 and described below:

1. The **Eastern Boundary Wells** group includes observation wells (OWs) located on the northeast section of the plant and recovery wells from which small quantities of free product have been removed.
2. The **Tank Farm Wells** group includes monitoring wells within the tank farm north of the process area.
3. The **Marketing Tank Farm (MKTF) Wells** group includes monitoring wells installed to delineate a hydrocarbon plume associated with a seep discovered west of the crude tank (Tank 101).
4. The **Solid Waste Management Unit (SWMU) 1 Wells** group consists of a cluster of monitoring wells and leak detection units for the New American Petroleum Institute Separator at the aeration basin, the wastewater treatment plant (WWTP), and the sanitary treatment pond (STP). The SWMU 1 wells and WWTP wells were combined due to the proximity of the two areas (NMED 2021d).
5. The **Land Treatment Unit (LTU) Wells** group includes the monitoring wells surrounding the RCRA-permitted LTU.
6. The **Evaporation Ponds (EPs)** group includes surface sampling locations for the EPs and for the effluent from the STP.

7. The **Western Boundary Wells** group consists of the nested wells situated along the northwest and west side of the Refinery.
8. The **Deep Wells** group include five OWs. Three OWs are located in the south-southwest section of the Refinery property and two are located north of the tank farm.
9. The **Raw Water Production Wells** include PW-2, PW-3, and PW-4; the wells are located south of, west of, and within the MKTF area, respectively. The Production Wells were segregated from the Deep Wells in the 2022 Plan as requested by NMED to better reflect the screened intervals of the Production Wells (NMED 2021d).

Designated wells and sample points are monitored on a quarterly, semiannual, and/or annual basis following the procedures presented in this 2024 Plan, as described in Section 4.0 and Appendix B.

1.3 New Monitoring Wells for 2024

No new permanent monitoring wells were installed during 2023. Therefore, no new monitoring wells will be added to the 2024 sampling list. Any new monitoring wells will be installed and sampled in accordance with the RCRA post-closure care permit and filed with the Office of State Engineers (NMED 2017).

2.0 Site Conditions

The Refinery is located within a rural and sparsely populated section of McKinley County, NM. It is situated in the high desert plain on the western flank of the Continental Divide approximately 17 miles east of Gallup, NM (Figure 1-1). The surrounding land is comprised primarily of public and private lands used for cattle and sheep grazing.

2.1 Site Topography

Local topography consists of a gradually inclined down-slope from high ground in the southeast to a lowland fluvial plain in the northwest. The highest point on Refinery property is located at the southeast corner boundary (elevation approximately 7,040 feet [ft] above mean sea level [amsl]) and the lowest point is located at the northwest corner boundary (elevation approximately 6,860 ft amsl). Surface soils within most of the area of investigation are primarily Rehobeth silty clay loam. The Refinery is located on a flat man-made terrace.

2.2 Surface Water

Surface water in the Refinery consists of the man-made EPs and aeration basins (Figure 2-1). There are several storm water conveyance ditches located throughout the Refinery. These ditches are discharged into contained basins where storm water is collected and allowed to evaporate or discharged into two designated outfalls. The outfalls are located on the east and west section of the property, identified as Outfall 001 and Outfall 002. Outfall 001 is located directly south of EP-8 on the western edge of the Refinery's property boundary and Outfall 002 is located north of the railroad loading rack on the eastern section of the Refinery.

Directly west of the crude tank area, there is a concrete barrier with a control valve that discharges from a culvert, which carries storm water flow from the Truck Loading Rack area. The control valve is kept closed. This concrete barrier is located downstream of the "hydrocarbon seep area." The flow from this concrete barrier continues in a north-northwest direction alongside the southern bermed areas of EP-3, EP-4, EP-5, and EP-6 and towards the Outfall 001 area. At the WWTP, there are three storm drains located on the south, southwest, and west side. These drains are connected to an underground storm culvert that exits on the northwest section of STP-1 into a conveyance ditch along the northern edge of EP-2 and into a holding pond equipped with manual flow valves, located north of EP-3. The valves are normally closed but would be opened if the water in the holding pond becomes high. The discharge from this holding pond then flows north-northwest towards the Outfall 001 area.

2.3 Geology

Site boring logs indicate that subsurface fluvial and alluvial soils are primarily comprised of clays and silts with discontinuous inter-bedded sand layers. Very low permeability bedrock (e.g., claystones and siltstones) underlie the surface soils. The Chinle Group, Upper Triassic Period, crops out over a large area south of the Refinery. The uppermost subunit within the Chinle Group is the Petrified Forest Formation, which is also sometimes referred to as the Petrified Forest Member. Inter-bedded within the Chinle Group is the Sonsela Sandstone bed, which lies within and parallels the dip of the Chinle Group. Its high point is located southeast of the Refinery and slopes downward to the northwest as it passes under the Refinery. Due to the hydraulic confinement of the Petrified Forest Formation aquitard, the Sonsela Sandstone bed acts as a water-bearing reservoir and is artesian at its lower extremis. Artesian conditions exist through much of the central and western portions of the Refinery.

2.4 Hydrogeology

Groundwater flow within the shallow alluvium and the upper Chinle Formation is highly variable due to the presence of complex and irregular stratigraphy including sand stringers, cobble beds, and dense clay layers. Hydraulic conductivity ranges from 30 ft per day (ft/d) for gravelly sands immediately overlying the Petrified Forest Formation to 3×10^{-5} ft/d in the clay soils located near the surface. Groundwater flow within the Lower Chinle Formation is extremely slow and typically averages less than 2.83×10^{-7} ft/d (i.e., less than 0.01 ft per year).

Water level data are collected routinely at the Refinery. Wells at the Refinery have been categorized based on the hydrogeologic unit in which they are screened, including the alluvial/fluvial upper sand aquifer, the Chinle/alluvium aquifer, and the Sonsela Sandstone aquifer. The alluvial/fluvial upper sand aquifer has a limited areal extent, existing only on the western margin on the Refinery. Groundwater occurrence in this aquifer is sporadic and limited (Appendix B-1, Figure 1).

The majority of the wells monitored lie within the shallow weathered sediments that comprise the Chinle/alluvium aquifer. Within the Chinle/alluvium aquifer, shallow groundwater located under the Refinery property generally flows along the upper contact of the Chinle Formation. The prevailing flow is from the southeast to the northwest, although localized areas may have varying flow directions based on the subsurface geology (Appendix B-1, Figure 2).

Groundwater within the Sonsela flows southeast to northwest (Appendix B-1, Figure 3). Hydraulic heads measured within the Sonsela are generally lower than those observed within the shallow aquifer near the topographic high on which the Refinery process area and tank farm are situated, and higher than those observed within the shallow aquifer in topographically low areas to the west and northwest, near the evaporation ponds. The higher head in the Sonsela in low areas is due to confining pressure from lower permeability Chinle Formation bedrock between the shallow Chinle/Alluvium aquifer and the Sonsela Sandstone bed at depth, which makes the Sonsela Sandstone aquifer artesian.

3.0 Groundwater Monitoring Programs

Groundwater monitoring at the Refinery is conducted pursuant to the RCRA Post-Closure Permit (NMED 2017) and in accordance with this 2024 Plan. There are two objectives of the groundwater monitoring program at the Refinery: (1) monitor facility-wide groundwater conditions and submit the information in a facility-wide annual groundwater report (due annually to NMED by April 1), and (2) provide information on MNA occurring in the MKTF wells in the hydrocarbon seep area. MNA data are submitted in an annual MNA report. Both programs are discussed below.

3.1 Facility-wide Groundwater Monitoring Program

The facility-wide program will consist of fluid level measurements, groundwater sample collection, and analysis from a series of monitoring wells, recovery wells, outfalls, and EP locations. The monitoring network is divided into nine groups (Section 1.2 and Figure 1-2). The sampling frequency varies by individual well. The analytes are consistent across the nine monitoring groups. Section 4.0 presents the 2024 sampling locations and analyte list.

Appendix B presents the procedures used for sample collection and analysis and includes the following activities:

- Well gauging (i.e., depth to groundwater, depth to SPH [if present], and depth to the bottom of the well)
- Well purging and sampling, including equipment, groundwater stabilization criteria, and collection of field quality parameters
- Sample handling and waste management procedures
- Field and laboratory quality assurance procedures

Groundwater samples will not be collected from monitoring wells that have measurable SPH of 0.01 ft thickness or greater. If a SPH recovery system is present in a well, recovery system operation will be halted for 24 hours prior to sampling to allow groundwater to equilibrate, and the fluid level will be measured. If the well does not have measurable SPH, the recovery system will be removed from the well, and the well will be purged and sampled. For wells that are purged dry, samples will be collected if recharge volume is sufficient for sample collection within 24 hours. Wells not sampled due to insufficient recharge will be documented in the field log. If samples cannot be collected from a location due to safety concerns, arrangements will be made to collect samples from the affected location at a different time by changing the scheduled samplings dates. The annual report will include deviations and safety concern requiring the deviation should a deviation be required.

Data from the facility-wide groundwater will be presented in an annual report in accordance with the RCRA Post Closure Permit (NMED 2017) Parts IV.C.3 and IV.L.4. The report will include:

- Scope of activities, including deviations from the 2024 Plan
- Field monitoring results
- Analytical data results, including comparison to applicable regulatory standards
- Remediation system monitoring
- Summary
- Tables, figures, and appendices will be provided as appropriate

As requested by NMED (NMED 2021e, Comment 3), and in the response by the Refinery (Western 2021c, Comment 3), the October 17, 2019, gauging data for Well OW-58A (Figure 1-2) will not be included in future reports.

3.2 Monitored Natural Attenuation Program

MNA groundwater monitoring will be conducted on an annual basis (Western 2021b) for the select MKTF monitoring wells:

- MKTF-02R
- MKTF-04R
- MKTF-09
- MKTF-10
- MKTF-13
- MKTF-16
- MKTF-17R
- MKTF-19
- MKTF-20
- MKTF-21
- MKTF-22
- MKTF-24
- MKTF-25

The MNA well locations are highlighted in blue on Figure 3-1. The sampling will be conducted concurrently with the third quarter facility-wide monitoring event, following the practices presented in Section 3.1 and Appendix B. Samples will be analyzed for the constituents presented in Table 3-1 and evaluated for evidence of chlorinated volatile organic compounds (CVOCs) MNA and methyl tert-butyl ether (MTBE) MNA. The laboratory will be asked to use method 8260 and report to the method detection limits with estimated “J” flags to achieve lower detection limits on CVOCs, pending NMED approval.

The MNA evaluation for 2021 was presented in the “2021 Annual Monitored Natural Attenuation Report” (Western 2022) and was approved by NMED August 22, 2022 (NMED 2022c). MNA reporting is completed in accordance with the “Response to Approval with Modifications, Natural Attenuation

Assessment and Proposed Work Plan for the Hydrocarbon Seep Area" (Western 2021d). The 2024 MNA report will include:

- A summary of the MNA analytical data.
- An update to the United States Environmental Protection Agency quantitative spreadsheet scoring the MNA potential.
- A statistical trend analysis for CVOCs and MTBE.
- A discussion section summarizing natural attenuation progress, including trends in contaminant concentrations and key MNA indicators.
- Tables, figures, and appendices will be provided as appropriate.

4.0 Facility-wide Groundwater Monitoring Program Revisions

Prior to preparing the 2022 Plan, NMED and the Refinery conducted a meeting on December 3, 2021, to discuss work plan and report presentation. Follow-up communications regarding the 2022 analyte list were conducted via email from January 5, 2022, through January 20, 2022, (Personal Communication 2022) and were incorporated into the 2022 Plan and future Plans. The Skinner List (Appendix C) (USEPA 1997) was used to guide the 2022 follow-up communications. The proposed modifications and the rationale are presented in the following sections.

4.1 Modifications to Monitoring Locations

The monitoring locations are presented in Table 4-1 and shown on Figure 1-2. The Refinery has been unable to confirm the Oil Sump LDU location and will remove the location from the monitoring locations. No other modifications to monitoring locations are proposed for 2024.

4.2 Modifications to Monitoring Frequency

The monitoring frequency was evaluated based on the 2023 sampling events. No monitoring frequency changes are proposed for the 2024 Plan. Table 4-1 presents the 2024 frequency for the monitoring groups.

4.3 Modifications to Target Analytes

The 2024 facility-wide analyte list will be used for all wells in the groundwater monitoring program, unless noted in Section 4.3.1. The data will be used to evaluate the groundwater on a facility-wide basis. The 2024 analyte list is presented in Table 4-2. As noted in the 2023 Plan, dissolved metals are sampled only in even years. Table 4-2 has been revised to include both total and dissolved metals. No new modifications to the facility-wide 2024 analyte list will be requested based on historical data.

4.3.1 Miscellaneous Data Additions and Removals

- Analytes can be added to or deleted from the sampling list through annual data evaluation with approval from NMED or as requested by NMED. The following changes have been applied for the 2023 sampling events, as appropriate: Pentafluorobenzene will be removed with NMED approval as requested in “2023 Facility-Wide Groundwater Monitoring Work Plan” (Western 2023c) because it is an approved laboratory internal standard for United States Environmental Protection Agency Method 8260 and may be added to samples analyzed using Method 8260. Therefore, the results may be falsely elevated and are not indicative of field conditions.
- NMED requested the addition of chloride, nitrate, nitrite, sulfate, and sulfides as facility wide analytes in “Disapproval, 2023 Facility-Wide Groundwater Monitoring Work Plan” (NMED 2023a,

Comment 12). Analytes will be added on an annual basis. Table 4-2 is revised to include these additional analytes.

As noted in the 2022 Plan and 2023 Plan, dissolved metals are only sampled in even years. Table 4-2 is revised to include sampling for dissolved metals in 2024.

5.0 Monitored Natural Attenuation Program Revisions

Discussions between NMED and the Refinery are incorporated into this 2024 Plan. The proposed modifications and the rationale are presented in the following sections.

5.1 Modifications to Monitoring Locations

The MNA monitoring locations are shown on Figure 3-1. No modifications to monitoring locations are proposed for the MNA program in 2024.

5.2 Modifications to Monitoring Frequency

No modifications to the monitoring frequency are proposed for the MNA program in 2024.

5.3 Modifications to Target Analytes

Analytes specific to the MNA program are presented in Table 3-1. Field parameters (conductance, dissolved oxygen, oxidation reduction potential, pH, salinity, temperature, and total dissolved solids) were not included in the evaluation. Field parameters will continue to be measured in all wells.

NMED requested the addition of analytes in Comment 7 of "Disapproval, 2023 Facility-Wide Groundwater Monitoring Work Plan" (NMED 2023a). Per NMED, total organic carbon, carbon dioxide, alkalinity, and volatile fatty acids are included as laboratory analytes in table 3-1. The Refinery will sample for these analytes once every 3 years beginning in the 4th quarter of 2023. This is due to the long length of time it will take to see trends in these parameters due to the presence of hydrocarbons and CVOCs. The next sampling of these analytes will take place in 2026.

6.0 References

Marathon Petroleum Company (MPC). 2020. Natural Attenuation Assessment and Proposed Workplan for the Hydrocarbon Seep Area, Marathon Petroleum Company, LP, Gallup Refinery (dba Western Refining Southwest, Inc.), EPA ID #NMD000333211. December 15.

New Mexico Environment Department (NMED). 2017. Western Refining Southwest, Inc. Gallup Refinery, EPA ID NM No. NM000333211, Final RCRA Post-closure Permit, October 2013. Modified September.

NMED. 2021a. Disapproval, Natural Attenuation Assessment and Proposed Work Plan for the Hydrocarbon Seep Area, French Drain Soil Investigation Work Plan, Western Refining Southwest LLC, Gallup Refinery, EPA ID #NMD000333211, HWB-WRG-20-023. January 26.

NMED. 2021b. Approval with Modifications, Response to Disapproval, Natural Attenuation Assessment and Proposed Work Plan for the Hydrocarbon Seep Area. September 28.

NMED. 2021c. Second Disapproval, [Revised] Facility Wide Groundwater Monitoring Work Plan – Updates for 2021, Western Refining Southwest LLC, Gallup Refinery, McKinley County, Gallup, New Mexico, EPA ID #NMD000333211, HWB-WRG-21-006. November 15.

NMED. 2021d. Direction, Proposed Groundwater Well Groupings Figure, Western Refining Southwest Inc., Gallup Refinery, EPA ID #NMD000333211, HWB-WRG-MISC. August 17.

NMED. 2021e. Approval with Modifications [Revised] Annual Groundwater Monitoring Report Gallup Refinery – 2019, Western Refining Southwest INC., Gallup Refinery EPA ID# NMD000333211 HWB-WRG-20-01. May 4.

NMED. 2022a. Approval with Modifications, 2022 Facility Wide Groundwater Monitoring Work Plan, Western Refining Southwest LLC, Gallup Refinery, McKinley County, Gallup, New Mexico, EPA ID #NMD000333211, HWB-WRG-21-006. May 25.

NMED. 2022b. Response to Approval with Modifications Natural Attenuation Assessment and Proposed Workplan for the Hydrocarbon Seep Area, Western Refining Southwest LLC, Gallup Refinery, McKinley County, Gallup, New Mexico, EPA ID #NMD000333211, HWB-WRG-20-023. April 5.

NMED. 2022c. Approval with Modifications Natural Attenuation Report, Western Refining Southwest LLC, Gallup Refinery, McKinley County, Gallup, New Mexico, EPA ID #NMD000333211, HWB-WRG-20-023. August 22.

NMED. 2023a. Disapproval, 2023 Facility-Wide Groundwater Monitoring Work Plan, Western Refining Southwest LLC, Gallup Refinery, McKinley County, Gallup, New Mexico, EPA ID #NMD000333211, HWB-WRG-21-006. October 18.

NMED. 2023b. Approval with Modifications, Revised 2022 Facility-Wide Groundwater Monitoring Work Plan, Western Refining Southwest LLC, Gallup Refinery, McKinley County, Gallup, New Mexico, EPA ID #NMD000333211, HWB-WRG-22-001. February 1.

NMED. 2023c. Approval with Modifications, 2022 Monitored Natural Attenuation Report, Western Refining Southwest LLC, Gallup Refinery, McKinley County, Gallup, New Mexico, EPA ID #NMD000333211, HWB-WRG-21-006. October 26.

Personal Communication. 2022. Marathon Gallup – 2022 Groundwater Work Plan Revised Analyte List. Email from Mr. Michiya Suzuki (NMED) to Ms. Lesli Alexander (Trihydro). January 5 through January 20.

United States Environmental Protection Agency (USEPA). 1997. Region 5 Waste Management Branch "Skinner List" Constituents of Concern for Waste from Petroleum Processes.

Western Refining Southwest LLC (Western). 2021a. Response to Disapproval, Natural Attenuation Assessment and Proposed Work Plan for the Hydrocarbon Seep Area, French Drain Soil Investigation Work Plan, Western Refining Southwest LLC, Gallup Refinery, EPA ID #NMD000333211, HWB-WRG-20-023. August 27.

Western. 2021b. Response to Approval with Modifications, Natural Attenuation Assessment and Proposed Work Plan for the Hydrocarbon Seep Area, Western Refining Southwest LLC, Gallup Refinery, EPA ID #NMD000333211, HWB-WRG-20-023. December 17.

Western. 2021c. Response to Approval with Modifications, Annual Groundwater Monitoring Report Gallup Refinery – 2019, Western Refining Southwest Inc., Marathon Gallup Refinery, EPA ID #NMD000333211, HWB-WRG-20-013. July 31.

Western. 2021d. Response to Approval with Modifications, Natural Attenuation Assessment and Proposed Work Plan for the Hydrocarbon Seep Area, Western Refining Southwest LLC, Gallup Refinery, EPA ID #NMD000333211, HWB-WRG-20-023. December 21.

Western. 2022. 2021 Annual Monitored Natural Attenuation Report, Western Refining Southwest LLC, D/B/A Marathon Gallup Refinery, EPA ID #NMD000333211. December 19.

Western. 2023a. Response to Approval with Modifications, 2022 Facility Wide Groundwater Monitoring Work Plan, Western Refining Southwest LLC, D/B/A Marathon Gallup Refinery, EPA ID #NMD000333211, HWB-WRG-22-001. April 1.

Western. 2023b. Part A and Part B RCRA Permit Renewal Application, Western Refining Southwest LLC, D/B/A Marathon Gallup Refinery, EPA ID #NMD000333211. June 23.

Western. 2023c. 2023 Facility Wide Groundwater Monitoring Work Plan, Western Refining Southwest LLC, D/B/A Marathon Gallup Refinery, EPA ID #NMD000333211. January 31.

Figures

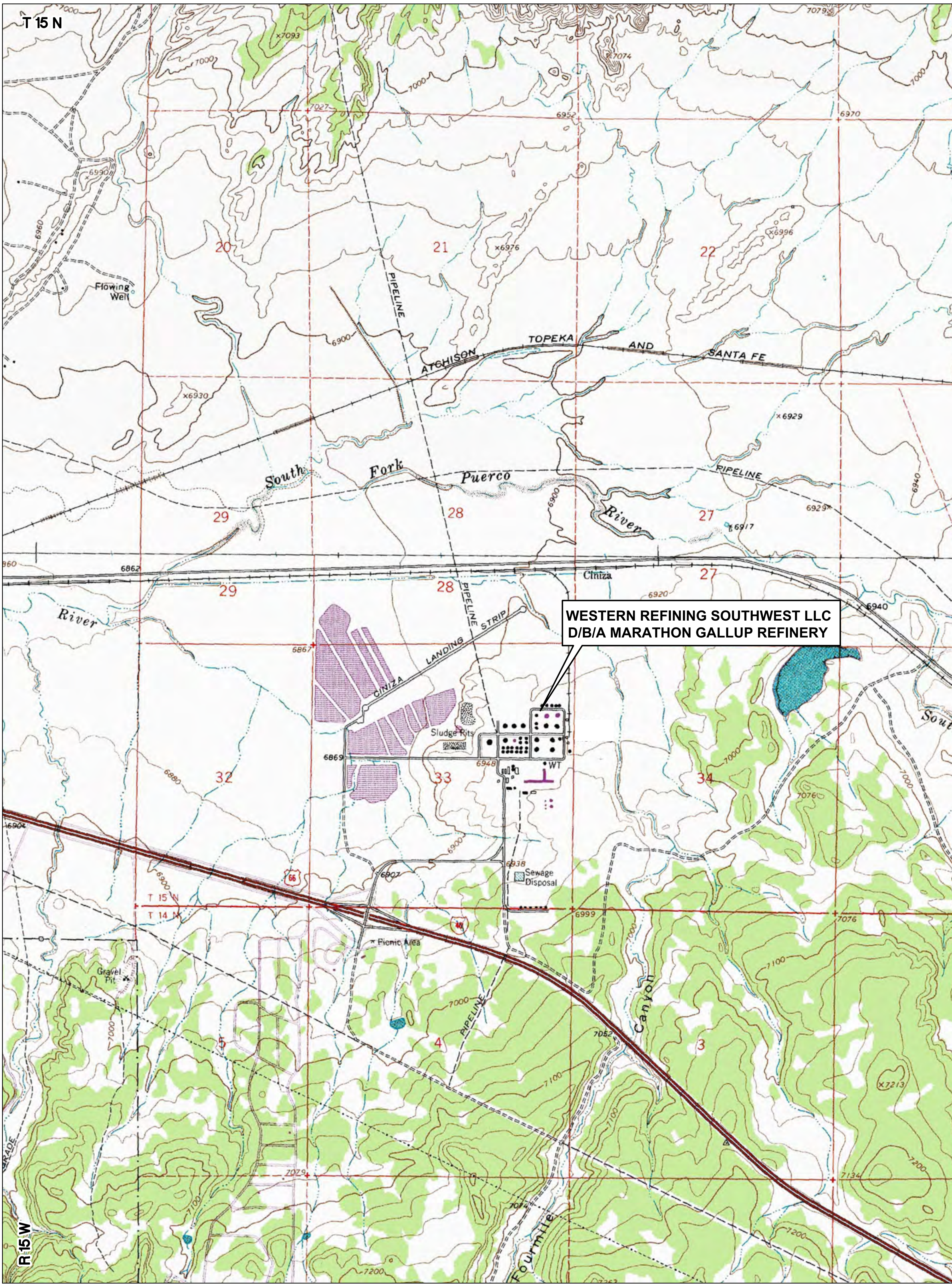
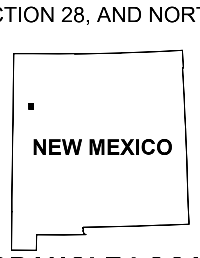


Image Cite: U.S. Geological Survey, 1:24,000–Scale 7.5 Minute Digital Raster Graphic Quadrangle, McKinley County, Publication: 2004

NOTE:
SITE LEGAL DESCRIPTION - TOWNSHIP 15 NORTH, RANGE 15 WEST, SECTION 33, LOWER QUARTER SECTION 28, AND NORTHEAST QUARTER SECTION 4.



QUADRANGLE LOCATION

N

0 2,000'

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FIGURE 1-1

SITE LOCATION AND TOPOGRAPHIC MAP

WESTERN REFINING SOUTHWEST LLC
D/B/A MARATHON GALLUP REFINERY
GALLUP, NEW MEXICO

Drawn By: REP	Checked By: BN	Scale: 1" = 2,000'	Date: 1/6/2023	File: 697-GWWP-SITELAYTOPO-2023

\\TRIHYDRO.COM\CLIENTS\ITON\MARATHON\CADD\GALLUP_REPORTS\GW WORKPLANS\202212_2023GWWP\697-GWWP-SITELAYTOPO-2023

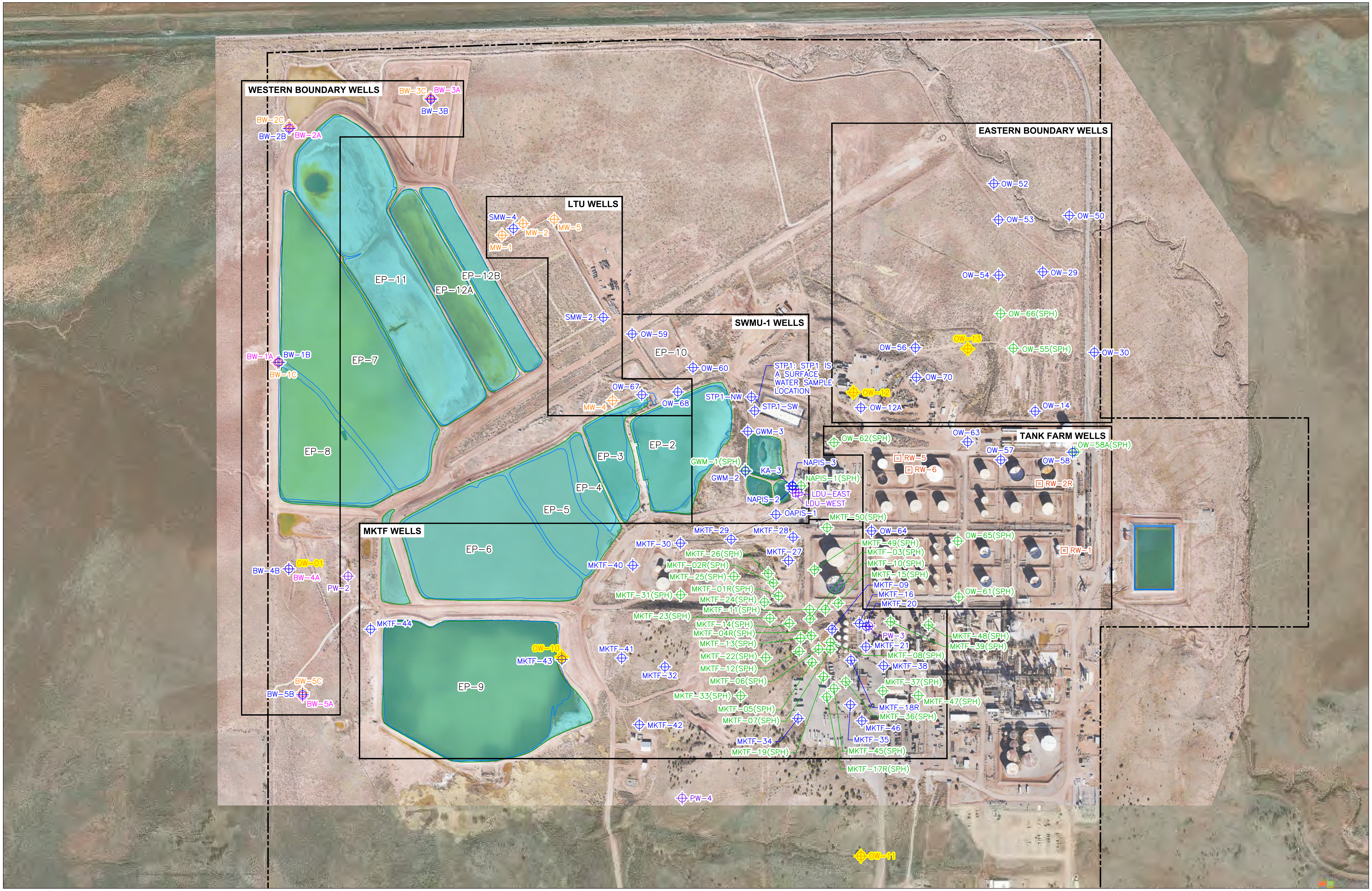

Image Cite: USDA/FSA – Aerial Photography Field Office, NAIP MrSID – Publication: 2014

EXPLANATION

BW-5C	SONSELA WELL AND DESIGNATION
BW-5B	CHINLE/ALLUVIUM INTERFACE WELL AND DESIGNATION
BW-5A	ALLUVIAL/FLUVIAL UPPER SAND WELL AND DESIGNATION
MKTF-03(SPH)	SPH MONITORING WELL AND DESIGNATION
PW-4	RAW WATER PRODUCTION WELL AND DESIGNATION
RW-6	RECOVERY WELL AND DESIGNATION
LDU-EAST	LEAK DETECTION UNIT AND DESIGNATION

	DEEP WELL GROUP
	WELL GROUP
	SURFACE WATER
EP	EVAPORATION POND
LTU	LAND TREATMENT UNIT
MKTF	MARKETING TANK FARM

SPH	SEPARATE-PHASE HYDROCARBON (DETECTED IN 2023)
STP	SANITARY TREATMENT POND
SWMU	SOLID WASTE MANAGEMENT UNIT
WWT	WASTE WATER TREATMENT

N

0 400' 800'

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FIGURE 1-2

FACILITY AND WELL GROUP 2024

**WESTERN REFINING SOUTHWEST LLC
D/B/A MARATHON GALLUP REFINERY
GALLUP, NEW MEXICO**

Drawn By: REP | Checked By: KE | Scale: 1" = 400' | Date: 12/29/23 | File: 697-GWWP-FACWELLGROUPS-2024

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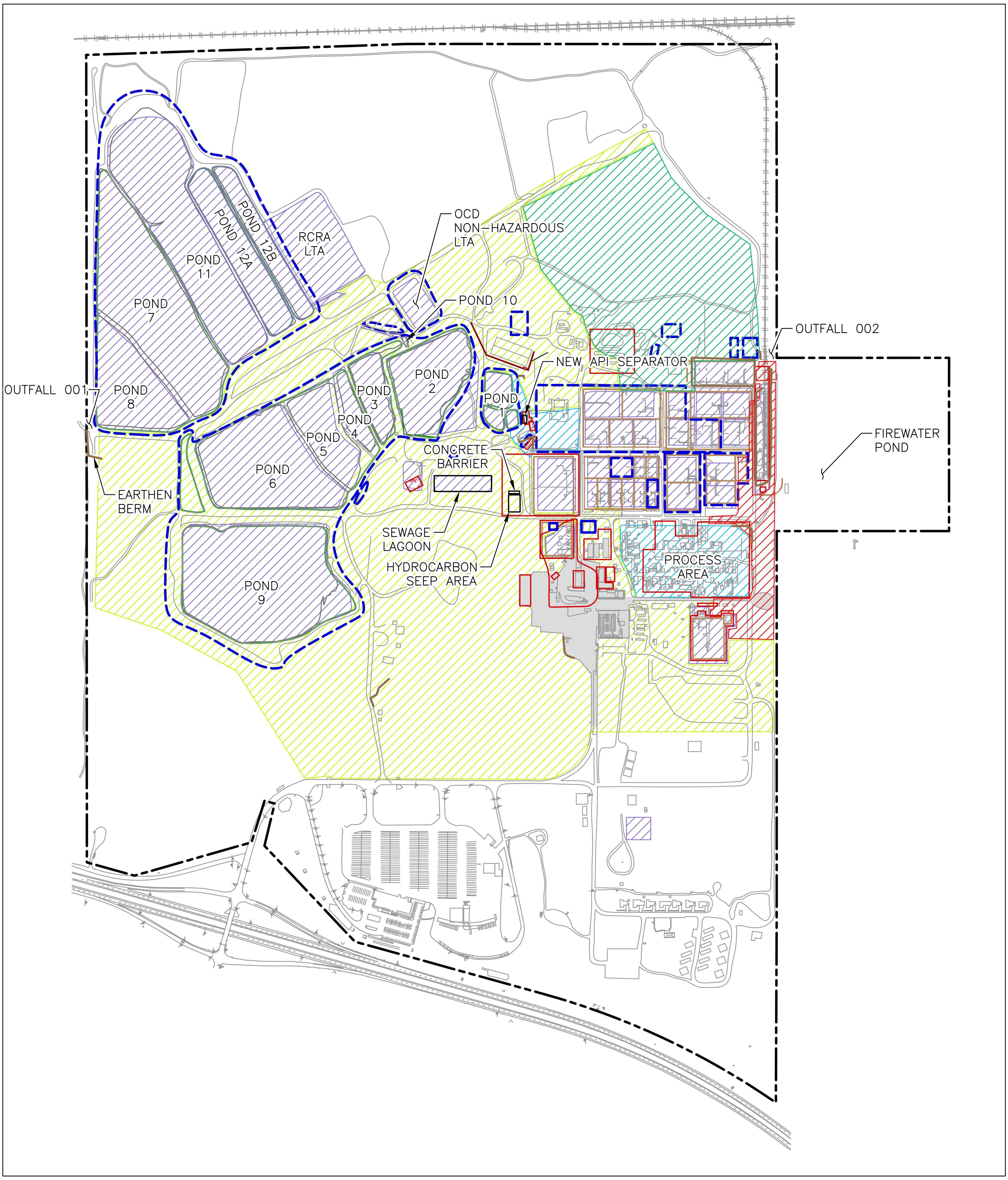

EXPLANATION

- PROPERTY BOUNDARY (APPROXIMATE)
- SOLID WASTE MANAGEMENT UNIT (SWMU)
- AREA OF CONCERN (AOC)
- EARTHEN BERM
- CONTAINED/BERMED AREA, NO STORMWATER RUN OFF DISCHARGED TO ANOTHER POINT
- AREA CONTRIBUTING FLOW TO OUTFALL 2
- DRAINS TO GRASSY AREA, DOES NOT LEAVE SITE
- NEW STORMWATER COLLECTION BASIN
- AREA CONTRIBUTING FLOW TO OUTFALL 1
- PROCESS AREA, STORMWATER DRAINS TO POND 1
- IMPERVIOUS SURFACE

API	AMERICAN PETROLEUM INSTITUTE
LTA	LAND TREATMENT AREA
OCD	OIL CONSERVATION DIVISION
RCRA	RESOURCE CONSERVATION AND RECOVERY ACT

NOTE:

IMPERVIOUS AREAS ARE IDENTIFIED FOR DISCHARGING AREAS ONLY. IMPERVIOUS SURFACES WITHIN AREAS WHERE STORMWATER DOES NOT DISCHARGE HAVE NOT BEEN IDENTIFIED, CONSIDERING THESE AREAS DO NOT PRODUCE REGULATED STORMWATER DISCHARGES.

N

0 800'

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FIGURE 2-1

STORMWATER CATCH BASINS

WESTERN REFINING SOUTHWEST LLC
D/B/A MARATHON GALLUP REFINERY
GALLUP, NEW MEXICO

Drawn By: REP	Checked By: BN	Scale: 1" = 800'	Date: 1/6/23	File: 697-GWWP-STRMCTCHBASIN-2022

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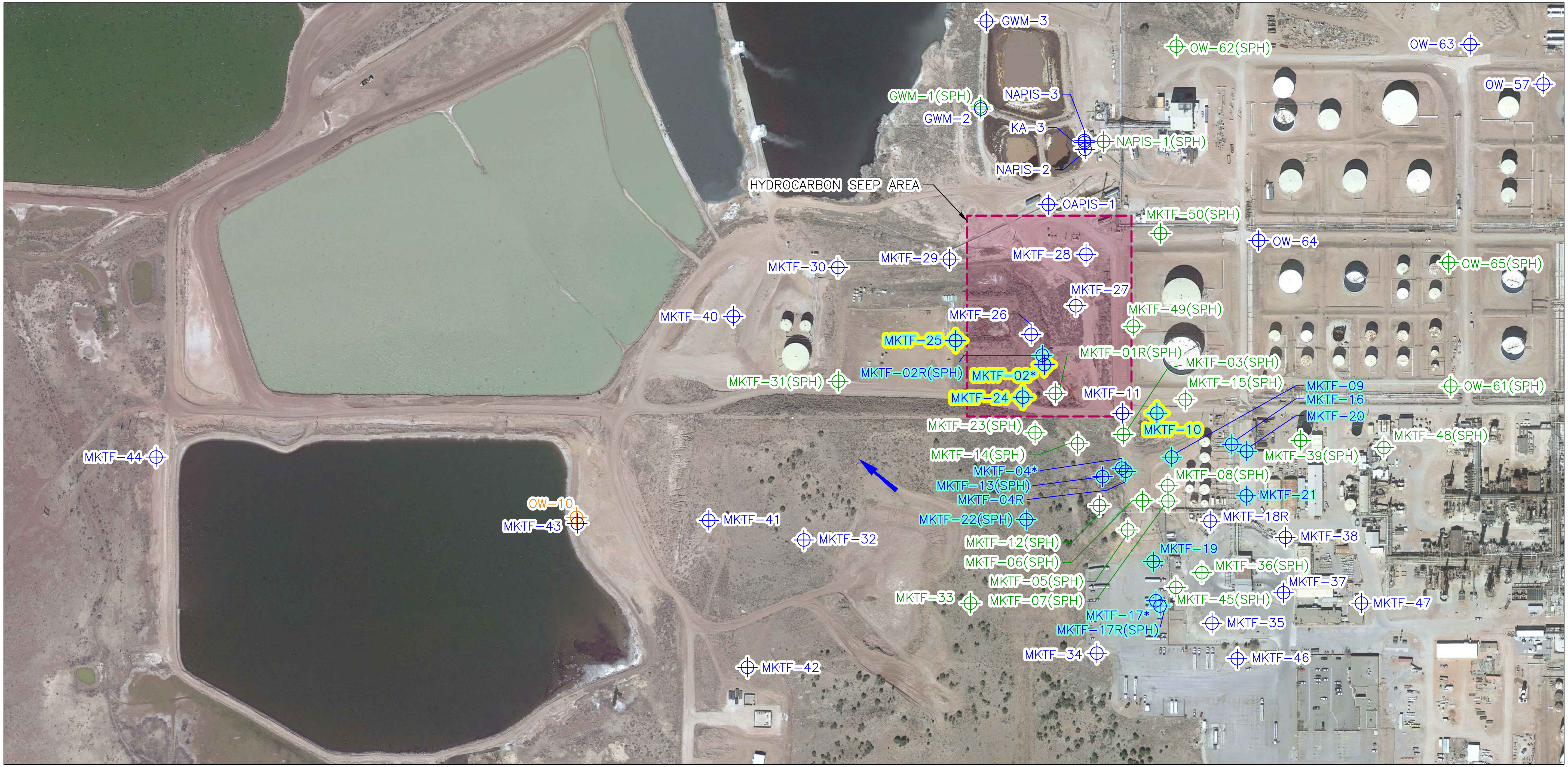

Image Citation: Google Earth Pro Imagery, Publication: March 2016.

EXPLANATION

NEW MEXICO

QUADRANGLE LOCATION

NOTE:

SITE LEGAL DESCRIPTION - TOWNSHIP 15 NORTH, RANGE 15 WEST, SECTION 33

OW-10	SONSELA WELL AND DESIGNATION
MKTF-42	CHINLE/ALLUVIUM INTERFACE WELL AND DESIGNATION
MKTF-33	SPH MONITORING WELL AND DESIGNATION
MKTF-17*	MKTF MNA WELL
MKTF-10	MONITORING WELL WITH CONSISTENT DETECTION OF VINYL CHLORIDE
	GENERAL GROUNDWATER FLOW DIRECTION
	HYDROCARBON SEEP AREA

MKTF	MARKETING TANK FARM
MNA	MONITORED NATURAL ATTENUATION
SPH	SEPARATE PHASE HYDROCARBON (DETECTED DURING THIRD QUARTER 2023 SAMPLING EVENT)
*	DENOTES WELLS THAT WERE RE-DRILLED AND PLUGGED. SAMPLES WILL BE TAKEN FROM RE-DRILLED WELLS

0 300'

N

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FIGURE 3-1

MNA WELL NETWORK

WESTERN REFINING SOUTHWEST LLC
D/B/A MARATHON GALLUP REFINERY
GALLUP, NEW MEXICO

Drawn By: REP	Checked By: bb	Scale: 1" = 300'	Date: 12/11/23	File: 697-GWWP-SITEMNA-2023

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Tables

TABLE 3-1. MNA GROUNDWATER ANALYTICAL LIST
WESTERN REFINING SOUTHWEST LLC, D/B/A/ MARATHON GALLUP REFINERY, GALLUP, NEW MEXICO

Analyte	Method of Analysis	Significance for MNA	Analyte Used in CVOC or MTBE Evaluation	Utility for MNA Analyses
BTEX	Laboratory	Source of organics for reducing conditions	CVOC, MTBE	Monitor trends
MTBE	Laboratory	Decreasing trends indicate natural attenuation	MTBE	Monitor trends
TBA	Laboratory	Decreasing trends indicate natural attenuation	MTBE	Monitor trends, degradation product of MTBE
PCE	Laboratory	Decreasing trends indicate natural attenuation	CVOC	Monitor trends
TCE	Laboratory	Decreasing trends indicate natural attenuation	CVOC	Monitor trends, degradation product of PCE
cis-1,2-DCE	Laboratory	Decreasing trends indicate natural attenuation	CVOC	Monitor trends, degradation product of TCE
1,1-DCE	Laboratory	Decreasing trends indicate natural attenuation	CVOC	Monitor trends, degradation product of TCE
1,1-DCA	Laboratory	Decreasing trends indicate natural attenuation	CVOC	Monitor trends
1,2-DCA	Laboratory	Decreasing trends indicate natural attenuation	CVOC	Monitor trends
Vinyl chloride	Laboratory	Decreasing trends indicate natural attenuation	CVOC	Monitor trends, degradation product of cis-1,2-DCE and 1,1-DCE
Ethene [1]	Laboratory	Decreasing trends indicate natural attenuation	CVOC	Monitor trends, degradation product of vinyl chloride
Ethane [1]	Laboratory	Decreasing trends indicate natural attenuation	CVOC	Monitor trends, degradation product of vinyl chloride
Methane [1]	Laboratory	Decreasing trends indicate natural attenuation	CVOC, MTBE	Monitor trends, indicator for CVOC and MTBE degradation
Chloride	Laboratory	End product of 1,1-DCA and 1,2-DCA degradation	CVOC	Monitor trends, but dissolved salts may mask trends
Nitrate	Laboratory	Potential electron receptor for biodegradation	CVOC, MTBE	Presence indicates potential for biodegradation
Nitrite	Laboratory	Form of nitrate reduced by biodegradation	CVOC, MTBE	Presence indicates possible biodegradation
Sulfate/sulfide	Laboratory	Potential electron receptor for biodegradation	CVOC, MTBE	Monitor trends
Iron (ferric/ferrous) (total/dissolved)	Laboratory	Potential electron receptor for biodegradation	CVOC, MTBE	Monitor trends
Manganese (total/dissolved)	Laboratory	Potential electron receptor for biodegradation	CVOC, MTBE	Monitor trends
Total Organic Carbon	Laboratory	Decreasing trends indicate natural attenuation	CVOC, MTBE	Monitor trends
Carbon Dioxide	Laboratory	Decreasing trends indicate natural attenuation	CVOC, MTBE	Monitor trends
Alkalinity	Laboratory	Decreasing trends indicate natural attenuation	CVOC, MTBE	Monitor trends
Volatile Fatty Acids	Laboratory	Decreasing trends indicate natural attenuation	CVOC, MTBE	Monitor trends
Temperature	Field	Rate of natural attenuation	CVOC, MTBE	Monitor trends
pH	Field	Neutral range 6-8 required for biodegradation	CVOC, MTBE	Monitor level and trends
DO	Field	Presence required for aerobic biodegradation	CVOC, MTBE	Monitor level and trends
ORP	Field	Indicates redox state for biodegradation	CVOC, MTBE	Monitor level and trends

BTEX - benzene, toluene, ethylbenzene, xylene
CVOC - chlorinated volatile organic compound
DCA - dichloroethane
DCE - dichloroethene
DO - dissolved oxygen
MNA - monitored natural attenuation
MTBE - methyl tert-butyl ether
ORP - oxidation reduction potential measured using an silver/silver chloride reference cell
PCE - tetrachloroethene
TCE - trichloroethene
TBA - tert-butyl alcohol

Note:
[1] Compound will be analyzed in monitoring wells MKTF-2, MKTF-10, MKTF-24, and MKTF-25 only.

TABLE 4-1. 2024 GROUNDWATER MONITORING NETWORK AND SAMPLING FREQUENCY
WESTERN REFINING SOUTHWEST LLC, D/B/A MARATHON GALLUP REFINERY, GALLUP, NEW MEXICO

Well Network	Sample Frequency[1]
Western Boundary	
BW-1A	Annual
BW-1B	Annual
BW-1C	Annual
BW-2A	Annual
BW-2B	Annual
BW-2C	Annual
BW-3A	Annual
BW-3B	Annual
BW-3C	Annual
BW-4A	Annual
BW-4B	Annual
BW-5A	Annual
BW-5B	Quarterly
BW-5C	Quarterly
Land Treatment Unit	
MW-1	Annual
MW-2	Annual
MW-4	Annual
MW-5	Annual
SMW-2	Annual
SMW-4	Annual
OW-67	Quarterly
OW-68	Quarterly
SWMU 1	
GWM-1	Quarterly
GWM-2	Quarterly
GWM-3	Quarterly
OW-59	Quarterly
OW-60	Quarterly
NAPIS-1	Quarterly
NAPIS-2	Quarterly
NAPIS-3	Quarterly
KA-3	Quarterly
OAPIS-1	Quarterly
STP1-NW	Quarterly
STP1-SW	Quarterly
East LDU	Quarterly
West LDU	Quarterly
Oil Sump LDU	Remove - Unable to Locate

TABLE 4-1. 2024 GROUNDWATER MONITORING NETWORK AND SAMPLING FREQUENCY
WESTERN REFINING SOUTHWEST LLC, D/B/A MARATHON GALLUP REFINERY, GALLUP, NEW MEXICO

Well Network	Sample Frequency[1]
Eastern Boundary	
OW-12A	Quarterly
OW-14	Quarterly
OW-29	Quarterly
OW-30	Quarterly
OW-50	Quarterly
OW-52	Quarterly
OW-53	Quarterly
OW-54	Quarterly
OW-55	Quarterly
OW-56	Quarterly
OW-66	Quarterly
OW-70	Quarterly
Tank Farm	
OW-57	Quarterly
OW-58	Quarterly
OW-58A	Quarterly
OW-61	Quarterly
OW-62	Quarterly
OW-63	Quarterly
OW-64	Quarterly
OW-65	Quarterly
RW-1	Quarterly
RW-2R	Quarterly
RW-5	Quarterly
RW-6	Quarterly
Production Wells	
PW-2	Annual[2]
PW-3	Quarterly
PW-4	Annual
Deep Wells	
OW-1	Quarterly
OW-10	Quarterly
OW-11	Annual
OW-12	Semiannual
OW-13	Quarterly

TABLE 4-1. 2024 GROUNDWATER MONITORING NETWORK AND SAMPLING FREQUENCY
WESTERN REFINING SOUTHWEST LLC, D/B/A MARATHON GALLUP REFINERY, GALLUP, NEW MEXICO

Well Network	Sample Frequency[1]
Marketing Tank Farm	
MKTF-01R	Quarterly
MKTF-02R	Quarterly; MNA Annually
MKTF-03	Quarterly
MKTF-04R	Quarterly; MNA Annually
MKTF-05	Quarterly
MKTF-06	Quarterly
MKTF-07	Quarterly
MKTF-08	Quarterly
MKTF-09	Quarterly; MNA Annually
MKTF-10	Quarterly; MNA Annually
MKTF-11	Quarterly
MKTF-12	Quarterly
MKTF-13	Quarterly; MNA Annually
MKTF-14	Quarterly
MKTF-15	Quarterly
MKTF-16	Quarterly; MNA Annually
MKTF-17R	Quarterly; MNA Annually
MKTF-18R	Quarterly
MKTF-19	Quarterly; MNA Annually
MKTF-20	Quarterly; MNA Annually
MKTF-21	Quarterly; MNA Annually
MKTF-22	Quarterly; MNA Annually
MKTF-23	Quarterly
MKTF-24	Quarterly; MNA Annually
MKTF-25	Quarterly; MNA Annually
MKTF-26	Quarterly
MKTF-27	Quarterly
MKTF-28	Quarterly
MKTF-29	Quarterly
MKTF-30	Quarterly
MKTF-31	Quarterly
MKTF-32	Quarterly
MKTF-33	Quarterly
MKTF-34	Quarterly
MKTF-35	Quarterly
MKTF-36	Quarterly
MKTF-37	Quarterly
MKTF-38	Quarterly
MKTF-39	Quarterly
MKTF-40	Quarterly
MKTF-41	Quarterly
MKTF-42	Quarterly
MKTF-43	Quarterly
MKTF-44	Quarterly
MKTF-45	Quarterly
MKTF-46	Quarterly
MKTF-47	Quarterly
MKTF-48	Quarterly
MKTF-49	Quarterly
MKTF-50	Quarterly

TABLE 4-1. 2024 GROUNDWATER MONITORING NETWORK AND SAMPLING FREQUENCY
WESTERN REFINING SOUTHWEST LLC, D/B/A MARATHON GALLUP REFINERY, GALLUP, NEW MEXICO

Well Network	Sample Frequency[1]
Evaporation Ponds	
EP-2	Semiannual
EP-3	Semiannual
EP-4	Semiannual
EP-5	Semiannual
EP-6	Semiannual
EP-7	Semiannual
EP-8	Semiannual
EP-9	Semiannual
EP-11	Semiannual
EP-12A	Semiannual
EP-12B	Semiannual
STP-1 to EP-2	Quarterly

MNA - Monitored Natural Attenuation
SPH - Separate phase hydrocarbon

Notes:
[1] Wells will be sampled at listed frequency unless measurable SPH is detected during sampling event
[2] Sampled in 3 year intervals; Sampled in 2023, next event is 2026.

TABLE 4-2. 2024 GROUNDWATER MONITORING ANALYTE LIST
WESTERN REFINING SOUTHWEST LLC, D/B/A MARATHON GALLUP REFINERY, GALLUP, NEW MEXICO

CONSTITUENT	COMMENTS	FREQUENCY
VOC		
1,1,1-Trichloroethane	Facility-wide analyte	Quarterly
1,1-Dichloroethane (1,1-DCA)	Facility-wide and MNA analyte[1]	Quarterly
1,1-Dichloroethene (1,1-DCE)	Facility-wide and MNA analyte	Quarterly
1,2,4-Trimethylbenzene	Facility-wide analyte	Quarterly
1,2-Dibromoethane (EDB)	Facility-wide analyte	Quarterly
1,2-Dichloroethane (1,2-DCA)	Facility-wide and MNA analyte	Quarterly
1,3,5-Trimethylbenzene	Facility-wide analyte	Quarterly
2-Butanone (MEK)	Facility-wide analyte	Quarterly
Acetone	Facility-wide analyte	Quarterly
Benzene	Facility-wide and MNA analyte	Quarterly
Bromomethane	Facility-wide analyte	Quarterly
Carbon Disulfide	Facility-wide analyte	Quarterly
Chlorobenzene	Facility-wide analyte	Quarterly
Chloroform	Facility-wide analyte	Quarterly
Chloromethane	Facility-wide analyte	Quarterly
cis-1,2-Dichloroethene (cis-1,2-DCE)	Facility-wide and MNA analyte	Quarterly
Ethylbenzene	Facility-wide and MNA analyte	Quarterly
Isopropyl benzene	Facility-wide analyte	Quarterly
Methylene Chloride	Facility-wide analyte	Quarterly
Methyl Tert-Butyl Ether (MTBE)	Facility-wide and MNA analyte	Quarterly
n-Butylbenzene	Facility-wide analyte	Quarterly
n-Propyl benzene	Facility-wide analyte	Quarterly
Pentafluorobenzene	Facility-wide analyte	Quarterly
p-Isopropyl toluene	Facility-wide analyte	Quarterly
sec-Butylbenzene	Facility-wide analyte	Quarterly
Styrene	Facility-wide analyte	Quarterly
Tetrachloroethene (PCE)	Facility-wide and MNA analyte	Quarterly
Toluene	Facility-wide and MNA analyte	Quarterly
Trichloroethene (TCE)	Facility-wide and MNA analyte	Quarterly
Vinyl Chloride	Facility-wide and MNA analyte	Quarterly
Xylenes, Total	Facility-wide and MNA analyte	Quarterly
SVOC		
1,4-Dichlorobenzene	Facility-wide analyte	Quarterly
1,4-Dioxane	Facility-wide analyte	Quarterly
1-Methylnaphthalene	Facility-wide analyte	Quarterly
2,4,6-Trichlorophenol	Facility-wide analyte	Quarterly
2,4-Dimethylphenol	Facility-wide analyte	Quarterly
2,4-Dinitrophenol	Facility-wide analyte	Quarterly
2-Methylnaphthalene	Facility-wide analyte	Quarterly
2-Methylphenol	Facility-wide analyte	Quarterly
3,4-Methylphenol	Facility-wide analyte	Quarterly
Acenaphthene	Facility-wide analyte	Quarterly
Anthracene	Facility-wide analyte	Quarterly

TABLE 4-2. 2024 GROUNDWATER MONITORING ANALYTE LIST
WESTERN REFINING SOUTHWEST LLC, D/B/A MARATHON GALLUP REFINERY, GALLUP, NEW MEXICO

CONSTITUENT	COMMENTS	FREQUENCY
Benzo(a)anthracene	Facility-wide analyte	Quarterly
Benzoic Acid	Facility-wide analyte	Quarterly
Bis(2-ethylhexyl)phthalate	Facility-wide analyte	Quarterly
Chrysene	Facility-wide analyte	Quarterly
Diethyl phthalate	Facility-wide analyte	Quarterly
Dimethyl phthalate	Facility-wide analyte	Quarterly
Di-n-butyl phthalate	Facility-wide analyte	Quarterly
Di-n-octylphthalate	Facility-wide analyte	Quarterly
Fluoranthene	Facility-wide analyte	Quarterly
Fluorene	Facility-wide analyte	Quarterly
Indeno(1,2,3-cd)pyrene	Facility-wide analyte	Quarterly
Naphthalene	Facility-wide analyte	Quarterly
Phenanthrene	Facility-wide analyte	Quarterly
Phenol	Facility-wide analyte	Quarterly
Pyrene	Facility-wide analyte	Quarterly
Pyridine	Facility-wide analyte	Quarterly
METALS[2]		
Antimony, Dissolved	Facility-wide analyte	Quarterly
Arsenic, Dissolved	Facility-wide analyte	Quarterly
Barium, Dissolved	Facility-wide analyte	Quarterly
Beryllium, Dissolved	Facility-wide analyte	Quarterly
Cadmium, Dissolved	Facility-wide analyte	Quarterly
Chromium, Dissolved	Facility-wide analyte	Quarterly
Cobalt, Dissolved	Facility-wide analyte	Quarterly
Lead, Dissolved	Facility-wide analyte	Quarterly
Mercury, Dissolved	Facility-wide analyte	Quarterly
Nickel, Dissolved	Facility-wide analyte	Quarterly
Selenium, Dissolved	Facility-wide analyte	Quarterly
Silver, Dissolved	Facility-wide analyte	Quarterly
Vanadium, Dissolved	Facility-wide analyte	Quarterly
Zinc, Dissolved	Facility-wide analyte	Quarterly
Antimony, Total	Facility-wide analyte	Quarterly
Arsenic, Total	Facility-wide analyte	Quarterly
Barium, Total	Facility-wide analyte	Quarterly
Beryllium, Total	Facility-wide analyte	Quarterly
Cadmium, Total	Facility-wide analyte	Quarterly
Chromium, Total	Facility-wide analyte	Quarterly
Cobalt, Total	Facility-wide analyte	Quarterly
Lead, Total	Facility-wide analyte	Quarterly
Mercury, Total	Facility-wide analyte	Quarterly
Nickel, Total	Facility-wide analyte	Quarterly
Selenium, Total	Facility-wide analyte	Quarterly
Silver, Total	Facility-wide analyte	Quarterly
Vanadium, Total	Facility-wide analyte	Quarterly
Zinc, Total	Facility-wide analyte	Quarterly

TABLE 4-2. 2024 GROUNDWATER MONITORING ANALYTE LIST
WESTERN REFINING SOUTHWEST LLC, D/B/A MARATHON GALLUP REFINERY, GALLUP, NEW MEXICO

CONSTITUENT	COMMENTS	FREQUENCY
GENERAL CHEMISTRY		
Biochemical Oxygen Demand	Evaporation Pond Samples Only	Semiannual
Chemical Oxygen Demand	Evaporation Pond Samples Only	Semiannual
Coliform, E-Coli	Evaporation Pond Samples Only	Semiannual
Cyanide, Total	Facility-wide analyte	Annually
Chloride	Facility-wide and MNA analyte[5]	Annually
Nitrate	Facility-wide and MNA analyte[5]	Annually
Nitrite	Facility-wide and MNA analyte[5]	Annually
Sulfate	Facility-wide and MNA analyte[5]	Annually
Sulfides	Facility-wide and MNA analyte[5]	Annually
TPH DRO	Facility-wide analyte	Quarterly
TPH GRO	Facility-wide analyte	Quarterly
TPH ORO	Facility-wide analyte	Quarterly
2023 SPECIFIC WELL PARAMETERS		
Pesticides (Method 8081B)	**Per NMED 2019 Comment 25 (2020)[3] and Comment 10 (2021)[4]**	
2,4-DDE	EP-2 only	Semiannual
4,4-DDD	EP-2 only	Semiannual
4,4-DDE	EP-2 only	Semiannual
4,4-DDT	EP-2 only	Semiannual
a-BHC	EP-2 only	Semiannual
Aldrin	EP-2 only	Semiannual
b-BHC	EP-2 only	Semiannual
Chlordane	EP-2 only	Semiannual
d-BHC	EP-2 only	Semiannual
Dieldrin	EP-2 only	Semiannual
Endosulfan I	EP-2 only	Semiannual
Endosulfan II	EP-2 only	Semiannual
Endosulfan sulfate	EP-2 only	Semiannual
Endrin	EP-2 only	Semiannual
Endrin aldehyde	EP-2 only	Semiannual
g-BHC (Lindane)	EP-2 only	Semiannual
Heptachlor	EP-2 only	Semiannual
Heptachlor epoxide	EP-2 only	Semiannual
Methoxychlor	EP-2 only	Semiannual
Toxaphene	EP-2 only	Semiannual
PFAS (Method 537.1)	**Per NMED Comment 30 (2020)[3]**	
PFBA	OW-63 only	Quarterly
PFPeA	OW-63 only	Quarterly
PFBS	OW-63 only	Quarterly
4:2 FTS	OW-63 only	Quarterly
PFHxA	OW-63 only	Quarterly
PFPeS	OW-63 only	Quarterly
PFHpA	OW-63 only	Quarterly
PFHxS	OW-63 only	Quarterly
6:2 FTS	OW-63 only	Quarterly
PFOA	OW-63 only	Quarterly

TABLE 4-2. 2024 GROUNDWATER MONITORING ANALYTE LIST
WESTERN REFINING SOUTHWEST LLC, D/B/A MARATHON GALLUP REFINERY, GALLUP, NEW MEXICO

CONSTITUENT	COMMENTS	FREQUENCY
PFHpS	OW-63 only	Quarterly
PFNA	OW-63 only	Quarterly
PFOSA	OW-63 only	Quarterly
PFDA	OW-63 only	Quarterly
8:2 FTS	OW-63 only	Quarterly
PFNS	OW-63 only	Quarterly
MeFOSAA	OW-63 only	Quarterly
EtFOSAA	OW-63 only	Quarterly
PFUnA	OW-63 only	Quarterly
PFDS	OW-63 only	Quarterly
PFDoA	OW-63 only	Quarterly
PFTrDA	OW-63 only	Quarterly
PFTeDA	OW-63 only	Quarterly
FIELD PARAMETERS		
Conductivity	Facility-wide analyte	Quarterly
DO	Facility-wide and MNA analyte	Quarterly
ORP	Facility-wide and MNA analyte	Quarterly
pH	Facility-wide and MNA analyte	Quarterly
Salinity	Facility-wide analyte	Quarterly
Temperature	Facility-wide and MNA analyte	Quarterly
Total Dissolved Solids	Facility-wide analyte	Quarterly
Turbidity	Facility-wide analyte	Quarterly

COC - Constituent of concern

DO - Dissolved oxygen

DRO - Diesel Range Organic

GRO - Gasoline Range Organic

NMED - New Mexico Environment Department

MNA - Monitored Natural Attenuation

ORO - Oil Range Organic

ORP - Oxidation Reduction Potential

PFAS - Pre- and Polyfluoroalkyl substances

SVOC - Semi-volatile organic compound

TPH - Total Petroleum Hydrocarbon

VOC - Volatile Organic Compound

Notes:

[1]Analytes are included in both the facility-wide groundwater monitoring program and the MNA groundwater program (see Table 3-1).

[2] Personal Communication. 2022. Marathon Gallup - 2022 Groundwater Work Plan Revised Analyte List. Emails between Mr. Michiya Suzuki (NMED) and Ms. Lesli Alexander (Trihydro). January 5 through January 20.

[3] NMED. 2020. Disapproval, Annual Groundwater Monitoring Report Gallup Refinery -2019, Western Refining Southwest Inc., Gallup Refinery, EPA ID #NMD000333211, HWB-WRG-20-013. November 23. Comments 25 (Pesticides) and 30 (PFAS).

[4] NMED. 2021. Second Disapproval, [Revised] Facility Wide Groundwater Monitoring Work Plan - Updates for 2021, Western Refining Southwest Inc., Gallup Refinery, McKinley County, Gallup, New Mexico, EPA ID #NMD000333211, HWB-WRG-21-006. November 15. Comment 10.

[5] NMED. 2023. Disapproval, 2023 Facility Wide Groundwater Monitoring Work Plan, Western Refining Southwest LLC, Gallup Refinery, McKinley County, Gallup, New Mexico, EPA ID #NMD000333211, HWB-WRG-21-006. October 18. Comment 12.

Appendices A through C (Please see attached CD)

Appendix A – Background Information

Appendix B – Investigation Methods

Appendix C – Skinner List

Appendix A – Background Information

WESTERN REFINING SOUTHWEST LLC
D/B/A MARATHON GALLUP REFINERY
APPENDIX A. BACKGROUND INFORMATION

JANUARY 25, 2024

Table of Contents

List of Figures

List of Attachments

List of Acronyms

AOC	Area of Concern
AL	aeration lagoon
API	American Petroleum Institute
EP	evaporation pond
HP	Hydraulic Profiling
I-40	Interstate 40
IM	interim measures
KOD	Knock Out Drum
LDU	leak detection unit
LIF	Laser-Induced Fluorescence
LTU	land treatment unit
MKTF	Marketing Tank Farm
NAPIS	New American Petroleum Institute Separator
NM	New Mexico
NMED	New Mexico Environment Department
OAPIS	Old American Petroleum Institute Separator
RCRA	Resource Conservation and Recovery Act
SPH	separate phase hydrocarbon
SWMU	solid waste management unit
TPH	total petroleum hydrocarbons
WWTP	wastewater treatment plant

1.0 Introduction

This appendix provides an overview of background information relevant for the Western Refining Southwest LLC, D/B/A Marathon Gallup Refinery (Refinery) located in Gallup, New Mexico (NM). The Refinery is situated on an 810-acre irregular shaped tract of land that is largely located within the southern one-quarter of Section 28 and throughout Section 33 of Township 15 North, Range 15 West of the New Mexico Prime Meridian. A small component of the property lies within the northeastern one-quarter of Section 4 of Township 14 North, Range 15 West. The Gallup Refinery is located at Exit 39 on Interstate 40 (I-40) at Jamestown, NM approximately 17 miles east of Gallup. The Refinery is indefinitely idled and being maintained near operating conditions.

2.0 Regulatory Status

The Refinery is regulated under a Resource Conservation and Recovery Act (RCRA) post-closure permit (NMED 2017a), completing corrective action and compliance activities. The following regulations and permits govern the Refinery:

- Standard Industrial Classification code 2911 (petroleum refining) and North American Industry Classification System code 32411
- Final Resource Conservation and Recovery Act Post-Closure Permit, United States Environmental Protection Agency ID Number NMD000333211
- NM Oil Conservation Division Abatement Plan Number AP-111
- 2015 NPDES MSGP, ID #NMR053168

3.0 Historical Refinery Operations

Built in the 1950s, the Refinery is located within a rural and sparsely populated area east of Gallup, NM. The Refinery is indefinitely idled as of October 9, 2020. During operation, the Refinery was a crude oil refining and petroleum products manufacturing facility. There were no non-petroleum fuel organic chemicals, plastics, or synthetic fibers manufactured that contributed to the process flow of wastewater. The Refinery did not manufacture lubricating oils. As a result of the processing steps, the Refinery produced a wide range of petroleum products including propane, butane, unleaded gasoline, diesel, residual fuel, and non-petroleum commercial by-products of fertilizer and solid elemental sulfur.

Historically, the Refinery primarily received crude oil via two 6-inch diameter pipelines, which entered the Refinery property from the north (Four Corners Area). In addition, the Refinery also received natural gasoline feedstock via a 4-inch diameter pipeline that came in from the west along the I-40 corridor from the Western Refining Southwest LLC – Wingate Plant, which is also indefinitely idled. Crude oil and other products also arrived at the Refinery via railroad cars. These feed stocks were then stored in tanks until refined into petroleum fuel products.

Above ground storage tanks were used throughout the Refinery to hold and store crude oil, gasoline, intermediate feed stocks, finished products, chemicals, and water. The capacity of these tanks ranged in size from less than 1,000 barrels to 80,000 barrels. Pumps, valves, and piping systems were used throughout the Refinery to transfer various liquids among storage tanks and processing units. A railroad spur track and a railcar loading rack were used to transfer feed stocks and products from Refinery storage tanks into and out of railcars. Several tank truck loading racks were used at the Refinery to load out finished products, received crude oil, other feed stocks, additives, and chemicals when operating.

Even though the Refinery has an indefinite idle status, the process wastewater system remains in operation. The system is a network of curbing, paving, catch basins, and underground piping used to collect surface runoff from various processing areas within the Refinery. The wastewater effluent then flows into the equalization tanks and the New American Petroleum Institute (API) Separator (NAPIS). Currently, only remediation fluids and surface runoff are processed through the system.

While the Refinery is in indefinite idle, water is held in evaporation pond (EP)-2 to evaporate and is not distributed to the other ponds. No wastewater is currently discharged from the Refinery to surface waters of the state.

Currently, all above-ground large tanks have leak detection or equivalent systems, such as radar gauges. Pumps that could leak hydrocarbons are within containment areas and all tanks are located inside earthen berms to contain spills. The NAPIS has double walls and a leak detection system installed.

4.0 Environmental Investigations and Assessments

There are 14 Solid Waste Management Units (SWMUs) identified at the Refinery and one closed Land Treatment Unit (LTU). On December 31, 2013, the RCRA Post-Closure Care Permit (RCRA Permit) became effective under the New Mexico Administrative Code §20.4.1.901A(10). The RCRA Permit identified an additional 21 Areas of Concern (AOCs) requiring corrective action. These units are listed below, and the locations are identified on Figure 4-1.

RCRA Regulated Units

- LTU

SWMUs

- SWMU 1 – Aeration Basin
- SWMU 2 – Evaporation Ponds
- SWMU 3 – Empty Container Storage Area
- SWMU 4 – Old Burn Pit
- SWMU 5 – Landfill Areas
- SWMU 6 – Tank Farm
- SWMU 7 – Fire Training Area
- SWMU 8 – Railroad Rack Lagoon
- SWMU 9 – Drainage Ditch and the Inactive Land farm
- SWMU 10 – Sludge Pits
- SWMU 11 – Secondary Oil Skimmer
- SWMU 12 – Contact Wastewater Collection System
- SWMU 13 – Drainage Ditch between North and South Evaporation Ponds
- SWMU 14 – Old API Separator (OAPIS)

AOCs

- AOC 15 – NAPIS
- AOC 16 – NAPIS Overflow Tanks
- AOC 17 – Railroad Loading/Unloading Facility
- AOC 18 – Asphalt Tank Farm (tanks 701-709, 713, 714)

- AOC 19 – East Fuel Oil Loading Rack
- AOC 20 – Crude Slop and Ethanol Unloading Facility
- AOC 21 – Main Loading Racks
- AOC 22 – Loading Rack Additive Tank Farm
- AOC 23 – Retail Fuel Tank Farm (tanks 1-7, 912, 913, 1001, 1002)
- AOC 24 – Crude Oil Tank Farm (tanks 101 and 102)
- AOC 25 – Tank 573 (Kerosene Tank)
- AOC 26 – Process Units
- AOC 27 – Boiler and Cooling Unit Area
- AOC 28 – Warehouse and Maintenance Shop Area
- AOC 29 – Equipment Yard and Drum Storage Area
- AOC 30 – Laboratory
- AOC 31 – Tanks 27 and 28
- AOC 32 – Flare and Ancillary Tanks (tanks Z85V2, Z85V3, Z84-T105)
- AOC 33 – Storm Water Collection System
- AOC 34 – Scrap Yard
- AOC 35 – Main Truck Loading Rack, Crude Slop and Ethanol Unloading Facility, Additive Tank Farm/Loading Rack, and Retail Tank Farm (tanks 1-7, 912, 913, 1001, and 1002)

The RCRA Permit was modified in September 2017 (NMED 2017a), with SWMU 8 and AOCs 19 and 25 granted Corrective Action Complete status. AOC 32 was combined with SWMU 14; AOC 33 was combined with SWMU 12. AOCs 20, 21, 22, and 23 were combined to make AOC 35. The schedule in the RCRA Permit Appendix E, Table E-1 was amended to reflect prior submittals, revised due dates and deferral of other units. A new Consent Order was executed in January 2017 (NMED 2017b), which resulted in 11 AOCs (AOC 16, 17, 18, 24, 26, 27, 28, 29, 30, 31, and 34) being removed from the RCRA Permit and transferred to the Consent Order for further evaluation. The Refinery received correspondence from the New Mexico Environmental Department (NMED) on August 19, 2021, to restore the 11 AOCs back to the RCRA Permit. The Permit modification was submitted by the Refinery to NMED on November 30, 2021 (Western 2021a).

Figure 4-1 also identifies known release areas and other Refinery features. Release areas and investigation areas are described in the following subsections. Where appropriate, reference to figures depicting detailed views of specific areas where investigation borings have been conducted or planned are included in the text of the following subsections. The figures referenced have been copied from the relevant work plans and compiled into Attachment A of this appendix. No other modifications were made to the figures and their inclusion here is intended to provide an overview of the assessments. For additional detail, refer to the relevant work plan or report.

4.1 New American Petroleum Institute Separator Unit

The NAPIS unit (AOC 15 on Figure 4-1) was put into service in October 2004 (Attachment A-1). The NAPIS has one up gradient well, NAPIS-1, located on the east side and three down-gradient shallow monitoring wells, NAPIS 2, NAPIS-3, and KA-3, which are located along the west side (Figure 4-1 and Attachment A-1). The NAPIS unit is equipped with three leak detection units (LDUs) on the east and west bays, including the oil sump section in the east bay, and are designated as East LDU, West LDU, and oil sump LDU. The Refinery is currently investigating the source of the fluid found in the East and West LDUs. Preliminary assessment of the NAPIS does not indicate leaking from the concrete secondary containment (Western 2021b).

4.2 Aeration Basin

The aeration basin (SWMU-1 on Figure 4-1 and Attachment A-1) in the Facility's RCRA Permit (NMED 2017a), includes three cells known as aeration lagoon (AL)-1, AL-2 and holding pond 1 (currently referred to as EP-1) (Attachment A-1). These three cells have been out of service since the startup of the wastewater treatment plant (WWTP) in 2012. SWMU-1 closure was postponed and is scheduled to begin in 2024 with the excavation of AL-1 and AL-2, followed by the excavation of EP-1.

4.3 Heat Exchanger Bundle Pad

A workplan to investigate benzene exceedances near the Bundle Cleaning Pad (near SWMU 3 in the center of the Refinery on Figure 4-1 and Attachment A-2) was submitted to NMED in September 2021 (Western 2021c). Benzene exceedances have been found near the Bundle Cleaning Pad, in MKTF-16, since 2013 (Attachment A-2). The workplan proposed to install soil borings around the Bundle Pad to evaluate the source of the benzene found in MKTF-16. The field investigation was completed in May 2022. Findings were submitted to NMED in the Heat Exchanger Bundle Pad Investigation Report, dated November 2022 (Western 2022a).

4.4 North Drainage Ditch

On April 22, 2015, the Refinery notified NMED-Hazardous Waste Bureau of the discovery of separate phase hydrocarbon (SPH) in a drainage ditch in the northern portion of the property, north of SWMU 4 on Figure 4-1 and Attachment A-3. Surface water samples were collected from the standing water in the drainage ditch. Benzene, toluene, ethylbenzene, and xylenes were detected as well as methyl tert-butyl ether, total petroleum hydrocarbons (TPH)-gasoline range organics, and TPH-diesel range organics. An investigation was conducted in May 2016 with installation of well OW-56. An additional investigation in the North Drainage Ditch was conducted in August 2021, which included the installation of five temporary wells, three new monitoring wells, and soils samples collected from six soil borings. Findings were presented in a report to NMED on December 17, 2021 (Western 2021d). An approval with modifications for the investigation was received on April 25, 2022 (NMED 2022). The response to approval with modifications for the investigation report was submitted to NMED on August 16, 2022 (Western 2022b). During 2022, additional investigation of the North Drainage ditch area was requested per NMED. The North Drainage Ditch Area Investigation Work Plan Phase II was submitted in November 2022 (Western 2022c). A disapproval for the North Drainage Ditch Investigation Work Plan Phase II was received on August 15, 2023 (NMED 2023).

4.5 Sour Naphtha Release

On March 26, 2017, a sour naphtha release occurred from a pipeline approximately 4 ft beneath the service road near the intersection northwest of the bundle cleaning pad on Figure 4-1 and Attachment A-4. The estimated volume released was less than 210 gallons which surfaced and flowed down the road to the west. Following the release, approximately 16 tons of impacted soil were excavated. The Sour Naphtha Release Workplan was submitted to NMED on September 28, 2021 (Western 2021e). The Sour Naphtha Release Workplan proposed to install soil borings and collect surface samples to delineate impacts from the sour naphtha release. The field investigation was completed in May 2022. Findings were submitted to NMED in the Sour Naphtha Investigation Report, dated November 2022 (Western 2022d).

4.6 Railcar Release

On May 7, 2017, a hydrocarbon spill was discovered pooling underneath the pipe rack located along the west side of the rail car loading area (Figure 4-1 and Attachment A-5). An estimated 8,900 gallons of recovered gasoline were placed in the slop tank. The on-site laboratory analyzed a release sample, which verified that the released hydrocarbon was gasoline. In an effort to remove impacts, approximately 153 tons of impacted soils were excavated from beneath the pipe rack in November 2018. On March 13, 2019, diesel was discovered leaking in the same area as the 2017 gasoline release. Diesel leaked across the railroad tracks into a culvert, carrying the diesel into the stormwater system. An estimated 1,764 gallons were released; 1,680 gallons were recovered via vacuum truck and 84 gallons that had been released onto the ground surface were non-recoverable. An investigation of the release area was conducted in August 2021. The investigation included collecting surface samples and installing soil borings to delineate the extent of hydrocarbon impacts in the area. The investigation report was submitted to NMED on December 12, 2021 (Western 2021f). In 2022, NMED requested further investigation in the AOC 17 – Railroad Loading and Unloading Facility area. An investigation work plan was submitted to NMED on January 10, 2023 that included details of the installation of soil borings and collection of soil samples (Western 2023a).

4.7 Flare Knock Out Drum Investigation

The Flare Knock Out Drum (KOD) is located adjacent to OAPIS-1 on Figure 4-1 and Attachment A-6. On April 20, 2017, a hose attached to a Sandpiper (double diaphragm) pump at the flare KOD tank ruptured which resulted in a release of approximately 80 barrels of caustic (approximately 20 to 30 percent sodium hydroxide, with a pH of 12.0) to the surrounding area. Approximately 20 to 30 gallons of caustic were pumped from the area into a vacuum truck, which had been diluted with approximately 100 gallons of water and pumped into the refinery sewer system at a pH of 8.0. An investigation into the affected soils was conducted in July and September of 2021. The investigation consisted of collecting soil samples and pH data to determine if excavation and/or further investigation is warranted. The Flare KOD Caustic Release Investigation report was submitted to NMED on October 27, 2021 (Western 2021g).

4.8 French Drain Investigation

The French Drain is located on the east side of STP-1 (Figure 4-1 and Attachment A-7). Hydrocarbon impacts were discovered in the drain line of the STP-1 French Drain on February 6, 2018. Subsequent investigation efforts were completed on February 8 and 10, 2018. The French Drain Soil Sampling Investigation Work Plan was submitted to NMED on December 15, 2020 (MPC 2020a) and was approved with modifications on January 8, 2021, (NMED 2021). The work plan proposed installation of soil borings and sample collection further north, east and west of the STP-1 French Drain and north of the WWTP. This investigation will evaluate the need for any further investigation and/or remediation.. The investigation was completed in October 2022. The investigation report was submitted to NMED on March 31, 2023 (Western 2023b).

4.9 Sanitary Lagoon

The sanitary lagoon is adjacent to well MKTF-25 (Figure 4-1 and Attachment A-8). It was installed when the facility opened in 1957. The lagoon held wastewater and/or raw sewage prior to October 11, 2018, and has since dried out. There is a pipeline that carried sewage from the laboratory, warehouse, truck rack, and machine shop to the sanitary lagoon. The pipeline that discharged to the lagoon was cut and the up-stream portion plugged with concrete on October 11, 2018. A 2019 investigation was conducted in the sanitary lagoon to determine if past use of the lagoon has caused groundwater impacts. The Sanitary Lagoon investigation report, submitted February 2020, concluded that impacts found beneath the Sanitary Lagoon are generally consistent with those observed in the surrounding Marketing Tank Farm (MKTF) wells and that the area should be addressed as part of the larger MKTF plume (MPC 2020b). The initial investigation was to include collecting soil samples beneath the pipeline to determine if there were impacts from potential leaks in the pipe. This part of the investigation was postponed due to the Truck Loading Rack release in October 2019. The investigation below the pipeline, which was altered to include analysis for hydrocarbon as well as sewage impacts, was conducted in September 2021. The results of the investigation were submitted in March 2022 in the Investigation Phase II Report, Sanitary Lagoon (Western 2022e).

4.10 Tank 570 Release

On October 23, 2019, a tank inspection indicated multiple leaks in the floor of Tank 570 (Figure 4-1). Tank 570 was used for 83 octane gasoline storage and was taken out of service for repair. The gasoline release from Tank 570 was investigated in the November 2019 and May 2021 Laser-Induced

Fluorescence (LIF) investigations. The LIF investigations indicated that the gasoline had migrated northeast, north, and northwest. Section 4.13 discusses the investigation results.

4.11 Truck Loading Rack Release/Marketing Tank Farm Area

On October 27, 2019, a leak was discovered in an underground gasoline transfer line west of the truck loading rack (Figure 4-1). Hydrocarbon was observed seeping out of the ground into a stormwater ditch. The line was immediately taken out of service when the release was discovered and has since been replaced. The initial volume estimate was greater than 100 barrels of hydrocarbon. The initial LIF Investigation, conducted in November 2019, was to investigate the extent of the release in the MKTF and Truck Loading Rack areas. Subsequent LIF investigations in February and May 2021 were conducted, in part, to further delineate the hydrocarbon release originating from Truck Loading Rack release. Section 4.13 discusses the investigation results.

4.12 AOC 35 – Marketing Tank Farm

AOC 35 (Figure 4-1) includes the main truck loading rack, crude slop and ethanol unloading facility, additive tank farm loading rack, and the retail tank farm (Attachment A-9). Historical groundwater sample results within and around AOC 35 have shown impacts from petroleum hydrocarbons. The work originally scheduled for AOC 35, described in the investigation work plan originally dated August 2018, was postponed due to the Truck Loading Rack Release. The Revised AOC 35 Investigation Work Plan No. 2 (Western 2021h) was submitted to NMED on August 31, 2021, and included revisions to the original work plan to incorporate the Truck Loading Rack release as well as data from LIF investigations in the area.

4.13 Laser-Induced Fluorescence/Hydraulic Profiling Investigations

In response to more recent releases (approximately 2019 to present) a series of LIF/Hydraulic Profiling (HP) investigations were conducted. LIF is a direct-push site characterization method in which laser light excites fluorescent molecules that exist in most petroleum fuels and oils. Fluorescence is measured as a proxy for SPH presence. The HP tool is run concurrently and is used to assess the geologic unit permeability and hydrostratigraphy. The combination of LIF and HP tools on a single direct push probe facilitates investigation of SPH while simultaneously characterizing lithologic variability that influences SPH mass storage and transport.

The November 2019 LIF investigation was conducted to investigate the extent of the releases in the Marketing Tank Farm and Tank 570 areas. A subsequent LIF investigation in February 2021 was conducted to further delineate the hydrocarbon release originating from the MKTF and Truck Loading Rack areas. The May 2021 investigation focused on Tank 570 and additional areas of the Refinery, including the northern and eastern boundaries, Tank Farm, MKTF, and in and around the wastewater treatment plant. Data gaps from the initial MKTF investigation were also addressed. The Marketing Tank Farm LIF report (MPC 2021), the Tank 570 and additional areas report (Western 2021i), and the Marketing Tank Farm Addendum (Western 2021j) have been submitted to NMED. Additional details on the methods and the investigations can be found in these reports.

5.0 Interim Actions

This section describes ongoing interim remediation actions conducted at the Refinery.

5.1 Hydrocarbon Seep Area

In June 2013, a hydrocarbon seep was discovered east of Tanks 101 and 102 (Figure 4-1 and Attachment A-10). Excavations in the area indicated sufficient hydrocarbons were present for six 6-inch sumps to be installed for fluid recovery via vacuum truck. The area was identified as the "Hydrocarbon Seep Area" and quarterly interim measures (IM) reports are submitted to NMED. Additionally, in 2016, a series of retention ditches were installed north of the sumps. Fluid is extracted from the sumps, at a minimum, of once a month. Standing water and/or hydrocarbon found in the first retention ditch is also recovered, though the retention ditch has been dry since January 2020. Between 2013 and 2018, 19,009 gallons of SPH and 1,549,620 gallons of water were extracted from the sumps. Since 2019, no measurable SPH has been extracted from the sumps and 49,300 gallons of water have been extracted. A total of 50 MKTF monitoring wells have been installed to monitor impacts to groundwater in relation to the Hydrocarbon Seep area.

5.2 Borrow Pit Seep Area

A hydrocarbon seep, suspected to be related to the Truck Loading Rack release, was discovered December 2020 west of the truck loading rack, in the borrow pit (Figure 4-1 and Attachment A-11). In April 2021, six sumps and two piezometers were installed in the borrow pit. Fluid recovery from the sumps is conducted via vacuum truck 3 to 4 times per week as an IM to prevent further hydrocarbon migration. Recovery efforts began in May 2021 with a consistent average of 31.5 gallons of SPH extracted per day through October 2021. Extraction rates are submitted in the Quarterly Hydrocarbon Seep Reports.

6.0 References

Marathon Petroleum Company (MPC). 2020a. French Drain Soil Sampling Investigation Work Plan, Marathon Petroleum Corporation, Gallup Refining Division EPA ID# NMD000333211. December 15.

MPC. 2020b. Investigation Report Sanitary Lagoon, Marathon Petroleum Company LP Gallup Refinery, EPA ID #NMD000333211. February 17.

MPC. 2021. Marketing Tank Farm Laser-Induced Fluorescence/Hydraulic Profiling Investigation Report, Marathon Petroleum Corporation LP, Gallup Refinery, D/B/A Western Refining Southwest LLC, EPA ID #NMD000333211. March 31.

New Mexico Environment Department (NMED). 2017a. Western Refining Southwest, Inc., Gallup Refinery, EPA ID NM No. NM000333211, Final RCRA Post-Closure Permit. Modified September.

NMED. 2017b. Western Refining Southwest, Inc., Order on Consent. January 20.

NMED. 2021. Approval with Modifications, French Drain Soil Sampling Investigation Work Plan, Western Refining Southwest, Inc., Gallup Refinery, EPA ID #NMD000333211, January 8.

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NMED. 2023. Disapproval North Drainage Ditch Area Investigation Work Plan Phase II, Western Refining Southwest LLC, D/B/A Marathon Gallup Refinery, EPA ID#NMD000333211. August 15.

Western Refining Southwest LLC (Western). 2021a. Class 1 Permit Modification Request – Marathon Gallup Refinery, RCRA Post-Closure Permit – EPA ID NM No. MND000333211. November 30.

Western. 2021b. Response to Approval with Modifications, Annual Groundwater Monitoring Report Gallup Refinery – 2019, Western Refining Southwest LLC, Marathon Gallup Refinery, EPA ID #NMD000333211, HWB-WRG-20-013. December 17.

Western. 2021c. Heat Exchanger Bundle Pad Investigation Work Plan, Marathon Gallup Refinery (dba Western Refining Southwest LLC), EPA ID# NMD000333211. September 30.

Western. 2021d. North Drainage Ditch Area Investigation Report, Western Refining Southwest LLC, Marathon Gallup Refinery, EPA ID #NMD000333211. December 17.

Western. 2021e. Sour Naphtha Release Work Plan, Marathon Gallup Refinery (dba Western Refining Southwest LLC), EPA ID# NMD000333211. September 28.

Western. 2021f. Rail Car Loading Area Release Soil Sampling Investigation Report, Western Refining Southwest LLC, D/B/A Marathon Gallup Refinery, EPA ID# NMD000333211. December 12.

Western. 2021g. Flare KOD Caustic Release Investigation Report, Western Refining Southwest LLC, D/B/A Marathon Gallup Refinery, EPA ID# NMD000333211. October 27.

Western. 2021h. Revised Investigation Work Plan No. 2 Area of Concern 35, Western Refining Southwest, Inc., Marathon Gallup Refinery, EPA ID #NMD000333211.August 31.

Western. 2021i. Tank 570 Release and Additional Areas Laser-Induced Fluorescence/Hydraulic Profiling Investigation Report, Western Refining Southwest LLC, D/B/A Marathon Gallup Refinery, EPA ID #NMD000333211. October 27.

Western. 2021j. Marketing Tank Farm Laser-Induced Fluorescence/Hydraulic Profiling Investigation Report Addendum, Western Refining Southwest LLC, D/B/A Marathon Gallup Refinery, EPA ID #NMD000333211. November 19.

Western. 2022a. Heat Exchanger Bundle Pad Investigation Report, Western Refining Southwest LLC, D/B/A Marathon Gallup Refinery, EPA ID #NMD000333211. November 28.

Western. 2022b. Response to Approval with Modifications, North Drainage Ditch Area Investigation Report, Western Refining Southwest LLC, D/B/A Marathon Gallup Refinery, EPA ID #NMD000333211. August 16.

Western. 2022c. North Drainage Ditch Area Investigation Work Plan Phase II, Western Refining Southwest LLC, D/B/A Marathon Gallup Refinery, EPA ID#NMD000333211. November 28.

Western. 2022d. Sour Naphtha Release Investigation Report, Western Refining Southwest LLC, D/B/A Marathon Gallup Refinery, EPA ID #NMD000333211. November 28.

Western. 2022e. Investigation Phase II Report Sanitary Lagoon, Western Refining Southwest LLC, D/B/A Marathon Gallup Refinery, EPA ID #NMD000333211. March 4.

Western. 2023a. Area of Concern 17 – Railroad Loading/Unloading Facility Investigation Work Plan, Western Refining Southwest LLC, D/B/A Marathon Gallup Refinery, EPA ID #NMD000333211. January 10.

Western. 2023b. French Drain Soil Sampling Investigation Report, Western Refining Southwest LLC, D/B/A Marathon Gallup Refinery, EPA ID #NMD000333211. March 31.

Figure

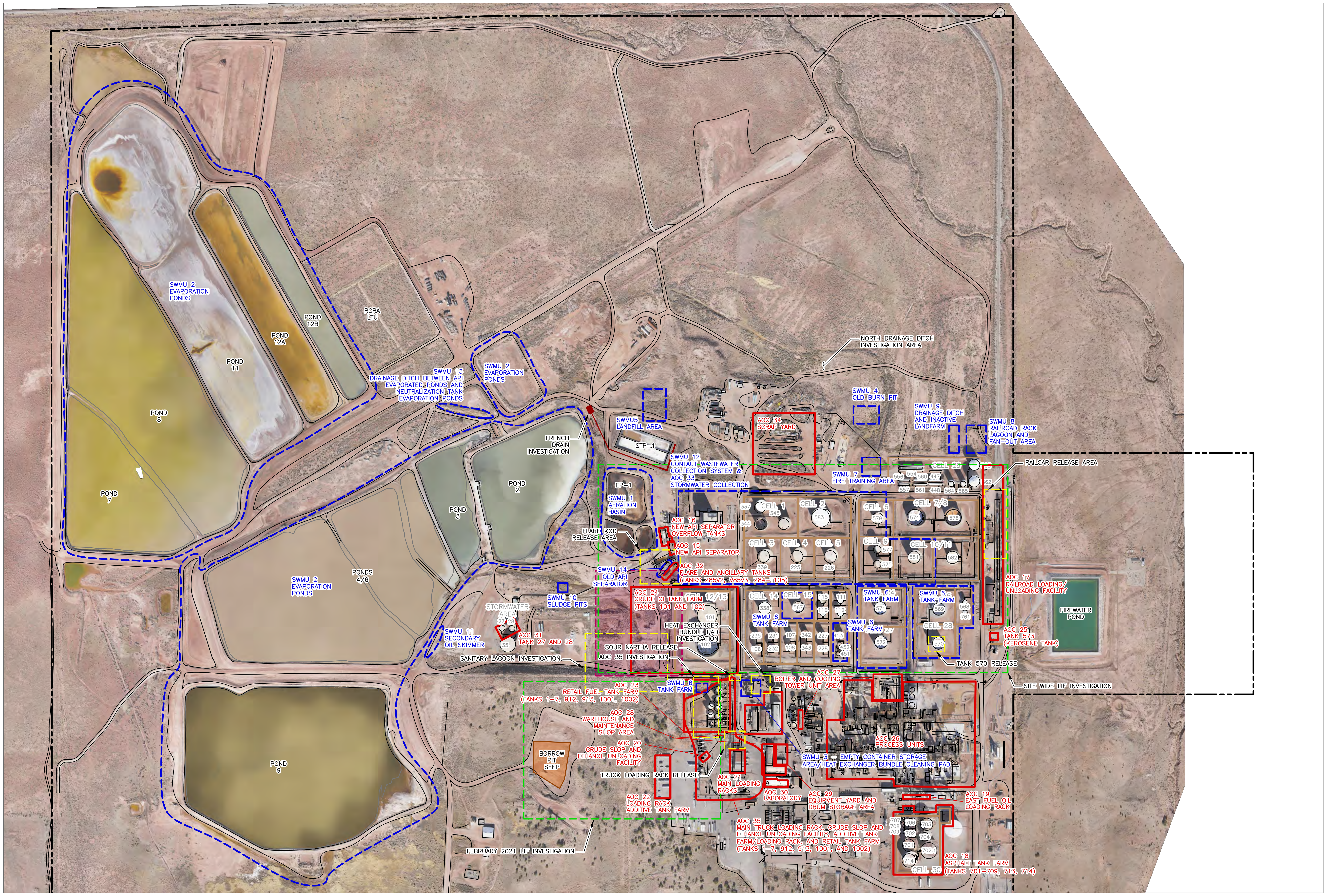

Image Cite: USDA/FSA – Aerial Photography Field Office, NAIP MrSID – Publication: 2014

EXPLANATION

- PROPERTY BOUNDARY (APPROXIMATE)
- AOC LOCATION
- SWMU LOCATION
- FRENCH DRAIN
- RELEASE AND/OR INVESTIGATION AREA
- LIF (LASER INDUCED FLUORESCENCE)
- BORROW PIT SEEP (APPROXIMATE)
- HYDROCARBON SEEP AREA

AOC AREA OF CONCERN
STP SANITARY TREATMENT POND
SWMU SOLID WASTE MANAGEMENT UNIT

NOTE:

THE FOLLOWING WORK INVESTIGATIONS ARE COMPLETED SITE WIDE: GROUNDWATER MONITORING, FENCELINE MONITORING, WEEKLY ON-SITE SUPPORT.

N

0 400' 800'

Trihydro CORPORATION
1252 Commerce Drive
Laramie, Wyoming 82070
www.trihydro.com
(P) 307/745.7474 (F) 307/745.7729

FIGURE 4-1

SITE MAP

WESTERN REFINING SOUTHWEST LLC
D/B/A MARATHON GALLUP REFINERY
GALLUP, NEW MEXICO

Drawn By: REP	Checked By: BB	Scale: 1" = 400'	Date: 12/19/23	File: 697-GWWP-SITEMAP-2023

\\TRIHYDRO.COM\CLIENTS\TON\MARATHON\CADD\GALLUP_REPORTS\WORKPLANS\202401_2024_GW_WP\697-GWWP-SITEMAP-2023

Attachment A – Relevant Figures

EXPLANATION

MONITORING WELL LOCATION

NOTES:

AL - AERATION LAGOON
EP - EVAPORATION POND
NAPIS - NEW AMERICAN PETROLEUM INSTITUTE SEPARATOR UNIT
SWMU - SOLID WASTE MANAGEMENT UNIT

N

0 80'

Trihydro CORPORATION
1252 Commerce Drive
Laramie, WY 82070
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FIGURE A-1

SWMU 1 AERIAL PHOTO (MAY 2018)

WESTERN REFINING SOUTHWEST, LLC
D/B/A MARATHON GALLUP REFINERY
GALLUP, NEW MEXICO

Drawn By: KEJ | Checked By: CF | Scale: 1" = 80' | Date: 10/15/21 | File: 1-2_SWMU1_Fig1-2

Image Cite: USDA /fsa – Aerial Photography Field Office, NAIP MrSID – Publication: 2014

EXPLANATION

△ HEB-8	BUNDLE PAD INVESTIGATION SOIL BORING LOCATION (MAY 2022)
MKTF-16	CHINLE/ALLUVIUM INTERFACE WELL AND DESIGNATION
■	MANHOLE LOCATION
– – –	SWMU 3 LOCATION
——S——	PROCESS SEWER LINE
□	BUNDLE PAD SUMP
○	TANK

N

0 30'

Trihydro CORPORATION
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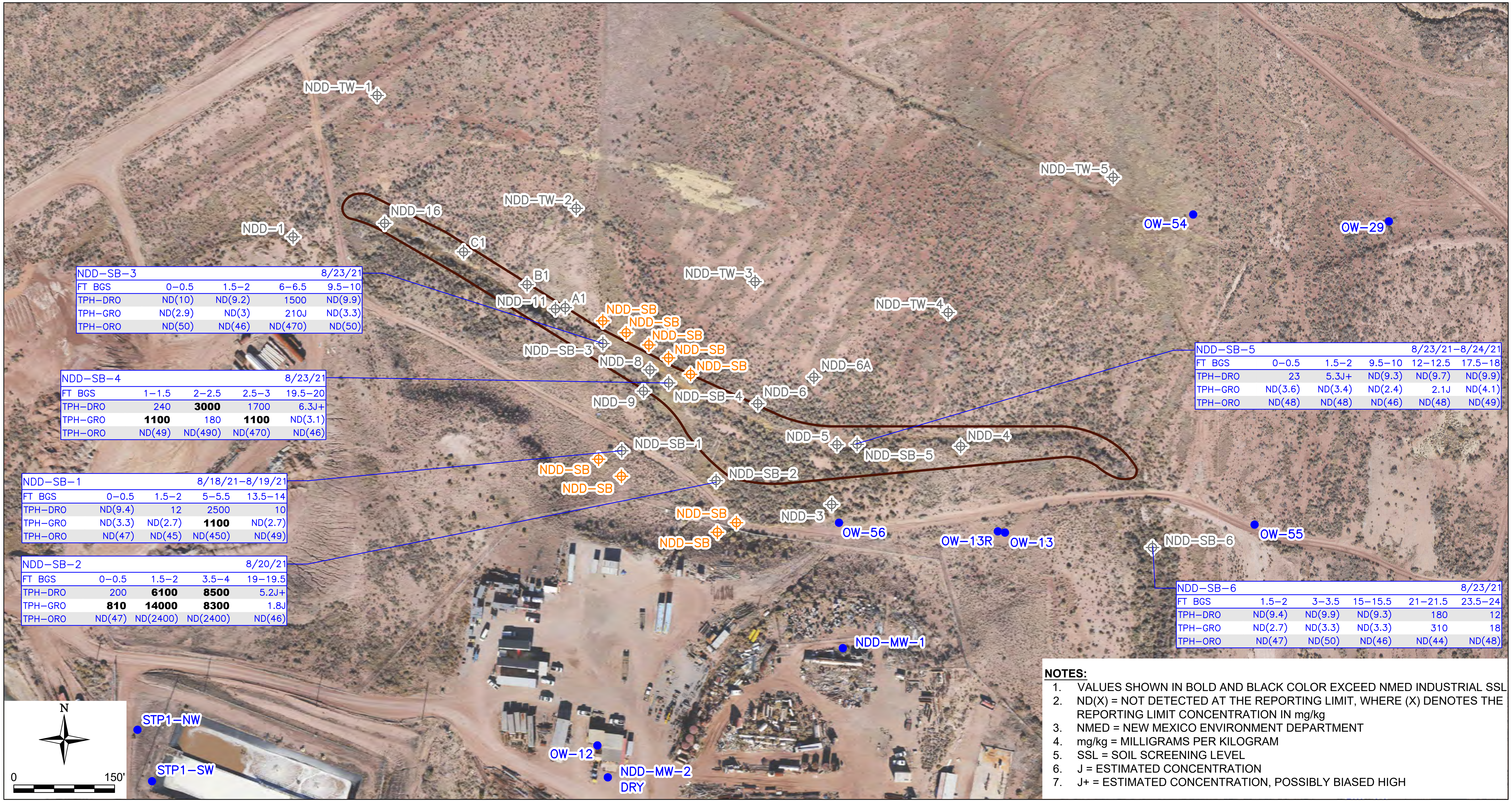
FIGURE A-2
SAMPLE LOCATIONS
HEAT EXCHANGER BUNDLE PAD
INVESTIGATION REPORT
WESTERN REFINING SOUTHWEST, LLC
D/B/A MARATHON GALLUP REFINERY
GALLUP, NEW MEXICO

Drawn By: REP | Checked By: BB | Scale: 1" = 30' | Date: 10/5/22 | File: 697-BUNDLEPADINVLOCS-202209

\\TRIHYDRO.COM\CLIENTS\TON\MARATHON\CADD\GALLUP_REPORTS\SWMU\SWMU3_HXBUNDLEPAD\INVESTIGATIONREPORT\697-BUNDLEPADINVLOCS-202209



NDD-SB-3				8/23/21
FT BGS	0-0.5	1.5-2	6-6.5	9.5-10
TPH-DRO	ND(10)	ND(9.2)	1500	ND(9.9)
TPH-GRO	ND(2.9)	ND(3)	210J	ND(3.3)
TPH-ORO	ND(50)	ND(46)	ND(470)	ND(50)

NDD-SB-4				8/23/21
FT BGS	1-1.5	2-2.5	2.5-3	19.5-20
TPH-DRO	240	**3000**	1700	6.3J+
TPH-GRO	**1100**	180	**1100**	ND(3.1)
TPH-ORO	ND(49)	ND(490)	ND(470)	ND(46)

NDD-SB-1				8/18/21-8/19/21
FT BGS	0-0.5	1.5-2	5-5.5	13.5-14
TPH-DRO	ND(9.4)	12	2500	10
TPH-GRO	ND(3.3)	ND(2.7)	**1100**	ND(2.7)
TPH-ORO	ND(47)	ND(45)	ND(450)	ND(49)

NDD-SB-2				8/20/21
FT BGS	0-0.5	1.5-2	3.5-4	19-19.5
TPH-DRO	200	**6100**	**8500**	5.2J+
TPH-GRO	**810**	**14000**	**8300**	1.8J
TPH-ORO	ND(47)	ND(2400)	ND(2400)	ND(46)

NDD-SB-5					8/23/21-8/24/21
FT BGS	0-0.5	1.5-2	9.5-10	12-12.5	17.5-18
TPH-DRO	23	5.3J+	ND(9.3)	ND(9.7)	ND(9.9)
TPH-GRO	ND(3.6)	ND(3.4)	ND(2.4)	2.1J	ND(4.1)
TPH-ORO	ND(48)	ND(48)	ND(46)	ND(48)	ND(49)

NDD-SB-6					8/23/21
FT BGS	1.5-2	3-3.5	15-15.5	21-21.5	23.5-24
TPH-DRO	ND(9.4)	ND(9.9)	ND(9.3)	180	12
TPH-GRO	ND(2.7)	ND(3.3)	ND(3.3)	310	18
TPH-ORO	ND(47)	ND(50)	ND(46)	ND(44)	ND(48)

NOTES:

1. VALUES SHOWN IN BOLD AND BLACK COLOR EXCEED NMED INDUSTRIAL SSL
2. ND(X) = NOT DETECTED AT THE REPORTING LIMIT, WHERE (X) DENOTES THE REPORTING LIMIT CONCENTRATION IN mg/kg
3. NMED = NEW MEXICO ENVIRONMENT DEPARTMENT
4. mg/kg = MILLIGRAMS PER KILOGRAM
5. SSL = SOIL SCREENING LEVEL
6. J = ESTIMATED CONCENTRATION
7. J+ = ESTIMATED CONCENTRATION, POSSIBLY BIASED HIGH

Image Cite: USDA /fsa – Aerial Photography Field Office, NAIP MrSID – Publication: 2014

EXPLANATION

- STP1-SW — MONITORING WELL LOCATION AND DESIGNATION
- NDD-SB — PROPOSED SOIL BORING LOCATION
- NDD-3 — HISTORICAL SOIL BORING LOCATION AND DESIGNATION
- NORTH DRAINAGE DITCH BOUNDARY
- TPH — TOTAL PETROLEUM HYDROCARBONS

CONSTITUENT TABLE EXPLANATION

	NDD-SB-2		8/20/2021	
SAMPLE LOCATION →	NDD-SB-2		8/20/2021	← SAMPLE DATE
FEET BELOW GROUND SURFACE →	FT BGS		1	
TPH DIESEL RANGE ORGANICS →	TPH-DRO	1000	3000	
TPH GASOLINE RANGE ORGANICS →	TPH-GRO	100	500	
TPH OIL RANGE ORGANICS →	TPH-ORO	1000	3000	

NMED RESIDENTIAL SSL (mg/kg)
NMED INDUSTRIAL SSL (mg/kg)

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FIGURE A-3

PROPOSED SOIL BORING / HISTORIC SAMPLING LOCATIONS WITH HISTORIC TPH SOIL ANALYTICAL RESULTS NORTH DRAINAGE DITCH INVESTIGATION WORK PLAN PHASE II

WESTERN REFINING SOUTHWEST LLC D/B/A MARATHON GALLUP REFINERY GALLUP, NEW MEXICO

Drawn By: KLM	Checked By: BB	Scale: 1" = 150'	Date: 8/19/2022	File: 697-NDD-BORINGLOC-202208

\\TRIHYDRO.COM\CLIENTS\TON\MARATHON\CADD\GALLUP_REPORTS\SITEWIDE\NORTHDRAINAGEDITCH\202210_IWP-PHASEII\697-NDD-BORINGLOC-202208

Image Cite: USDA /fsa – Aerial Photography Field Office, NAIP MrSID – Publication: 2014

2 SOUR NAPHTHA RELEASE MAY 2022 SOIL INVESTIGATION LOCATIONS
SCALE: 1" = 60'

N

0 60'

Image Cite: USDA /fsa – Aerial Photography Field Office, NAIP MrSID – Publication: 2014

1 KEY MAP
SCALE: 1" = 800'

N

0 800'

EXPLANATION

- MAY 2022 EXCAVATION BACKFILL CONFIRMATION SAMPLE LOCATION
- MAY 2022 SOIL INVESTIGATION LOCATION
- SOUR NAPHTHA RELEASE EXCAVATION EXTENT AREA
- SOUR NAPHTHA RELEASE AREA
- APPROXIMATE SOUR NAPHTHA RELEASE EXTENT
- RELEASE FLOW DIRECTION
- ------6880------ SURFACE CONTOURS (2-FOOT INTERVAL)

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FIGURE A-4

2022 SOUR NAPHTHA INVESTIGATION LOCATIONS

D/B/A WESTERN REFINING SOUTHWEST LLC MARATHON GALLUP REFINERY GALLUP, NEW MEXICO

Drawn By: KML	Checked By: JH	Scale: AS SHOWN	Date: 9/1/22	File: 697-IR-SOURNAPHTHAINVLOCS-202207

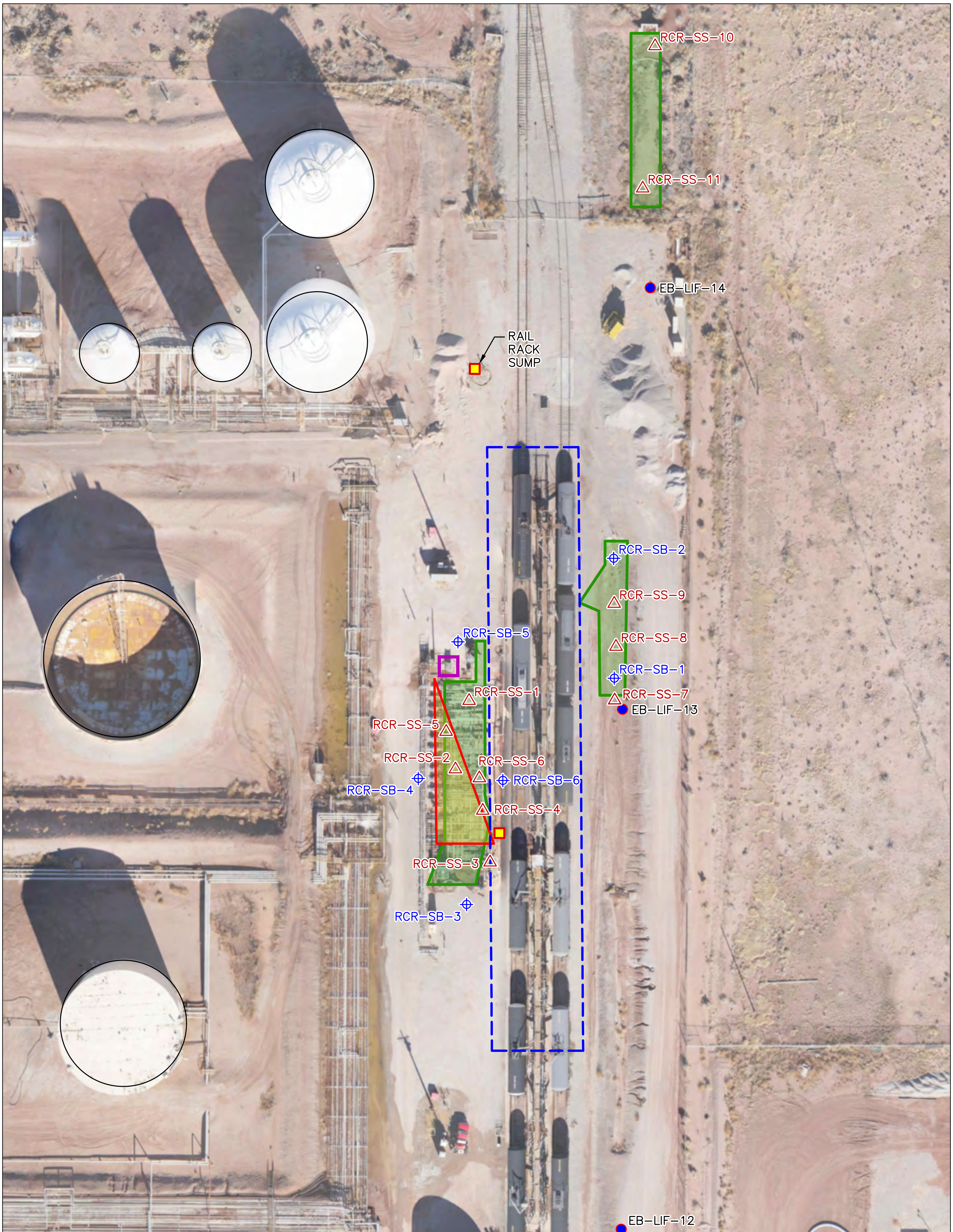

Image Cite: USDA /fsa – Aerial Photography Field Office, NAIP MrSID – Publication: 2014

EXPLANATION

RCR–SB–3	SOIL BORING AND DESIGNATION
RCR–SS–3	SOIL SAMPLE AND DESIGNATION
EB–LIF–12	2019 LIF LOCATION AND DESIGNATION
	RAIL CAR LOADING AREA
	TANK
	DIESEL RELEASE EXTENT (MARCH 13, 2019)
	GASOLINE RELEASE EXTENT (MAY 7, 2017)
	DGS 105 ADDITIVE TANK
	RAIL RACK SUMP OR SEWER BOX

N

0 60'

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FIGURE A-5

SAMPLE LOCATIONS
RAIL CAR LOADING AREA RELEASE

WESTERN REFINING SOUTHWEST LLC
D/B/A MARATHON GALLUP REFINERY
GALLUP, NEW MEXICO

Drawn By: REP	Checked By: EC	Scale: 1" = 60'	Date: 11/22/21	File: 697-AOC17-GPSSAMPLOCS-202110

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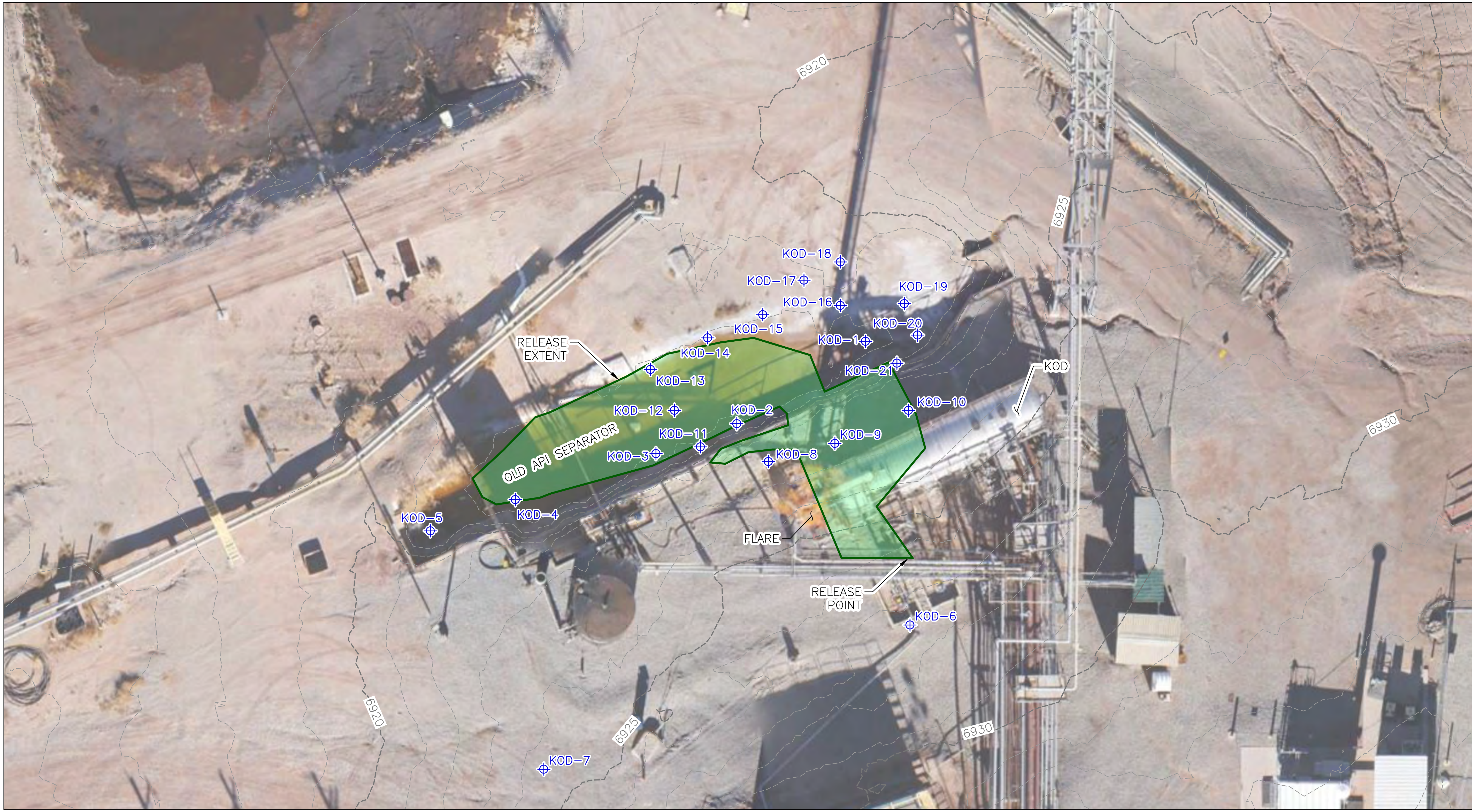

Image Cite: Trihydro Corporation – UAS Aerial Photography – Publication: 2018

\\TRIHYDRO.COM\CLIENTS\TON\MARATHON\CADD\GALLUP_REPORTS\RELEASES\FLARE_KODRELEASE\697-KOD-SAMPLOC-202108

EXPLANATION

KOD-7	SOIL SAMPLE AND DESIGNATION
	EXTENT OF SOIL IMPACTS
6935	EXISTING CONTAINMENT ELEVATION CONTOURS (INTERVAL = 1')
API	AMERICAN PETROLEUM INSTITUTE
KOD	KNOCKOUT DRUM

N

0 20'

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FIGURE A-6

SAMPLE LOCATIONS
FLARE KOD CAUSTIC RELEASE INVESTIGATION

WESTERN REFINING SOUTHWEST LLC
D/B/A MARATHON GALLUP REFINERY
GALLUP, NEW MEXICO

Drawn By: REP	Checked By: EC	Scale: 1" = 20'	Date: 9/27/2021	File: 697-KOD-SAMPLOC-202108

FD-BH-10		
Sample Depth	Analyte	Result
5.2 - 6.2 ft bgs	TPH-GRO	**740**

Image Cite: DigitalGlobe © CNES (2020) Distribution Airbus DS © Microsoft Corporation, BING Imagery

EXPLANATION

FD-BH-13	PROPOSED STEP-OUT BORING AND DESIGNATION (PLANNED SUMMER 2023)
FD-BH-12	BORING AND DESIGNATION (INSTALLED OCTOBER 2022)
BH-1	BORING AND DESIGNATION (INSTALLED FEBRUARY 2018)
	FRENCH DRAIN
	HYDROCARBON IMPACTS (EXCAVATION INSTALLED FEBRUARY 2018)
	HYDROCARBON ABSENT (EXCAVATION INSTALLED FEBRUARY 2018)

FT BGS	FEET BELOW GROUND SURFACE
TPH-GRO	TOTAL PETROLEUM HYDROCARBONS - GASOLINE RANGE ORGANICS
SSL	SOIL SCREENING LEVEL
RES	RESIDENTIAL
CW	CONSTRUCTION WORKER
STP	SANITARY TREATMENT POND
EP	EVAPORATION POND

NOTE:

VALUES IN **BOLD AND BLACK TEXT** EXCEED CONSTRUCTION WORKER SSL

N

0 100'

ANALYTE TABLE EXPLANATION

Category	Analyte	Res SSL	CW SSL
General Chemistry	TPH-GRO	100	**500**

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FIGURE A-7
PROPOSED STEP-OUT LOCATIONS
FRENCH DRAIN SOIL SAMPLING
INVESTIGATION REPORT

WESTERN REFINING SOUTHWEST LLC
D/B/A MARATHON GALLUP REFINERY
GALLUP, NEW MEXICO

Drawn By: REP	Checked By: BB	Scale: 1" = 100'	Date: 3/20/2023	File: 697-FD-PROPSTOUTLOC_202303

\\TRIHYDRO.COM\CLIENTS\ITON\MARATHON\CADD\GALLUP_REPORTS\FRENCHDRAIN\FRENCHDRAININVESTIGATION\202303_FRENCHDRAININV-RPT\697-FD-PROPSTOUTLOC_202303

EXPLANATION

- MONITORING WELL
- ESTIMATED LOCATION OF THE SANITARY PIPELINE
- PREVIOUSLY EXCAVATED PIPELINE
- SITE FEATURE

N

0 100 '

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FIGURE A-8

OVERVIEW SANITARY LAGOON AND PIPELINE LOCATIONS

WESTERN REFINING SOUTHWEST LLC D/B/A MARATHON GALLUP REFINERY GALLUP, NEW MEXICO

Drawn By: KEJ	Checked By: BM	Scale: 1 " = 100 '	Date: 3/18/21	File: 2_Overview_SanitaryLagoon_Fig2.mxd

Image Cite: DigitalGlobe © CNES (2020) Distribution Airbus DS © Microsoft Corporation, BING Imagery

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EXPLANATION

MKTF-34	EXISTING MONITORING WELL LOCATION AND DESIGNATION
□	EXISTING SUMP LOCATION
red line	AOC 35 BOUNDARY
blue dashed line	OILY WATER DRAIN LINE
green line (SS)	SANITARY SEWER LINE

N

0 140'

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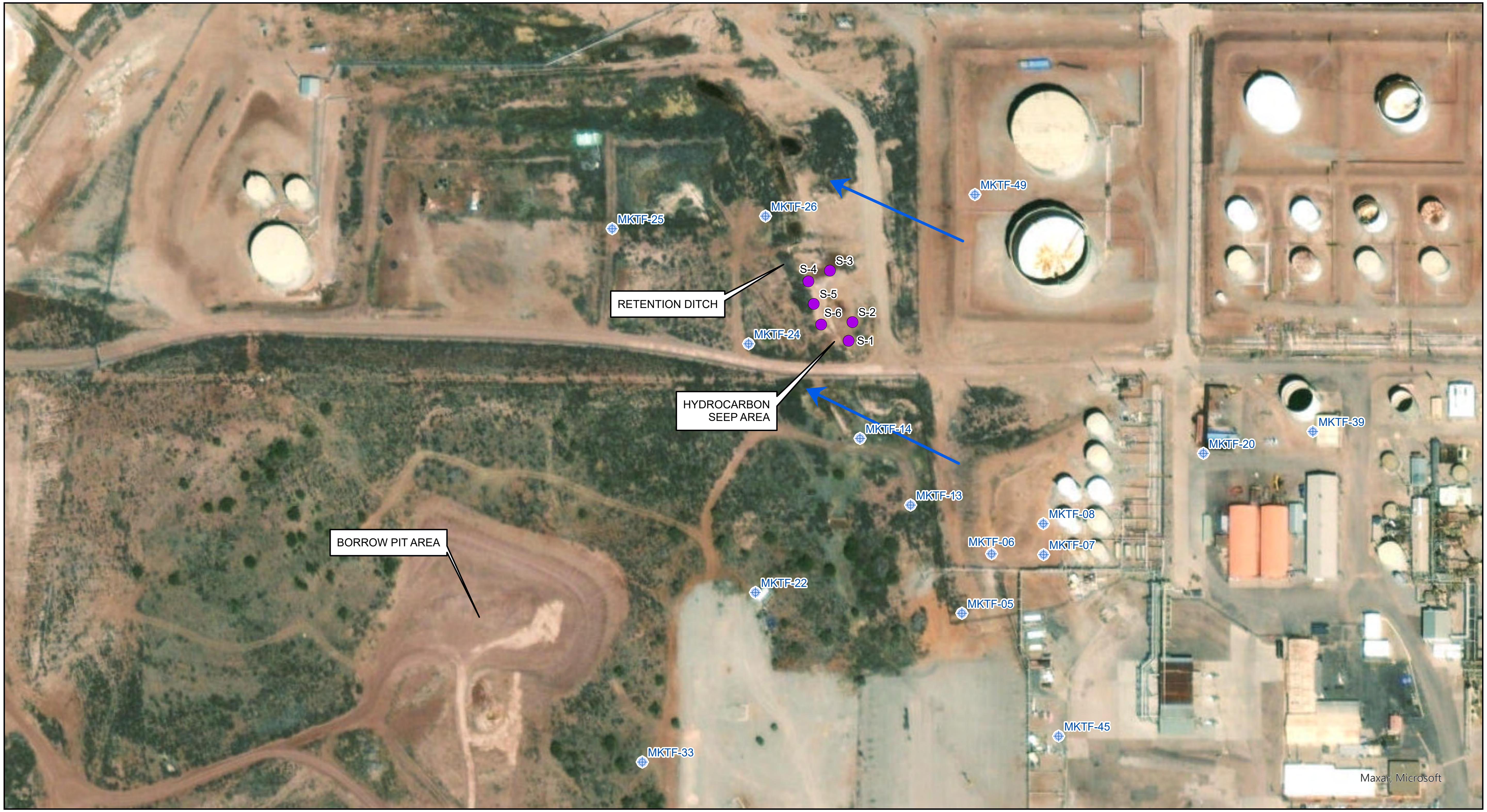
FIGURE A-9

AOC 35 MAP

WESTERN REFINING SOUTHWEST LLC
D/B/A MARATHON GALLUP REFINERY
GALLUP, NEW MEXICO

Drawn By: REP	Checked By: MS	Scale: 1" = 140'	Date: 8/23/2021	File: 697-GALLUPAOC35-SITEMAP_2021



EXPLANATION

- HYDROCARBON SEEP SUMPS
- MONITORING WELL
- GROUNDWATER GRADIENT

N

0 140'

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FIGURE A-10

HYDROCARBON SEEP AREA

WESTERN REFINING SOUTHWEST, LLC
D/B/A MARATHON GALLUP REFINERY
GALLUP, NEW MEXICO

Drawn By: BR	Checked By: BM	Scale: 1" = 140'	Date: 1/23/23	File: 1_HydrocarbonSeepArea_Fig1

EXPLANATION

- SUMP LOCATION
- MONITORING WELL LOCATION
- PIEZOMETER LOCATION
- SITE FEATURE

N

0 80 '

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FIGURE A-11

BORROW PIT SUMPS

WESTERN REFINING SOUTHWEST, LLC
D/B/A MARATHON GALLUP REFINERY
GALLUP, NEW MEXICO

Drawn By: BR	Checked By: MS	Scale: 1 " = 80 '	Date: 1/23/23	File: 2_SumpPiez_BorrowPit_Fig2.mxd

Appendix B – Investigation Methods

Appendix B-1 – Groundwater Sampling Methods

WESTERN REFINING SOUTHWEST LLC
D/B/A MARATHON GALLUP REFINERY
APPENDIX B. INVESTIGATION METHODS

JANUARY 25, 2024

Table of Contents

List of Figures

List of Attachments

List of Acronyms

BS/BSD	blank spike/blank spike duplicate
COC	chain of custody
DO	dissolved oxygen
DQO	data quality objectives
ft	foot/feet
in	inch
MKTF	Marketing Tank Farm
MNA	Monitored natural attenuation
MS/MSD	matrix spike/matrix spike duplicate
NMED	New Mexico Environment Department
ORP	oxidation reduction potential
QA	quality assurance
QC	quality control
Refinery	Western Refining Southwest LLC, D/B/A Marathon Gallup Refinery
SPH	separate phase hydrocarbon
SVOC	semivolatile organic compound
TDS	total dissolved solids
TPH	total petroleum hydrocarbons
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound

1.0 Introduction

This appendix provides an overview of the investigation methods required to conduct groundwater sampling at the Western Refining Southwest LLC D/B/A Marathon Gallup Refinery (Refinery) located in Gallup, New Mexico. Groundwater monitoring is conducted in accordance with the Refinery's Resource Conservation and Recovery Act Post-Closure Permit.

2.0 Groundwater Sampling Methodology

All monitoring wells scheduled for sampling during a groundwater sampling event will be sampled within 15 working days of the start of the monitoring and sampling event, weather permitting.

2.1 Well Gauging

At the beginning of each quarterly, semiannual, or annual sampling event, monitoring and recovery wells listed in Section 4.0 of the annual "Facility-Wide Groundwater Monitoring Work Plan" will be gauged to record the depth to separate phase hydrocarbon (SPH), if present, the depth to water, and the depth to bottom of the well. The gauging will be performed using an oil/water interface probe attached to a measuring tape capable of recording measurements to the nearest 0.01 foot (ft). If an SPH recovery system is present in a well, recovery system operation will be halted to allow groundwater to equilibrate, and the fluid level will be measured.

Each well is field verified with the well number on the well casing or adjacent to the well to ensure that samples are collected at the correct well location. Wells have a permanent marked reference point on the well casing from which groundwater levels and well depths are measured. The portable pump intake is lowered to the midpoint of the listed screened interval for each specific well using the markings identified on the pump hose, which are set at 1-ft intervals. In wells with dedicated pumps, the pumps have been installed at the midpoint of the screened interval.

All water/SPH levels are measured to an accuracy of the nearest 0.01 feet using an oil/water interface meter. Water levels and well depths in the deeper wells are gauged with an electric water depth meter. After determining water levels, well volumes are calculated using the appropriate conversion factors for a given well based on its internal diameter. Volume is equal to the height of the liquid column times the internal cross-sectional area of the well.

Gauging measurements will be recorded in a logbook or on a field gauging form. Data obtained from the gauging will be reported in the annual groundwater monitoring report.

The potentiometric surfaces for the Alluvial/Fluvial Upper Sand, Alluvium/Chinle, and Sonsela aquifers are presented in Figures 1 through 3, respectively. Attachment A-1 is a summary of the fluid level data collected in 2023 for the non-Marketing Tank Farm (MKTF) wells. Attachment A-2 is a summary of the fluid level data collected in 2023 for the MKTF wells. Attachments A-3 and A-4 include well information for the non-MKTF wells and MKTF wells, respectively. The well information consists of the survey data, screened intervals, and stratigraphic unit in which the wells are screened. Attachment A-5 includes well information for artesian wells also known as Process or Production wells. Information provided for the artesian wells was gathered from well boring logs. These wells are encased; therefore, measurement for depth to bottom cannot be field verified.

2.2 Well Purging and Sampling

Each well will be purged by removing groundwater prior to sampling to ensure that formation water is being sampled. Generally, at least three well volumes (or a minimum of two if the well has low recharge rate) will be purged from each well prior to sampling. Field water quality parameters measured during purging are pH, conductivity, temperature, dissolved oxygen (DO), oxidation-reduction potential (ORP), salinity, temperature, and total dissolved solids. One or more parameters must stabilize to within 10 percent for a minimum of three consecutive measurements before collecting groundwater samples using low-flow sampling techniques. When purging wells using a bailer, bailing will be considered complete when three well volumes have been removed from the wells. Field parameters will be measured and recorded while bailing, with the understanding that the process of hand-bailing may prevent stabilization of field parameters.

Once purging requirements are met, the well is ready for sample collection. The volume of groundwater purged, the instruments used, and the readings obtained at each interval will be recorded on the field-monitoring log. Well purging and sampling will be performed using 1.5-inch (in) x 3 ft and/or 3-in x 3-ft disposable polyethylene bailers for groundwater sampling and/or appropriately decontaminated portable sampling pumps.

If a well is pumped or bailed dry before two or three well volumes can be evacuated, samples will be collected after sufficient time has elapsed for an adequate volume of water to accumulate for the sampling event. The first sample will be tested for pH, conductivity, temperature, DO, ORP, salinity, temperature, and total dissolved solids. The well will be retested after sampling as a measure of purging efficiency and as a check on the stability of the water samples over time. All well purging and sampling information will be recorded in a logbook or on a field sampling form.

All wells are purged and sampled with dedicated or disposable equipment. Wells MW-1, MW-2, MW-4, MW-5, BW-1C, BW-2A, BW-2B, BW-3B, BW-4B, BW-5B, BW-5C, SMW-4, OW-1, OW-10, OW-13, OW-14, OW-29, and OW-30 are each equipped with a dedicated electrical pump. Wells SMW-2, OW-11, OW-12, OW-50, and OW-52 are purged and sampled using a portable Grundfos pump with dedicated tubing. The remaining wells are hand-bailed if the presence of water is detected. If SPH is detected in any of these wells, no samples will be collected. Purged well water is collected in 55-gallon drums, buckets, or totes and drained to the process sewer upstream of the New American Petroleum Institute Separator for treatment in the wastewater treatment plant.

Groundwater samples will be obtained from each well within 24 hours of the completion of well purging or as soon as the well sufficiently recharges. Sample collection methods will be documented in the logbook or in the field sampling form. The samples will be transferred to the appropriate, clean, laboratory-prepared containers provided by the analytical laboratory.

2.3 Sampling Equipment at Refinery

The following sampling equipment is maintained at the Refinery and used by the sampling personnel:

- Heron Instruments 100 ft. DipperT electric water depth tape complying with US GGG-T-106E, EEC Class II.
- Pall Corporation Acro 50A 0.45-micron disposable filter used with 60 ml disposable syringes for filtering water in the field.
- YSI pH/Conductivity meter Model 63, calibrated with a one-point, two-point, or three-point calibration procedure using pH standards of 7, 4 and 10 (measures pH, temperature, conductivity, TDS, salinity, DO, and ORP).
- IQ Scientific Instruments (measures pH, temperature, conductivity, TDS, salinity, DO, and ORP), Model IQ1806LP.
- Grundfos 2-in pumps with Grundfos 115-volt AC–to-DC converter.
- WaterMark Oil Water Interface Meter (100 ft), Model 101L/SMOIL, S/N 01-5509.

Calibration and maintenance procedures will be performed according to the manufacturer's specifications. In the event an instrument becomes inoperable, a similar instrument will be used.

2.4 Order of Collection

Samples will be collected in the order listed below:

- Volatile organic compound (VOC)
- Total petroleum hydrocarbons (TPH)- gasoline range organics
- TPH-diesel range organics and TPH-oil range organics
- Semivolatile organic compound (SVOC)
- Total Metals
- Dissolved metals
- Monitored natural attenuation (MNA) parameters (MKTF area well MNA subset only)
- Biochemical oxygen demand
- Chemical oxygen demand
- Cyanide
- Escherichia coli

If additional well specific parameters are required by the annual work plan, sampling order will be adjusted for the analyte as appropriate.

2.5 Filtration

Groundwater samples are collected and analyzed for both total and dissolved metals in even years. Samples are filtered prior to dissolve metals analysis. For dissolved metals, sample water is poured into a jar and then extracted with a syringe. The syringe is then used to force the sample water through a 0.45-micron pore filter into the proper sample bottle to collect dissolved metals samples. Filtration must be performed within 2 hours of sample collection. Pour the filtrate into a sample bottle containing HNO3 preservative.

For samples destined for total metals analysis, do not filter the sample, and preserve with HNO3 to pH <2 in the field.

2.6 Sample Handling

All sample containers are supplied by the contracted analytical laboratory and shipped to the Refinery in sealed coolers. Chemical preservation is also provided by the laboratory through pre-preserved bottle ware. Collection of groundwater samples are in the order of most volatile to least volatile, such as : VOCs, SVOCs, metals, phenols, cyanide, sulfate, chloride, nitrate, and nitrite. At a minimum, the following procedures will be used when collecting samples :

- Neoprene, nitrile, or other protective gloves will be worn when collecting samples for safety and sampling purity. New disposable gloves will be used to collect each sample.
- All samples collected for chemical analysis will be transferred into clean sample containers supplied by the analytical laboratory. The sample containers will be clearly marked. Sample container volumes and preservation methods will be in accordance with the most recent standard United States Environmental Protection Agency (USEPA) and industry accepted practices for use by accredited analytical laboratories. Sufficient sample volume will be obtained for the laboratory to complete the method-specific quality control (QC) analyses on a laboratory-batch basis.
- Sample labels and documentation will be completed for each sample.

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 in “Sample Custody” section of this Appendix, will be followed for all samples collected. All samples will be submitted to the laboratory to conduct the analyses within the method holding times.

2.7 General Well Sampling Procedures

Sample bottles and labels will be separated into plastic bags for each well to be sampled. The plastic bags, with the sample bottles, will be placed in an ice chest to take into the field. A logbook and/or field sample form will be used to document weather conditions and sample date and time. The label will be complete with location, date, time, analysis, preservative, and the name of the sampler. For low-flow sampling, converter speed will be adjusted prior to filling bottles. Sample labels will be affixed, and bottles will be filled according to lab instructions. Bottles with septa lids will be used for samples intended for VOC analysis. VOC bottles will be filled to the neck and a final amount of water will be added using the cap to form meniscus before screwing the lid onto the sample bottle. To ensure a proper sample has been collected, the bottles will be turned upside down and examined for bubbles, if bubbles are detected in the vial, the collection procedure will be repeated. If no bubbles are present, the lid will be secured, and the bottles will be packed in bubble wrap and placed in the cooler until sampling is completed.

Any reusable equipment that is not dedicated to a specific well will be decontaminated. Completed samples will be refrigerated until they are shipped to the laboratory. Appropriate shipping methods will be arranged to accommodate holding times. Sampling equipment and supplies will be checked, and proper inventory verified prior to sampling. Before departing, quality assurance (QA)/QC requirements will be checked to ensure there are additional equipment and supplies to meet additional requirements.

2.8 Surface Water Sample Collection

At the evaporation ponds, samples will be collected as a grab sample at the pond edge near the inlets. This location will be noted in the field logbook or field sampling form. The sampler will avoid disturbing sediment and gently allow the sample container to fill making sure that undue disturbance does not allow volatile constituents to be lost. The sample bottle will be used for the sample collection in a shallow location near the bank. If a separate bottle and/or bailer are used to refill the sample container, this will be noted in the logbook or field sample form. The decision to use a separate bottle/bailer will be made, if at all, by the sampler and the reasons will be noted in the logbook or field sampling form.

2.9 General Safety Procedures

Sampling personnel will carry a cell phone when collecting samples. While sampling procedures are generally well known and the appropriate sample bottles are ordered to match each sampling event, occasional questions do arise from unforeseen circumstances which may develop during sampling. At such times, sampling personnel contact the Project Manager to verify that sampling is correctly performed. Examples would be if a well were to run dry short of filling the last sample bottle or to determine if there is enough water for sample analysis.

Upon arrival at the field site, the sampler will set out safety equipment such as traffic cones and signs (if required). The vehicle will be parked at a sufficient distance away in order to prevent sample contamination from emissions. For safety, protection, and sampling purity, rubber gloves or disposable nitrile gloves will be worn and changed between each activity. Appropriate sample containers must be used for the type of analyses to be performed.

2.10 Decontamination Procedures

The objective of the decontamination procedures is to minimize the potential for cross-contamination. Most field equipment used for groundwater sampling will be disposable and, therefore, not require decontamination. To prevent cross-contamination, field equipment that comes into contact with water or soil will be decontaminated between each sampling location. The decontamination procedure will consist of washing the equipment with a non-phosphate detergent solution (e.g., Fantastik™, Liqui-Nox®), followed by two rinses of distilled water, and air dried.

Decontamination water and rinsate will be contained and disposed of the same way as purge water, as described in the "Well Purging and Sampling" section of this Appendix. Decontamination procedures and the cleaning agents used will be documented in the logbook or field sample form.

2.11 Field Equipment Calibration Procedures

Field equipment requiring calibration will be calibrated to known standards, in accordance with the manufacturers' recommended schedules and procedures. Calibration checks will be conducted daily, and the instruments will be recalibrated if necessary. Calibration measurements will be recorded in the logbook or field sample form.

If field equipment becomes inoperable, its use will be discontinued until the necessary repairs are made. A properly calibrated replacement instrument will be used in the interim. Instrumentation used during sampling events will be recorded in the logbook or field sample form.

2.12 Collection and Management of Investigation Derived Waste

Investigation derived waste generated during each groundwater sampling event may include purge water, decontamination water, excess sample material, and disposable sampling equipment. All water from all wells generated during sampling and decontamination activities will be temporarily stored in labeled 55-gallon drums until placed in the refinery wastewater treatment system upstream of the API separator. All other solid waste generated during sampling activities (sampling gloves, tubing, etc.) will be disposed of with the refinery's general municipal waste.

2.13 Documentation of Field Activities

Daily field activities, including observations and field procedures, will be recorded using indelible ink in the logbook or on field sample form. The original logbook(s) or field sample form(s) will be maintained at the Refinery. Completed forms will be maintained in a bound and sequentially numbered field file for reference during field activities. The daily record of field activities will include the following information:

- Well identification/evaporation pond location/outfall
- Date
- Start and finish sampling time
- Field team members, including visitors
- Weather conditions
- Daily activities and times conducted
- Observations
- Record of samples collected with sample designations
- Photo log (if needed)
- Field monitoring data, including health and safety monitoring (if needed)
- Equipment used and calibration records, if appropriate
- List of additional data sheets and maps completed
- An inventory of the waste generated and the method of storage or disposal
- Signature of personnel completing the field record

2.14 Sample Custody

All samples collected for analysis will be recorded in the logbook or field sample form. Chain-of-custody forms will be completed at the end of each sampling day, prior to the transfer of samples off site and will accompany the samples during shipment to the laboratory. A signed and dated custody seal will be affixed to the lid of the shipping container. Upon receipt of the samples at the laboratory, the custody seals will be broken, the chain-of-custody (COC) form will be signed as received by the laboratory, and the conditions of the samples will be recorded on the COC form. The original COC form will remain with the laboratory; copies will be sent to the Refinery. The Refinery will maintain copies of all COC forms generated as part of sampling activities. Copies of the COC records will be included with all draft and final laboratory reports submitted to the New Mexico Environment Department (NMED) and Oil Conservation Division.

2.15 Shipping Procedures

The following shipping procedures will be performed during each sampling event:

- Individual sample containers will be packed to prevent breakage and transported in a sealed cooler with ice or other suitable coolant or other USEPA 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.
- Each cooler or other container will be delivered directly to the analytical laboratory.
- Glass bottles will be separated in the shipping container by cushioning material to prevent breakage.
- Plastic containers will be protected from possible puncture during shipping using cushioning material.
- The COC form and sample request form will be shipped inside the sealed storage container to be delivered to the laboratory.
- Signed and dated COC seals will be applied to each cooler prior to transport of samples from the site.

2.16 Analytical Methods

Groundwater and surface water samples collected during the monitoring events will be analyzed using the specified analytical methods and for the constituents discussed in Section 4.0 of the annual "Facility-Wide Groundwater Monitoring Work Plan."

3.0 Laboratory Quality Assurance Procedures

Contract analytical laboratories will maintain internal QA programs in accordance with USEPA and industry accepted practices and procedures. At a minimum, the laboratories will use a combination of standards, blanks, surrogates, duplicates, matrix spike/matrix spike duplicates (MS/MSD), blank spike/blank spike duplicates (BS/BSD), and laboratory control samples to demonstrate analytical QA/QC. The laboratories will establish control limits for individual chemicals or groups of chemicals based on the long-term performance of the test methods. In addition, the laboratories will establish internal QA/QC that meets USEPA's laboratory certification requirements. The specific procedures to be completed are identified in the following sections.

3.1 Equipment Calibration Procedures and Frequency

The laboratory's equipment calibration procedures, calibration frequency, and calibration standards will be in accordance with the USEPA test methodology requirements and documented in the laboratory's QA and Standard Operating Procedures manuals. All instruments and equipment used by the laboratory will be operated, calibrated, and maintained according to the manufacturers' guidelines and recommendations. Operation, calibration, and maintenance will be performed by personnel who have been properly trained in these procedures. A routine schedule and record of instrument calibration and maintenance will be kept on file at the laboratory.

3.2 Field QA/QC Samples

Field duplicates, field blanks, equipment rinsate blanks (if required), reagent blanks, and trip blanks may be obtained for QA during sampling activities. The samples will be handled as described in the "Laboratory QA/QC Samples" section of this Appendix.

Field duplicates will consist of two samples either split from the same sample device or collected sequentially. Field duplicate groundwater samples will be collected at a frequency of one per ten regular samples and will be analyzed for the full set of analyses used for the regular sample collected. At a minimum, one duplicate sample per sampling day will be obtained.

Field blanks shall be obtained at a frequency of no less than one per day per site or unit. Field blanks shall be generated by filling sample containers in the field with deionized water and submitting the samples, along with the groundwater or surface water samples, to the analytical laboratory for the appropriate analyses.

Currently, all samples are collected using dedicated or disposable equipment; therefore, equipment blanks will not be collected. However, if non-dedicated or non-disposable equipment are used, equipment blanks shall be obtained for chemical analysis at the rate of 5 percent but no fewer than one rinsate blank per sampling day. Rinsate samples shall be generated by rinsing deionized water through decontaminated sampling equipment. The rinsate sample then shall be placed in the appropriate sample container and submitted with the groundwater or surface water samples to the analytical laboratory for the appropriate analyses.

Reagent blanks shall be obtained at a frequency of 10 percent but no fewer than one per day per unit if chemical analyses requiring the use of chemical reagents are conducted in the field during water sampling activities.

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 placed in an appropriate sample container. Trip blanks will be analyzed at a frequency of one for each shipping container of samples.

3.3 Laboratory QA/QC Samples

Analytical procedures will be evaluated by analyzing reagent or method blanks, surrogates, MS/MSDs, BS/BSDs and/or laboratory duplicates, as appropriate for each method. The laboratory QA/QC samples and frequency of analysis to be completed will be documented in the cited USEPA or other test methodologies. At a minimum, the laboratory will analyze laboratory blanks, MS/MSDs, BS/BSDs, and laboratory duplicates at a frequency of one in twenty for all batch runs requiring USEPA test methods and a frequency of one in ten for non-USEPA test methods. Laboratory batch QA/QC samples will be project specific.

3.4 Laboratory Deliverables

The analytical data package will be prepared in accordance with USEPA-established Level II analytical support protocol which will include:

- Transmittal letter, including information about the receipt of samples, the testing methodology performed, any deviations from the required procedures, any problems encountered in the analysis of the samples, any data quality exceptions, and any corrective actions taken by the laboratory relative to the quality of the data contained in the report.
- Sample analytical results, including sampling date; date of sample extraction or preparation; date of sample analysis; dilution factors and test method identification; water sample results in consistent units (milligrams per liter or micrograms per liter); and detection limits for undetected analytes. Results will be reported for all field samples, including field duplicates and blanks, submitted for analysis.
- Method blank results, including reporting limits for undetected analytes.
- Surrogate recovery results and corresponding control limits for samples and method blanks (organic analyses only).
- Laboratory duplicate results for inorganic analyses, including relative percent differences and corresponding control limits.

- Sample COC documentation.
- Holding times and conditions.
- Conformance with required analytical protocol(s).
- Instrument calibration.
- Blanks.
- Detection/quantitative limits.
- Recoveries of surrogates and/or MS/MSDs.
- Variability for duplicate analyses.
- Completeness.
- Data report formats.

Data deliverables provided by the laboratory that include analysis of organic compounds will also include the following:

- A cover letter referencing the procedure used and discussing any analytical problems, deviations, and modifications, including signature from authority representative certifying to the quality and authenticity of data as reported.
- A report of sample collection, extraction, and analysis dates, including sample holding conditions.
- Tabulated results for samples in units as specified, including data qualification in conformance with USEPA protocol, and definition of data descriptor codes.
- Final extract volumes (and dilutions required), sample size, wet-to-dry weight ratios, and instrument practical detection/quantitative limit for each analyte.
- Analyte concentrations with reporting units identified, including data qualification and a description of the qualifiers.
- Quantification of analytes in all blank analyses, as well as identification of method blank associated with each sample.
- Recovery assessments and a replicate sample summary, including all surrogate spike recovery data with spike levels/concentrations for each sample and all MS/MSD results (recoveries and spike amounts).

3.5 Review of Field and Laboratory QA/QC Data

The sample data, field, and laboratory QA/QC results will be evaluated for acceptability with respect to the data quality objectives (DQOs). Each group of samples will be compared with the DQOs and evaluated using data validation guidelines contained in USEPA guidance documents : "Guidance Document for the Assessment of RCRA Environmental Data Quality, National Functional Guidelines for Organic Data Review," "Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses," and the most recent version of SW-846, and industry-accepted QA/QC methods and procedures.

The laboratory will notify the Refinery Project Manager of data quality exceptions within one business day of identifying the data quality exception to allow for sample re-analysis, if possible. The Refinery Project Manager will contact NMED within one business day of receipt of laboratory notification of data quality exceptions to discuss the implementations and determine whether the data will still be considered acceptable, or if sample re-analysis or re-sampling is necessary.

3.6 Blanks, Field Duplicates, Reporting Limits and Holding Times

3.6.1 Blanks

The analytical results of field blanks and field rinsate blanks will be reviewed to evaluate the adequacy of the equipment decontamination procedures and the possibility of cross-contamination caused by decontamination of sampling equipment. The analytical results of trip blanks will be reviewed to evaluate the possibility for contamination resulting from the laboratory-prepared sample containers or the sample transport containers. The analytical results of laboratory blanks will be reviewed to evaluate the possibility of contamination caused by the analytical procedures. If constituents are detected in field or laboratory blanks, the sample data will be qualified or rejected, as appropriate. Methods and reasoning for the decision to qualify or reject sample data will be discussed in the annual groundwater report. Furthermore, any impact to data quality and/or need to adjust methods will be addressed in the report.

3.6.2 Field Duplicates

Field duplicates will consist of two samples either split from the same sample device or collected sequentially. The analytical data quality objectives for precision shall be used for water duplicates.

3.6.3 Method Reporting Limits

Method reporting limits for sample analyses will be established at the lowest level practicable for the method and analyte concentrations and will not exceed groundwater or surface water cleanup standards and screening levels. Detection limits that exceed established standards or screening levels and are reported as "not detected" will be considered data quality exceptions and an explanation for its acceptability for use will be provided.

3.6.4 Holding Times

Per USEPA protocol the sampling, extraction, and analysis dates will be reviewed to confirm that extraction and analyses were completed within the recommended holding times. Appropriate data qualifiers will be noted if holding times are exceeded.

3.7 Representativeness and Comparability

3.7.1 Representativeness

Representativeness is a qualitative parameter related to the degree to which the sample data represent the relevant specific characteristics of the media sampled. Procedures will be implemented to assure representative samples are collected and analyzed, such as repeated measurements of the same parameter at the same location over several distinct sampling events. Any procedures or variations that may affect the collection or analysis of representative samples will be noted and the data will be qualified.

3.7.2 Comparability

Comparability is a qualitative parameter related to whether similar sample data can be compared. To assure comparability, analytical results will be reported in appropriate units for comparison with other data (past studies, comparable sites, screening levels, and cleanup standards), and standard collection and analytical procedures will be implemented. Any procedure or variation that may affect comparability will be noted and the data will be qualified.

3.8 Laboratory Reporting, Documentation, Data Reduction, and Corrective Action

Upon receipt of each laboratory data package, data will be evaluated against the criteria outlined in the previous sections. Any deviation from the established criteria will be noted and the data will be qualified. A full review and discussion of analytical data QA/QC and all data qualifiers will be submitted as appendices or attachments to the groundwater monitoring reports. Data validation procedures for all samples will include checking the following, when appropriate:

- Holding times
- Detection limits
- Field equipment rinsate blanks
- Field blanks
- Field duplicates
- Trip blanks
- Reagent blanks

- Laboratory duplicates
- Laboratory blanks
- Laboratory MS/MSD
- Laboratory BS/BSD
- Surrogate recoveries

If significant quality assurance problems are encountered, appropriate corrective action will be implemented. All corrective action will be reported, and the corrected data will be qualified.

Figures

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EXPLANATION

● BW-1A 6842.25 — MONITORING WELL AND DESIGNATION (SHOWING GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL)

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0 400'

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FIGURE 1
ALLUVIAL / FLUVIAL UPPER SAND AQUIFER POTENTIOMETRIC SURFACE MAP (SEPTEMBER 2023)

WESTERN REFINING SOUTHWEST LLC
D/B/A MARATHON GALLUP REFINERY
GALLUP, NEW MEXICO

Drawn By: REP	Checked By: KE	Scale: 1" = 400'	Date: 11/29/2023	File: 697-GWWP-ALLUVIAL-2023

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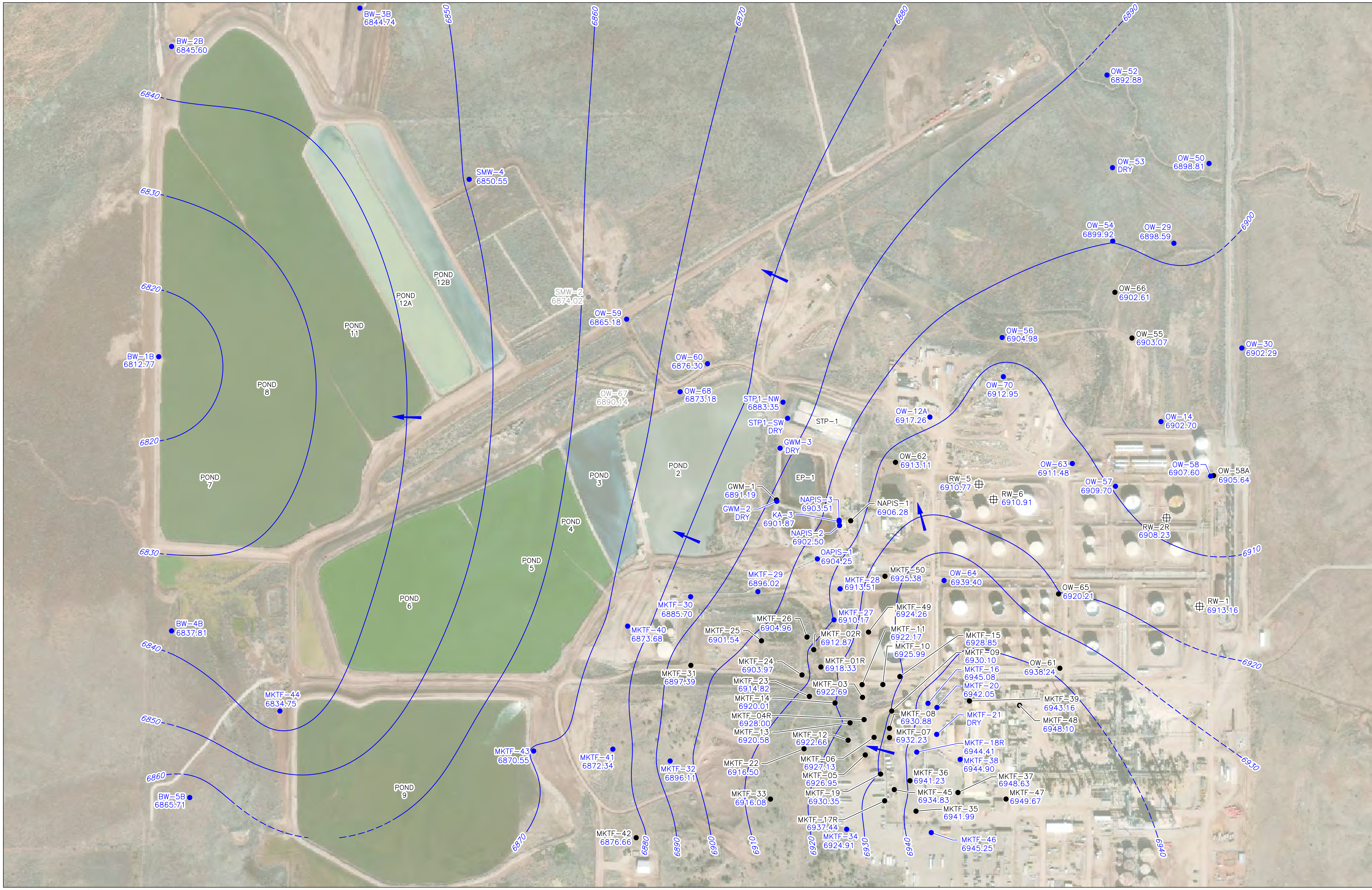

EXPLANATION

BW-5B 6865.71	CHINLE / ALLUVIUM AQUIFER WELL AND DESIGNATION (SHOWING GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL)
MKTF-42 6876.66	SPH MONITORING WELL AND DESIGNATION (BASED ON THIRD QUARTER 2023 SPH DATA, SHOWING GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL)
6860	LINE OF EQUAL ELEVATION OF POTENTIOMETRIC SURFACE (FEET ABOVE MEAN SEA LEVEL, DASHED WHERE INFERRED)
	ESTIMATED GROUNDWATER FLOW DIRECTION
RW-1	RECOVERY WELL
NM	NOT MEASURED
SPH	SEPARATE PHASE HYDROCARBON

NOTES:

1. POTENTIOMETRIC SURFACE GENERATED USING THIRD QUARTER 2023 ANNUAL MONITORING EVENT DATA.
2. DATA FROM WELLS SMW-02, OW-12A AND OW-67 APPEAR ANOMALOUS AND WERE NOT USED IN THE CONTOUR GENERATION FOR THIS REPORTING PERIOD.

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0 300' 600'

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FIGURE 2

CHINLE/ALLUVIUM AQUIFER POTENTIOMETRIC SURFACE MAP (SEPTEMBER 2023)

WESTERN REFINING SOUTHWEST LLC D/B/A MARATHON GALLUP REFINERY GALLUP, NEW MEXICO

Drawn By: REP	Checked By: KE	Scale: 1" = 300'	Date: 11/29/2023	File:697-GWWP-PS-CHINLE-2023

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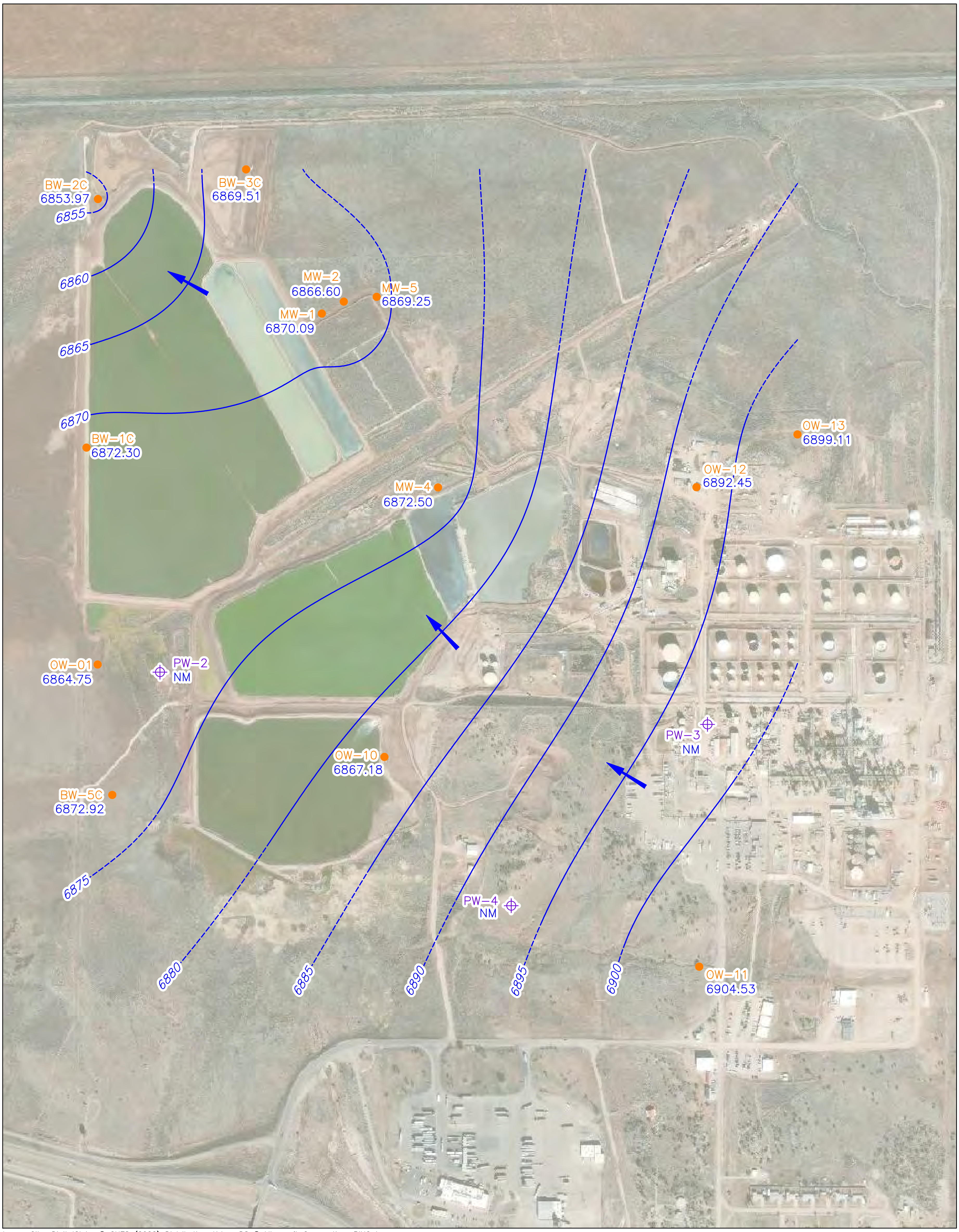

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EXPLANATION

BW-5C 6872.92	SONSELA AQUIFER MONITORING WELL AND DESIGNATION (SHOWING GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL)
6875	LINE OF EQUAL ELEVATION OF POTENTIOMETRIC SURFACE (FEET ABOVE MEAN SEA LEVEL, DASHED WHERE INFERRED)
	ESTIMATED GROUNDWATER FLOW DIRECTION
PW-4	RAW WATER PRODUCTION WELL AND DESIGNATION
NM	NOT MEASURED

NOTES:

1. POTENTIOMETRIC SURFACE GENERATED USING THIRD QUARTER 2023 ANNUAL MONITORING EVENT.
2. OW-01 AND OW-10 NOT INCLUDED IN CONTOUR DUE TO ARTESIAN CONDITIONS PRESENT.

N

0 600'

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FIGURE 3

SONSELA AQUIFER POTENTIOMETRIC SURFACE MAP (SEPTEMBER 2023)

WESTERN REFINING SOUTHWEST LLC D/B/A MARATHON GALLUP REFINERY GALLUP, NEW MEXICO

Drawn By: REP	Checked By: KE	Scale: 1" = 600'	Date: 11/29/2023	File: 697-GWWP-PS-SONSELA-2023

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Attachment A – Water Levels and Well Information

ATTACHMENT A-1. 2023 FLUID LEVEL DATA FOR NON-MKTF WELLS
GALLUP REFINERY, GALLUP, NEW MEXICO

Location	Date Measured	Measuring Point Elevation (ft-amsl)	Elevation Product Surface (ft-amsl)	Elevation Water Surface (ft-amsl)	Depth To Water (ft-bmpe)	Depth To Product (ft-bmpe)
BW-1A	9/5/2023	6885.12	ND	6842.25	42.87	ND
BW-1B	9/5/2023	6885.78	ND	6812.77	73.01	ND
BW-1C	9/5/2023	6885.68	ND	6872.30	13.38	ND
BW-2A	9/5/2023	6874.69	ND	6835.34	39.35	ND
BW-2B	9/5/2023	6874.50	ND	6845.60	28.90	ND
BW-2C	9/5/2023	6875.30	ND	6853.97	21.33	ND
BW-3A	9/5/2023	6878.39	ND	Dry	Dry	ND
BW-3B	9/5/2023	6878.59	ND	6844.74	33.85	ND
BW-3C	9/5/2023	6877.95	ND	6869.51	8.44	ND
BW-4A	9/5/2023	6873.18	ND	Dry	Dry	ND
BW-4B	9/5/2023	6873.23	ND	6837.81	35.42	ND
BW-5A	9/5/2023	6877.00	ND	Dry	Dry	ND
BW-5B	3/6/2023	6876.82	ND	6863.77	13.05	ND
BW-5B	6/1/2023	6876.82	ND	6863.92	12.90	ND
BW-5B	9/5/2023	6876.82	ND	6865.71	11.11	ND
BW-5C	3/6/2023	6876.85	ND	6874.00	2.85	ND
BW-5C	6/1/2023	6876.85	ND	6874.30	2.55	ND
BW-5C	9/5/2023	6876.85	ND	6872.92	3.93	ND
GWM-1	3/31/2023	6912.61	6891.71	6889.66	22.95	20.90
GWM-1	4/13/2023	6912.61	6891.73	6889.66	22.95	20.88
GWM-1	5/15/2023	6912.61	6891.75	6889.66	22.95	20.86
GWM-1	6/2/2023	6912.61	6891.71	6889.58	23.03	20.90
GWM-1	7/24/2023	6912.61	6891.71	6889.61	23.00	20.90
GWM-1	8/18/2023	6912.61	6891.73	6889.63	22.98	20.88
GWM-1	9/5/2023	6912.61	6891.71	6889.61	23.00	20.90
GWM-2	3/31/2023	6913.09	ND	Dry	Dry	ND
GWM-2	4/13/2023	6913.09	ND	Dry	Dry	ND
GWM-2	5/15/2023	6913.09	ND	Dry	Dry	ND
GWM-2	6/2/2023	6913.09	ND	Dry	Dry	ND
GWM-2	7/24/2023	6913.09	ND	Dry	Dry	ND
GWM-2	8/18/2023	6913.09	ND	Dry	Dry	ND
GWM-2	9/5/2023	6913.09	ND	Dry	Dry	ND
GWM-3	3/31/2023	6910.25	ND	Dry	Dry	ND
GWM-3	4/13/2023	6910.25	ND	Dry	Dry	ND
GWM-3	5/15/2023	6910.25	ND	Dry	Dry	ND
GWM-3	6/2/2023	6910.25	ND	Dry	Dry	ND
GWM-3	7/24/2023	6910.25	ND	Dry	Dry	ND
GWM-3	8/18/2023	6910.25	ND	Dry	Dry	ND

ATTACHMENT A-1. 2023 FLUID LEVEL DATA FOR NON-MKTF WELLS
GALLUP REFINERY, GALLUP, NEW MEXICO

Location	Date Measured	Measuring Point Elevation (ft-amsl)	Elevation Product Surface (ft-amsl)	Elevation Water Surface (ft-amsl)	Depth To Water (ft-bmpe)	Depth To Product (ft-bmpe)
GWM-3	9/5/2023	6910.25	ND	Dry	Dry	ND
KA-3	3/7/2023	6912.52	ND	6901.97	10.55	ND
KA-3	4/12/2023	6912.52	ND	6902.08	10.44	ND
KA-3	5/15/2023	6912.52	ND	6902.10	10.42	ND
KA-3	6/2/2023	6912.52	ND	6901.86	10.66	ND
KA-3	7/24/2023	6912.52	ND	6901.97	10.55	ND
KA-3	8/18/2023	6912.52	ND	6901.91	10.61	ND
KA-3	9/5/2023	6912.52	ND	6901.87	10.65	ND
MW-1	9/7/2023	6878.12	ND	6870.09	8.03	ND
MW-2	9/7/2023	6880.30	ND	6866.60	13.70	ND
MW-4	9/7/2023	6881.63	ND	6872.50	9.13	ND
MW-5	9/7/2023	6882.83	ND	6869.25	13.58	ND
NAPIS-1	3/7/2023	6913.86	6906.28	6906.22	7.64	7.58
NAPIS-1	4/13/2023	6913.86	6906.2	6906.09	7.77	7.66
NAPIS-1	5/15/2023	6913.86	6906.17	6906.16	7.70	7.69
NAPIS-1	6/2/2023	6913.86	6906.24	6906.18	7.68	7.62
NAPIS-1	7/25/2023	6913.86	6906.21	6906.16	7.70	7.65
NAPIS-1	8/18/2023	6913.86	6906.28	6906.22	7.64	7.58
NAPIS-1	9/7/2023	6913.86	6906.28	6906.26	7.60	7.58
NAPIS-2	3/7/2023	6912.65	ND	6903.44	9.21	ND
NAPIS-2	4/13/2023	6912.65	ND	6903.46	9.19	ND
NAPIS-2	5/15/2023	6912.65	ND	6903.20	9.45	ND
NAPIS-2	6/2/2023	6912.65	ND	6902.42	10.23	ND
NAPIS-2	7/25/2023	6912.65	ND	6902.37	10.28	ND
NAPIS-2	8/18/2023	6912.65	ND	6902.44	10.21	ND
NAPIS-2	9/7/2023	6912.65	ND	6902.50	10.15	ND
NAPIS-3	3/7/2023	6912.76	ND	6903.76	9.00	ND
NAPIS-3	4/13/2023	6912.76	ND	6903.71	9.05	ND
NAPIS-3	5/15/2023	6912.76	ND	6903.61	9.15	ND
NAPIS-3	6/2/2023	6912.76	ND	6903.56	9.20	ND
NAPIS-3	7/25/2023	6912.76	ND	6903.46	9.30	ND
NAPIS-3	8/18/2023	6912.76	ND	6903.49	9.27	ND
NAPIS-3	9/7/2023	6912.76	ND	6903.51	9.25	ND
OAPIS-1	3/7/2023	6916.73	ND	6903.63	13.10	ND
OAPIS-1	4/13/2023	6916.73	ND	6903.77	12.96	ND
OAPIS-1	5/15/2023	6916.73	ND	6903.70	13.03	ND
OAPIS-1	6/2/2023	6916.73	ND	6904.18	12.55	ND
OAPIS-1	7/25/2023	6916.73	ND	6904.15	12.58	ND

ATTACHMENT A-1. 2023 FLUID LEVEL DATA FOR NON-MKTF WELLS
GALLUP REFINERY, GALLUP, NEW MEXICO

Location	Date Measured	Measuring Point Elevation (ft-amsl)	Elevation Product Surface (ft-amsl)	Elevation Water Surface (ft-amsl)	Depth To Water (ft-bmpe)	Depth To Product (ft-bmpe)
OAPIS-1	8/23/2023	6916.73	ND	6904.23	12.50	ND
OAPIS-1	9/7/2023	6916.73	ND	6904.25	12.48	ND
OW-01	3/6/2023	6866.62	ND	6864.76	1.86	ND
OW-01	6/1/2023	6866.62	ND	6864.89	1.73	ND
OW-01	9/7/2023	6866.62	ND	6864.75	1.87	ND
OW-10	3/6/2023	6874.91	ND	6868.88	6.03	ND
OW-10	6/1/2023	6874.91	ND	6869.29	5.62	ND
OW-10	9/7/2023	6874.91	ND	6867.18	7.73	ND
OW-11	9/27/2023	6923.51	6905.32	6904.53	18.98	18.19
OW-12	3/7/2023	6940.69	ND	6893.64	47.05	ND
OW-12	9/27/2023	6940.69	ND	6892.45	48.24	ND
OW-12A	3/7/2023	6943.06	ND	6917.65	25.41	ND
OW-12A	4/13/2023	6943.06	ND	6917.68	25.38	ND
OW-12A	5/16/2023	6943.06	ND	6916.94	26.12	ND
OW-12A	6/2/2023	6943.06	ND	6916.68	26.38	ND
OW-12A	7/25/2023	6943.06	ND	6916.66	26.40	ND
OW-12A	8/23/2023	6943.06	ND	6917.21	25.85	ND
OW-12A	9/7/2023	6943.06	ND	6917.26	25.80	ND
OW-13	3/6/2023	6920.07	ND	6898.23	21.84	ND
OW-13	6/1/2023	6920.07	ND	6907.52	12.55	ND
OW-13	9/7/2023	6920.07	ND	6899.11	20.96	ND
OW-14	3/6/2023	6926.65	ND	6901.57	25.08	ND
OW-14	6/1/2023	6926.65	ND	6901.65	25.00	ND
OW-14	9/7/2023	6926.65	ND	6902.70	23.95	ND
OW-29	3/6/2023	6917.00	ND	6898.53	18.47	ND
OW-29	6/1/2023	6917.00	ND	6898.82	18.18	ND
OW-29	9/7/2023	6917.00	ND	6898.59	18.41	ND
OW-30	3/29/2023	6924.69	ND	6901.63	23.06	ND
OW-30	6/1/2023	6924.69	ND	6901.39	23.30	ND
OW-30	9/7/2023	6924.69	ND	6902.29	22.40	ND
OW-50	3/6/2023	6914.21	ND	6898.26	15.95	ND
OW-50	6/1/2023	6914.21	ND	6898.98	15.23	ND
OW-50	9/6/2023	6914.21	ND	6898.81	15.40	ND
OW-52	3/6/2023	6907.68	ND	6892.81	14.87	ND
OW-52	6/1/2023	6907.68	ND	6893.49	14.19	ND
OW-52	9/7/2023	6907.68	ND	6892.88	14.80	ND
OW-53	3/6/2023	6914.38	ND	Dry	Dry	ND
OW-53	6/1/2023	6914.38	ND	Dry	Dry	ND

ATTACHMENT A-1. 2023 FLUID LEVEL DATA FOR NON-MKTF WELLS
GALLUP REFINERY, GALLUP, NEW MEXICO

Location	Date Measured	Measuring Point Elevation (ft-amsl)	Elevation Product Surface (ft-amsl)	Elevation Water Surface (ft-amsl)	Depth To Water (ft-bmpe)	Depth To Product (ft-bmpe)
OW-53	9/7/2023	6914.38	ND	Dry	Dry	ND
OW-54	3/6/2023	6918.92	ND	6900.02	18.90	ND
OW-54	6/1/2023	6918.92	ND	6900.39	18.53	ND
OW-54	9/7/2023	6918.92	ND	6899.92	19.00	ND
OW-55	3/6/2023	6923.25	ND	6904.02	19.23	ND
OW-55	6/1/2023	6923.25	ND	6904.27	18.98	ND
OW-55	8/21/2023	6923.25	6903.70	6901.55	21.70	19.55
OW-55	9/6/2023	6923.25	6903.61	6901.45	21.80	19.64
OW-56	3/6/2023	6920.18	ND	6906.88	13.30	ND
OW-56	6/1/2023	6920.18	ND	6907.32	12.86	ND
OW-56	9/7/2023	6920.18	ND	6904.98	15.20	ND
OW-57	3/7/2023	6933.1	ND	6909.78	23.32	ND
OW-57	4/13/2023	6933.1	ND	6909.84	23.26	ND
OW-57	5/16/2023	6933.1	ND	6909.59	23.51	ND
OW-57	6/2/2023	6933.1	ND	6909.63	23.47	ND
OW-57	7/25/2023	6933.1	ND	6909.77	23.33	ND
OW-57	8/23/2023	6933.1	ND	6909.69	23.41	ND
OW-57	9/7/2023	6933.1	ND	6909.70	23.40	ND
OW-58	3/7/2023	6934.5	ND	6907.66	26.84	ND
OW-58	4/13/2023	6934.5	ND	6907.60	26.90	ND
OW-58	5/16/2023	6934.5	ND	6907.55	26.95	ND
OW-58	6/2/2023	6934.5	ND	6907.45	27.05	ND
OW-58	7/25/2023	6934.5	ND	6907.61	26.89	ND
OW-58	8/21/2023	6934.5	ND	6907.55	26.95	ND
OW-58	9/7/2023	6934.5	ND	6907.60	26.90	ND
OW-58A	3/7/2023	6935.88	6908.23	6902.08	33.80	27.65
OW-58A	4/13/2023	6935.88	6908.43	6901.83	34.05	27.45
OW-58A	5/16/2023	6935.88	6907.98	6902.34	33.54	27.90
OW-58A	6/2/2023	6935.88	6907.95	6902.13	33.75	27.93
OW-58A	7/25/2023	6935.88	6907.43	6902.08	33.80	28.45
OW-58A	8/21/2023	6935.88	6907.38	6900.18	35.70	28.50
OW-58A	9/6/2023	6935.88	6907.44	6900.22	35.66	28.44
OW-59	3/6/2023	6889.73	ND	6865.95	23.78	ND
OW-59	6/1/2023	6889.73	ND	6866.53	23.20	ND
OW-59	9/7/2023	6889.73	ND	6865.18	24.55	ND
OW-60	3/6/2023	6893.51	ND	6877.25	16.26	ND
OW-60	6/1/2023	6893.51	ND	6877.48	16.03	ND
OW-60	9/7/2023	6893.51	ND	6876.30	17.21	ND

ATTACHMENT A-1. 2023 FLUID LEVEL DATA FOR NON-MKTF WELLS
GALLUP REFINERY, GALLUP, NEW MEXICO

Location	Date Measured	Measuring Point Elevation (ft-amsl)	Elevation Product Surface (ft-amsl)	Elevation Water Surface (ft-amsl)	Depth To Water (ft-bmpe)	Depth To Product (ft-bmpe)
OW-61	3/6/2023	6963.57	6938.52	6937.41	26.16	25.05
OW-61	4/13/2023	6963.57	6938.62	6934.67	28.90	24.95
OW-61	5/16/2023	6963.57	6938.55	6934.62	28.95	25.02
OW-61	6/2/2023	6963.57	6938.62	6937.41	26.16	24.95
OW-61	7/25/2023	6963.57	6938.59	6937.37	26.20	24.98
OW-61	8/21/2023	6963.57	6938.42	6937.48	26.09	25.15
OW-61	9/6/2023	6963.57	6938.47	6937.54	26.03	25.10
OW-62	3/31/2023	6937.36	6913.83	6913.43	23.93	23.53
OW-62	4/13/2023	6937.36	6913.76	6913.36	24.00	23.60
OW-62	5/16/2023	6937.36	6913.44	6913.06	24.30	23.92
OW-62	6/2/2023	6937.36	6913.74	6913.35	24.01	23.62
OW-62	7/25/2023	6937.36	6913.76	6913.36	24.00	23.60
OW-62	8/23/2023	6937.36	6913.26	6912.39	24.97	24.10
OW-62	9/6/2023	6937.36	6913.33	6912.46	24.90	24.03
OW-63	3/7/2023	6935.06	ND	6911.70	23.36	ND
OW-63	4/13/2023	6935.06	ND	6911.78	23.28	ND
OW-63	5/16/2023	6935.06	ND	6911.62	23.44	ND
OW-63	6/2/2023	6935.06	ND	6911.36	23.70	ND
OW-63	7/25/2023	6935.06	ND	6911.41	23.65	ND
OW-63	8/23/2023	6935.06	ND	6911.46	23.60	ND
OW-63	9/7/2023	6935.06	ND	6911.48	23.58	ND
OW-64	3/7/2023	6947.4	ND	6939.90	7.50	ND
OW-64	4/13/2023	6947.4	ND	6939.60	7.80	ND
OW-64	5/16/2023	6947.4	ND	6939.44	7.96	ND
OW-64	6/2/2023	6947.4	ND	6939.36	8.04	ND
OW-64	7/25/2023	6947.4	ND	6939.30	8.10	ND
OW-64	8/23/2023	6947.4	ND	6939.37	8.03	ND
OW-64	9/7/2023	6947.4	ND	6939.40	8.00	ND
OW-65	3/7/2023	6954.05	6921.25	6920.93	33.12	32.80
OW-65	4/13/2023	6954.05	6922.1	6920.97	33.08	31.95
OW-65	5/16/2023	6954.05	6921.15	6921.03	33.02	32.90
OW-65	6/2/2023	6954.05	6920.69	6920.52	33.53	33.36
OW-65	7/25/2023	6954.05	6920.72	6920.48	33.57	33.33
OW-65	8/21/2023	6954.05	6920.2	6920.05	34.00	33.85
OW-65	9/6/2023	6954.05	6920.25	6920.09	33.96	33.80
OW-66	3/6/2023	6922.35	6904.05	6902.20	20.15	18.30
OW-66	4/13/2023	6922.35	6904.02	6902.00	20.35	18.33
OW-66	5/16/2023	6922.35	6904.06	6902.03	20.32	18.29

ATTACHMENT A-1. 2023 FLUID LEVEL DATA FOR NON-MKTF WELLS
GALLUP REFINERY, GALLUP, NEW MEXICO

Location	Date Measured	Measuring Point Elevation (ft-amsl)	Elevation Product Surface (ft-amsl)	Elevation Water Surface (ft-amsl)	Depth To Water (ft-bmpe)	Depth To Product (ft-bmpe)
OW-66	6/2/2023	6922.35	6904.1	6902.06	20.29	18.25
OW-66	7/11/2023	6922.35	6903.5	6901.45	20.90	18.85
OW-66	8/21/2023	6922.35	6903.18	6901.25	21.10	19.17
OW-66	9/6/2023	6922.35	6903.1	6901.15	21.20	19.25
OW-67	3/6/2023	6903.29	ND	6890.79	12.50	ND
OW-67	6/2/2023	6903.29	ND	6890.95	12.34	ND
OW-67	9/7/2023	6903.29	ND	6890.14	13.15	ND
OW-68	3/6/2023	6891.51	ND	6877.47	14.04	ND
OW-68	6/2/2023	6891.51	ND	6877.74	13.77	ND
OW-68	9/7/2023	6891.51	ND	6873.18	18.33	ND
OW-70	3/7/2023	6945.95	ND	6913.36	32.59	ND
OW-70	4/13/2023	6945.95	ND	6913.97	31.98	ND
OW-70	5/16/2023	6945.95	ND	6913.83	32.12	ND
OW-70	6/2/2023	6945.95	ND	6913.32	32.63	ND
OW-70	7/25/2023	6945.95	ND	6913.43	32.52	ND
OW-70	8/23/2023	6945.95	ND	6912.92	33.03	ND
OW-70	9/7/2023	6945.95	ND	6912.95	33.00	ND
RW-1	3/31/2023	6946.06	6914.52	6914.46	31.60	31.54
RW-1	4/13/2023	6946.06	6913.96	6913.89	32.17	32.10
RW-1	5/16/2023	6946.06	6913.89	6913.82	32.24	32.17
RW-1	6/2/2023	6946.06	6913.91	6913.87	32.19	32.15
RW-1	7/18/2023	6946.06	6914.24	6910.56	35.50	31.82
RW-1	8/21/2023	6946.06	6914.01	6910.38	35.68	32.05
RW-1	9/6/2023	6946.06	6914.06	6910.46	35.60	32.00
RW-2R	3/31/2023	6934.21	6910.31	6908.11	26.10	23.90
RW-2R	4/13/2023	6934.21	6910.46	6908.25	25.96	23.75
RW-2R	5/16/2023	6934.21	6909.26	6907.31	26.90	24.95
RW-2R	6/2/2023	6934.21	6908.81	6908.51	25.70	25.40
RW-2R	7/10/2023	6934.21	6908.56	6908.41	25.80	25.65
RW-2R	8/21/2023	6934.21	6908.21	6908.11	26.10	26.00
RW-2R	9/6/2023	6934.21	6908.26	6908.15	26.06	25.95
RW-5	3/31/2023	6943.57	6911.65	6910.27	33.30	31.92
RW-5	4/13/2023	6943.57	6911.62	6910.21	33.36	31.95
RW-5	5/16/2023	6943.57	6913.47	6910.07	33.50	30.10
RW-5	6/2/2023	6943.57	6913.46	6910.09	33.48	30.11
RW-5	7/11/2023	6943.57	6911.17	6909.73	33.84	32.40
RW-5	8/21/2023	6943.57	6911.02	6909.82	33.75	32.55
RW-5	9/6/2023	6943.57	6911.07	6909.85	33.72	32.50

ATTACHMENT A-1. 2023 FLUID LEVEL DATA FOR NON-MKTF WELLS
GALLUP REFINERY, GALLUP, NEW MEXICO

Location	Date Measured	Measuring Point Elevation (ft-amsl)	Elevation Product Surface (ft-amsl)	Elevation Water Surface (ft-amsl)	Depth To Water (ft-bmpe)	Depth To Product (ft-bmpe)
RW-6	3/31/2023	6944.01	6911.9	6910.26	33.75	32.11
RW-6	4/13/2023	6944.01	6911.81	6910.26	33.75	32.20
RW-6	5/16/2023	6944.01	6911.66	6910.11	33.90	32.35
RW-6	6/2/2023	6944.01	6911.7	6910.16	33.85	32.31
RW-6	7/11/2023	6944.01	6911.23	6909.89	34.12	32.78
RW-6	8/21/2023	6944.01	6911.26	6909.76	34.25	32.75
RW-6	9/6/2023	6944.01	6911.28	6909.81	34.20	32.73
SMW-2	9/7/2023	6883.97	ND	6874.02	9.95	ND
SMW-4	9/7/2023	6879.52	ND	6850.55	28.97	ND
STP1-NW	4/12/2023	6904.47	ND	6884.04	20.43	ND
STP1-NW	5/15/2023	6904.47	ND	6883.96	20.51	ND
STP1-NW	6/2/2023	6904.47	ND	6883.69	20.78	ND
STP1-NW	7/25/2023	6904.47	ND	6883.92	20.55	ND
STP1-NW	8/18/2023	6904.47	ND	6883.45	21.02	ND
STP1-NW	9/7/2023	6904.47	ND	6883.35	21.12	ND
STP1-SW	4/12/2023	6912.38	ND	Dry	Dry	ND
STP1-SW	5/15/2023	6912.38	ND	Dry	Dry	ND
STP1-SW	6/2/2023	6912.38	ND	Dry	Dry	ND
STP1-SW	7/25/2023	6912.38	ND	Dry	Dry	ND
STP1-SW	8/18/2023	6912.38	ND	Dry	Dry	ND
STP1-SW	9/7/2023	6912.38	ND	Dry	Dry	ND

Definitions:
amsl = above mean sea level
bmpe = below measuring point elevation
DRY = no water detected
ft = feet
MKTF = Market Tank Farm
ND = not detected

ATTACHMENT A-2. 2023 FLUID LEVEL DATA FOR MKTF WELLS
GALLUP REFINERY, GALLUP, NEW MEXICO

Location	Date Measured	Measuring Point Elevation (ft-amsl)	Elevation Product Surface (ft-amsl)	Elevation Water Surface (ft-amsl)	Depth To Water (ft-bmpe)	Depth To Product (ft-bmpe)
MKTF-01R	3/31/2023	6921.62	6918.42	6918.35	3.27	3.20
MKTF-01R	4/12/2023	6921.62	6918.44	6918.38	3.24	3.18
MKTF-01R	5/15/2023	6921.62	6918.42	6918.37	3.25	3.20
MKTF-01R	6/1/2023	6921.62	6918.59	6918.52	3.10	3.03
MKTF-01R	7/24/2023	6921.62	6918.62	6918.54	3.08	3.00
MKTF-01R	8/18/2023	6921.62	6918.54	6917.77	3.85	3.08
MKTF-01R	9/6/2023	6921.62	6918.52	6917.74	3.88	3.10
MKTF-02R	3/31/2023	6922.93	6912.86	6912.83	10.10	10.07
MKTF-02R	4/12/2023	6922.93	6912.80	6912.75	10.18	10.13
MKTF-02R	5/15/2023	6922.93	6912.78	6912.74	10.19	10.15
MKTF-02R	6/1/2023	6922.93	6912.92	6912.88	10.05	10.01
MKTF-02R	7/24/2023	6922.93	6913.01	6912.96	9.97	9.92
MKTF-02R	8/21/2023	6922.93	6912.90	6912.83	10.10	10.03
MKTF-02R	9/6/2023	6922.93	6912.88	6912.82	10.11	10.05
MKTF-03	3/31/2023	6931.69	6923.98	6923.94	7.75	7.71
MKTF-03	4/12/2023	6931.69	6924.61	6921.51	10.18	7.08
MKTF-03	5/15/2023	6931.69	6924.64	6921.54	10.15	7.05
MKTF-03	6/1/2023	6931.69	6924.71	6921.74	9.95	6.98
MKTF-03	7/24/2023	6931.69	6922.59	6921.44	10.25	9.10
MKTF-03	8/18/2023	6931.69	6923.07	6921.68	10.01	8.62
MKTF-03	9/6/2023	6931.69	6923.04	6921.64	10.05	8.65
MKTF-04R	3/31/2023	6937.96	6928.70	6928.67	9.29	9.26
MKTF-04R	4/12/2023	6937.96	6929.68	6929.67	8.29	8.28
MKTF-04R	5/15/2023	6937.96	6929.66	6929.65	8.31	8.30
MKTF-04R	6/1/2023	6937.96	6929.78	6929.76	8.20	8.18
MKTF-04R	7/24/2023	6937.96	6929.81	6929.79	8.17	8.15
MKTF-04R	8/18/2023	6937.96	ND	6928.05	9.91	ND
MKTF-04R	9/6/2023	6937.96	ND	6928.00	9.96	ND
MKTF-05	3/31/2023	6942.22	6927.90	6926.20	16.02	14.32
MKTF-05	4/12/2023	6942.22	6927.96	6927.54	14.68	14.26
MKTF-05	5/15/2023	6942.22	6927.95	6927.52	14.70	14.27
MKTF-05	6/1/2023	6942.22	6928.08	6927.64	14.58	14.14
MKTF-05	7/24/2023	6942.22	6926.38	6926.20	16.02	15.84
MKTF-05	8/21/2023	6942.22	6927.07	6926.62	15.60	15.15
MKTF-05	9/6/2023	6942.22	6927.05	6926.64	15.58	15.17
MKTF-06	3/31/2023	6946.81	6928.49	6927.31	19.50	18.32
MKTF-06	4/12/2023	6946.81	6929.61	6928.10	18.71	17.20
MKTF-06	5/15/2023	6946.81	6929.63	6928.16	18.65	17.18
MKTF-06	6/1/2023	6946.81	6929.58	6928.12	18.69	17.23
MKTF-06	7/24/2023	6946.81	6927.86	6926.69	20.12	18.95
MKTF-06	8/21/2023	6946.81	6927.11	6927.01	19.80	19.70

ATTACHMENT A-2. 2023 FLUID LEVEL DATA FOR MKTF WELLS
GALLUP REFINERY, GALLUP, NEW MEXICO

Location	Date Measured	Measuring Point Elevation (ft-amsl)	Elevation Product Surface (ft-amsl)	Elevation Water Surface (ft-amsl)	Depth To Water (ft-bmpe)	Depth To Product (ft-bmpe)
MKTF-06	9/6/2023	6946.81	6927.15	6927.06	19.75	19.66
MKTF-07	3/31/2023	6947.18	6932.65	6932.52	14.66	14.53
MKTF-07	4/12/2023	6947.18	6933.01	6932.98	14.20	14.17
MKTF-07	5/16/2023	6947.18	6932.66	6932.38	14.80	14.52
MKTF-07	6/1/2023	6947.18	6932.58	6932.28	14.90	14.60
MKTF-07	7/24/2023	6947.18	6932.28	6932.18	15.00	14.90
MKTF-07	8/21/2023	6947.18	6932.23	6932.18	15.00	14.95
MKTF-07	9/6/2023	6947.18	6932.25	6932.17	15.01	14.93
MKTF-08	3/31/2023	6947.09	6931.99	6930.61	16.48	15.10
MKTF-08	4/12/2023	6947.09	ND	6932.55	14.54	ND
MKTF-08	5/16/2023	6947.09	6931.79	6931.64	15.45	15.30
MKTF-08	6/1/2023	6947.09	6931.86	6931.69	15.40	15.23
MKTF-08	7/24/2023	6947.09	6931.19	6930.05	17.04	15.90
MKTF-08	8/21/2023	6947.09	6931.09	6930.14	16.95	16.00
MKTF-08	9/6/2023	6947.09	6931.11	6930.18	16.91	15.98
MKTF-09	3/31/2023	6946.50	6931.48	6931.42	15.08	15.02
MKTF-09	4/12/2023	6946.50	ND	6932.16	14.34	ND
MKTF-09	5/16/2023	6946.50	ND	6932.15	14.35	ND
MKTF-09	6/1/2023	6946.50	ND	6930.80	15.70	ND
MKTF-09	7/24/2023	6946.50	ND	6930.62	15.88	ND
MKTF-09	8/21/2023	6946.50	ND	6930.08	16.42	ND
MKTF-09	9/6/2023	6946.50	ND	6930.10	16.40	ND
MKTF-10	3/31/2023	6937.16	6929.18	6929.06	8.10	7.98
MKTF-10	4/12/2023	6937.16	6929.18	6925.83	11.33	7.98
MKTF-10	5/16/2023	6937.16	6929.16	6925.81	11.35	8.00
MKTF-10	6/1/2023	6937.16	6929.13	6925.86	11.30	8.03
MKTF-10	7/24/2023	6937.16	6929.07	6925.94	11.22	8.09
MKTF-10	9/6/2023	6937.16	6927.75	6920.69	16.47	9.41
MKTF-11	3/31/2023	6931.34	6922.74	6922.69	8.65	8.60
MKTF-11	4/12/2023	6931.34	6923.23	6923.22	8.12	8.11
MKTF-11	5/16/2023	6931.34	6923.24	6923.21	8.13	8.10
MKTF-11	6/1/2023	6931.34	6923.26	6923.24	8.10	8.08
MKTF-11	7/24/2023	6931.34	6923.36	6923.33	8.01	7.98
MKTF-11	8/18/2023	6931.34	ND	6922.14	9.20	ND
MKTF-11	9/6/2023	6931.34	ND	6922.17	9.17	ND
MKTF-12	3/6/2023	6942.11	6923.06	6923.01	19.10	19.05
MKTF-12	4/12/2023	6942.11	6923.70	6923.66	18.45	18.41
MKTF-12	5/15/2023	6942.11	6922.90	6922.83	19.28	19.21
MKTF-12	6/1/2023	6942.11	6922.59	6922.49	19.62	19.52
MKTF-12	7/24/2023	6942.11	6922.61	6922.53	19.58	19.50
MKTF-12	8/22/2023	6942.11	6922.71	6922.64	19.47	19.40

ATTACHMENT A-2. 2023 FLUID LEVEL DATA FOR MKTF WELLS
GALLUP REFINERY, GALLUP, NEW MEXICO

Location	Date Measured	Measuring Point Elevation (ft-amsl)	Elevation Product Surface (ft-amsl)	Elevation Water Surface (ft-amsl)	Depth To Water (ft-bmpe)	Depth To Product (ft-bmpe)
MKTF-12	9/6/2023	6942.11	6922.68	6922.61	19.50	19.43
MKTF-13	3/7/2023	6935.18	6922.03	6919.03	16.15	13.15
MKTF-13	4/12/2023	6935.18	6922.98	6918.51	16.67	12.20
MKTF-13	5/15/2023	6935.18	6922.60	6918.06	17.12	12.58
MKTF-13	6/1/2023	6935.18	6921.58	6917.99	17.19	13.60
MKTF-13	7/24/2023	6935.18	6920.78	6917.08	18.10	14.40
MKTF-13	8/21/2023	6935.18	6921.78	6916.68	18.50	13.40
MKTF-13	9/6/2023	6935.18	6921.85	6916.75	18.43	13.33
MKTF-14	3/7/2023	6928.02	6920.52	6920.47	7.55	7.50
MKTF-14	4/12/2023	6928.02	6920.86	6920.83	7.19	7.16
MKTF-14	5/15/2023	6928.02	6920.19	6919.14	8.88	7.83
MKTF-14	6/1/2023	6928.02	6920.09	6909.68	18.34	7.93
MKTF-14	7/24/2023	6928.02	6919.64	6919.02	9.00	8.38
MKTF-14	8/21/2023	6928.02	6920.22	6919.22	8.80	7.80
MKTF-14	9/6/2023	6928.02	6920.25	6919.27	8.75	7.77
MKTF-15	3/31/2023	6943.48	6929.98	6929.05	14.43	13.50
MKTF-15	4/12/2023	6943.48	6929.83	6929.44	14.04	13.65
MKTF-15	5/16/2023	6943.48	6929.38	6929.18	14.30	14.10
MKTF-15	6/1/2023	6943.48	6929.37	6929.15	14.33	14.11
MKTF-15	7/24/2023	6943.48	6929.00	6928.36	15.12	14.48
MKTF-15	8/18/2023	6943.48	6928.96	6928.15	15.33	14.52
MKTF-15	9/6/2023	6943.48	6929.04	6928.28	15.20	14.44
MKTF-16	3/7/2023	6950.58	ND	6942.48	8.10	ND
MKTF-16	4/12/2023	6950.58	ND	6941.83	8.75	ND
MKTF-16	5/16/2023	6950.58	ND	6941.75	8.83	ND
MKTF-16	6/1/2023	6950.58	ND	6941.66	8.92	ND
MKTF-16	7/24/2023	6950.58	ND	6941.56	9.02	ND
MKTF-16	9/6/2023	6950.58	ND	6945.08	5.50	ND
MKTF-17R	3/7/2023	6950.20	6937.50	6937.45	12.75	12.70
MKTF-17R	4/12/2023	6950.20	6938.05	6938.03	12.17	12.15
MKTF-17R	5/15/2023	6950.20	6937.82	6937.65	12.55	12.38
MKTF-17R	6/1/2023	6950.20	6937.82	6937.79	12.41	12.38
MKTF-17R	7/24/2023	6950.20	6937.55	6937.50	12.70	12.65
MKTF-17R	8/21/2023	6950.20	6937.50	6937.38	12.82	12.70
MKTF-17R	9/6/2023	6950.20	6937.47	6937.35	12.85	12.73
MKTF-18R	3/7/2023	6954.87	ND	6943.84	11.03	ND
MKTF-18R	4/12/2023	6954.87	ND	6944.26	10.61	ND
MKTF-18R	5/15/2023	6954.87	ND	6944.12	10.75	ND
MKTF-18R	6/1/2023	6954.87	ND	6944.32	10.55	ND
MKTF-18R	7/24/2023	6954.87	ND	6944.27	10.60	ND
MKTF-18R	8/22/2023	6954.87	ND	6944.36	10.51	ND

ATTACHMENT A-2. 2023 FLUID LEVEL DATA FOR MKTF WELLS
GALLUP REFINERY, GALLUP, NEW MEXICO

Location	Date Measured	Measuring Point Elevation (ft-amsl)	Elevation Product Surface (ft-amsl)	Elevation Water Surface (ft-amsl)	Depth To Water (ft-bmpe)	Depth To Product (ft-bmpe)
MKTF-18R	9/6/2023	6954.87	ND	6944.41	10.46	ND
MKTF-19	3/7/2023	6944.67	6930.56	6930.13	14.54	14.11
MKTF-19	4/12/2023	6944.67	6931.22	6930.84	13.83	13.45
MKTF-19	5/15/2023	6944.67	6930.89	6930.47	14.20	13.78
MKTF-19	6/1/2023	6944.67	6930.87	6930.74	13.93	13.80
MKTF-19	7/24/2023	6944.67	6930.52	6930.29	14.38	14.15
MKTF-19	8/21/2023	6944.67	6930.45	6930.19	14.48	14.22
MKTF-19	9/6/2023	6944.67	6930.42	6930.15	14.52	14.25
MKTF-20	3/7/2023	6951.78	ND	Dry	Dry	ND
MKTF-20	4/12/2023	6951.78	ND	6943.23	8.55	ND
MKTF-20	5/15/2023	6951.78	ND	6943.22	8.56	ND
MKTF-20	6/1/2023	6951.78	ND	6943.28	8.50	ND
MKTF-20	7/24/2023	6951.78	ND	6943.38	8.40	ND
MKTF-20	8/18/2023	6951.78	ND	6942.07	9.71	ND
MKTF-20	9/6/2023	6951.78	ND	6942.05	9.73	ND
MKTF-21	3/7/2023	6952.57	ND	6944.24	8.33	ND
MKTF-21	4/12/2023	6952.57	ND	Dry	Dry	ND
MKTF-21	5/15/2023	6952.57	ND	Dry	Dry	ND
MKTF-21	6/1/2023	6952.57	ND	Dry	Dry	ND
MKTF-21	7/24/2023	6952.57	ND	Dry	Dry	ND
MKTF-21	8/23/2023	6952.57	ND	Dry	Dry	ND
MKTF-21	9/6/2023	6952.57	ND	Dry	Dry	ND
MKTF-22	3/6/2023	6942.31	6916.46	6914.64	27.67	25.85
MKTF-22	4/12/2023	6942.31	6916.78	6914.87	27.44	25.53
MKTF-22	5/15/2023	6942.31	6916.51	6914.64	27.67	25.80
MKTF-22	6/1/2023	6942.31	6916.60	6914.28	28.03	25.71
MKTF-22	7/24/2023	6942.31	6916.21	6914.09	28.22	26.10
MKTF-22	8/21/2023	6942.31	6917.11	6914.86	27.45	25.20
MKTF-22	9/6/2023	6942.31	6917.06	6914.81	27.50	25.25
MKTF-23	3/7/2023	6929.98	6915.08	6915.06	14.92	14.90
MKTF-23	4/12/2023	6929.98	6915.10	6915.08	14.90	14.88
MKTF-23	5/15/2023	6929.98	6914.88	6914.87	15.11	15.10
MKTF-23	6/1/2023	6929.98	6914.84	6914.83	15.15	15.14
MKTF-23	7/24/2023	6929.98	6914.88	6914.86	15.12	15.10
MKTF-23	8/23/2023	6929.98	6914.82	6914.78	15.20	15.16
MKTF-23	9/6/2023	6929.98	6914.83	6914.78	15.20	15.15
MKTF-24	3/31/2023	6928.72	6905.48	6905.44	23.28	23.24
MKTF-24	4/13/2023	6928.72	6905.60	6905.57	23.15	23.12
MKTF-24	5/15/2023	6928.72	6905.62	6905.58	23.14	23.10
MKTF-24	6/2/2023	6928.72	6905.66	6905.57	23.15	23.06
MKTF-24	7/24/2023	6928.72	6905.60	6905.52	23.20	23.12

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GALLUP REFINERY, GALLUP, NEW MEXICO

Location	Date Measured	Measuring Point Elevation (ft-amsl)	Elevation Product Surface (ft-amsl)	Elevation Water Surface (ft-amsl)	Depth To Water (ft-bmpe)	Depth To Product (ft-bmpe)
MKTF-24	8/23/2023	6928.72	ND	6904.00	24.72	ND
MKTF-24	9/6/2023	6928.72	ND	6903.97	24.75	ND
MKTF-25	3/31/2023	6916.19	6902.69	6902.64	13.55	13.50
MKTF-25	4/13/2023	6916.19	6902.59	6902.55	13.64	13.60
MKTF-25	5/15/2023	6916.19	6902.56	6902.52	13.67	13.63
MKTF-25	6/2/2023	6916.19	6902.64	6902.59	13.60	13.55
MKTF-25	7/24/2023	6916.19	6902.86	6902.61	13.58	13.33
MKTF-25	8/23/2023	6916.19	ND	6901.53	14.66	ND
MKTF-25	9/6/2023	6916.19	ND	6901.54	14.65	ND
MKTF-26	3/31/2023	6915.31	6906.43	6906.36	8.95	8.88
MKTF-26	4/13/2023	6915.31	6906.41	6906.34	8.97	8.90
MKTF-26	5/16/2023	6915.31	6906.33	6906.26	9.05	8.98
MKTF-26	6/2/2023	6915.31	6906.65	6906.56	8.75	8.66
MKTF-26	7/24/2023	6915.31	6906.60	6906.51	8.80	8.71
MKTF-26	8/23/2023	6915.31	ND	6904.93	10.38	ND
MKTF-26	9/6/2023	6915.31	ND	6904.96	10.35	ND
MKTF-27	3/7/2023	6917.90	ND	6911.50	6.40	ND
MKTF-27	4/13/2023	6917.90	ND	6911.36	6.54	ND
MKTF-27	5/16/2023	6917.90	ND	6911.15	6.75	ND
MKTF-27	6/2/2023	6917.90	ND	6911.02	6.88	ND
MKTF-27	7/24/2023	6917.90	ND	6911.15	6.75	ND
MKTF-27	8/23/2023	6917.90	ND	6910.15	7.75	ND
MKTF-27	9/6/2023	6917.90	ND	6910.17	7.73	ND
MKTF-28	3/7/2023	6921.52	ND	6913.25	8.27	ND
MKTF-28	4/13/2023	6921.52	ND	6913.22	8.30	ND
MKTF-28	5/16/2023	6921.52	ND	6913.19	8.33	ND
MKTF-28	6/2/2023	6921.52	ND	6913.33	8.19	ND
MKTF-28	7/24/2023	6921.52	ND	6913.42	8.10	ND
MKTF-28	8/23/2023	6921.52	ND	6913.47	8.05	ND
MKTF-28	9/6/2023	6921.52	ND	6913.51	8.01	ND
MKTF-29	3/7/2023	6901.62	ND	6896.00	5.62	ND
MKTF-29	4/13/2023	6901.62	ND	6895.87	5.75	ND
MKTF-29	5/16/2023	6901.62	ND	6895.82	5.80	ND
MKTF-29	6/2/2023	6901.62	ND	6895.85	5.77	ND
MKTF-29	7/24/2023	6901.62	ND	6895.85	5.77	ND
MKTF-29	8/23/2023	6901.62	ND	6895.99	5.63	ND
MKTF-29	9/6/2023	6901.62	ND	6896.02	5.60	ND
MKTF-30	3/7/2023	6900.80	ND	6885.15	15.65	ND
MKTF-30	4/13/2023	6900.80	ND	6885.25	15.55	ND
MKTF-30	5/16/2023	6900.80	ND	6885.00	15.80	ND
MKTF-30	6/2/2023	6900.80	ND	6885.61	15.19	ND

ATTACHMENT A-2. 2023 FLUID LEVEL DATA FOR MKTF WELLS
GALLUP REFINERY, GALLUP, NEW MEXICO

Location	Date Measured	Measuring Point Elevation (ft-amsl)	Elevation Product Surface (ft-amsl)	Elevation Water Surface (ft-amsl)	Depth To Water (ft-bmpe)	Depth To Product (ft-bmpe)
MKTF-30	7/24/2023	6900.80	ND	6885.65	15.15	ND
MKTF-30	8/23/2023	6900.80	ND	6885.73	15.07	ND
MKTF-30	9/6/2023	6900.80	ND	6885.70	15.10	ND
MKTF-31	3/7/2023	6906.87	ND	6897.42	9.45	ND
MKTF-31	4/13/2023	6906.87	ND	6897.36	9.51	ND
MKTF-31	5/15/2023	6906.87	ND	6897.19	9.68	ND
MKTF-31	6/1/2023	6906.87	6897.70	6896.25	10.62	9.17
MKTF-31	7/24/2023	6906.87	ND	6897.47	9.40	ND
MKTF-31	8/23/2023	6906.87	ND	6897.35	9.52	ND
MKTF-31	9/6/2023	6906.87	ND	6897.39	9.48	ND
MKTF-32	3/6/2023	6911.11	ND	6896.63	14.48	ND
MKTF-32	4/11/2023	6911.11	ND	6896.86	14.25	ND
MKTF-32	5/15/2023	6911.11	ND	6896.73	14.38	ND
MKTF-32	6/1/2023	6911.11	ND	6896.53	14.58	ND
MKTF-32	7/24/2023	6911.11	ND	6896.53	14.58	ND
MKTF-32	8/21/2023	6911.11	ND	6896.06	15.05	ND
MKTF-32	9/6/2023	6911.11	ND	6896.11	15.00	ND
MKTF-33	3/6/2023	6939.75	6916.45	6916.41	23.34	23.30
MKTF-33	4/11/2023	6939.75	6916.75	6916.70	23.05	23.00
MKTF-33	5/15/2023	6939.75	ND	6916.60	23.15	ND
MKTF-33	6/2/2023	6939.75	ND	6916.58	23.17	ND
MKTF-33	7/24/2023	6939.75	ND	6916.65	23.10	ND
MKTF-33	8/21/2023	6939.75	6916.04	6916.02	23.73	23.71
MKTF-33	9/6/2023	6939.75	6916.09	6916.06	23.69	23.66
MKTF-34	3/6/2023	6945.35	6933.99	6933.98	11.37	11.36
MKTF-34	4/12/2023	6945.35	6928.61	6928.60	16.75	16.74
MKTF-34	5/15/2023	6945.35	ND	6929.61	15.74	ND
MKTF-34	6/2/2023	6945.35	ND	6925.95	19.40	ND
MKTF-34	7/24/2023	6945.35	ND	6926.05	19.30	ND
MKTF-34	8/21/2023	6945.35	ND	6924.88	20.47	ND
MKTF-34	9/6/2023	6945.35	ND	6924.91	20.44	ND
MKTF-35	3/7/2023	6951.65	6941.58	6941.51	10.14	10.07
MKTF-35	4/12/2023	6951.65	6941.92	6941.91	9.74	9.73
MKTF-35	5/16/2023	6951.65	6941.85	6941.83	9.82	9.80
MKTF-35	6/2/2023	6951.65	ND	6942.00	9.65	ND
MKTF-35	7/24/2023	6951.65	ND	6941.95	9.70	ND
MKTF-35	8/22/2023	6951.65	ND	6941.94	9.71	ND
MKTF-35	9/6/2023	6951.65	ND	6941.99	9.66	ND
MKTF-36	3/7/2023	6950.12	6940.91	6940.77	9.35	9.21
MKTF-36	4/12/2023	6950.12	ND	6941.21	8.91	ND
MKTF-36	5/16/2023	6950.12	ND	6941.14	8.98	ND

ATTACHMENT A-2. 2023 FLUID LEVEL DATA FOR MKTF WELLS
GALLUP REFINERY, GALLUP, NEW MEXICO

Location	Date Measured	Measuring Point Elevation (ft-amsl)	Elevation Product Surface (ft-amsl)	Elevation Water Surface (ft-amsl)	Depth To Water (ft-bmpe)	Depth To Product (ft-bmpe)
MKTF-36	6/2/2023	6950.12	6941.42	6941.41	8.71	8.70
MKTF-36	7/24/2023	6950.12	6941.24	6941.22	8.90	8.88
MKTF-36	8/22/2023	6950.12	6941.30	6941.16	8.96	8.82
MKTF-36	9/6/2023	6950.12	6941.27	6941.12	9.00	8.85
MKTF-37	3/7/2023	6958.87	6947.78	6947.76	11.11	11.09
MKTF-37	4/12/2023	6958.87	6948.37	6948.36	10.51	10.50
MKTF-37	5/16/2023	6958.87	6948.26	6948.25	10.62	10.61
MKTF-37	6/2/2023	6958.87	6948.38	6948.37	10.50	10.49
MKTF-37	7/24/2023	6958.87	6948.42	6948.40	10.47	10.45
MKTF-37	8/18/2023	6958.87	ND	6948.61	10.26	ND
MKTF-37	9/6/2023	6958.87	ND	6948.63	10.24	ND
MKTF-38	3/7/2023	6954.89	ND	6944.24	10.65	ND
MKTF-38	4/12/2023	6954.89	ND	6944.78	10.11	ND
MKTF-38	5/16/2023	6954.89	ND	6944.74	10.15	ND
MKTF-38	6/2/2023	6954.89	ND	6944.79	10.10	ND
MKTF-38	7/24/2023	6954.89	ND	6944.83	10.06	ND
MKTF-38	8/18/2023	6954.89	ND	6944.93	9.96	ND
MKTF-38	9/6/2023	6954.89	ND	6944.90	9.99	ND
MKTF-39	3/7/2023	6953.75	6943.17	6942.45	11.30	10.58
MKTF-39	4/12/2023	6953.75	6943.53	6943.02	10.73	10.22
MKTF-39	5/15/2023	6953.75	6943.37	6942.95	10.80	10.38
MKTF-39	6/2/2023	6953.75	6943.77	6943.35	10.40	9.98
MKTF-39	7/24/2023	6953.75	6943.52	6942.94	10.81	10.23
MKTF-39	8/18/2023	6953.75	6943.33	6942.79	10.96	10.42
MKTF-39	9/6/2023	6953.75	6943.30	6942.72	11.03	10.45
MKTF-40	3/7/2023	6894.33	ND	6880.11	14.22	ND
MKTF-40	4/12/2023	6894.33	ND	6880.23	14.10	ND
MKTF-40	5/16/2023	6894.33	ND	6880.21	14.12	ND
MKTF-40	6/2/2023	6894.33	ND	6880.44	13.89	ND
MKTF-40	7/24/2023	6894.33	ND	6880.32	14.01	ND
MKTF-40	9/6/2023	6894.33	ND	6873.68	20.65	ND
MKTF-41	3/6/2023	6893.64	ND	6872.75	20.89	ND
MKTF-41	4/11/2023	6893.64	ND	6872.88	20.76	ND
MKTF-41	5/16/2023	6893.64	ND	6872.73	20.91	ND
MKTF-41	6/1/2023	6893.64	ND	6873.19	20.45	ND
MKTF-41	7/24/2023	6893.64	ND	6873.13	20.51	ND
MKTF-41	8/21/2023	6893.64	ND	6872.30	21.34	ND
MKTF-41	9/6/2023	6893.64	ND	6872.34	21.30	ND
MKTF-42	3/6/2023	6892.95	ND	6876.92	16.03	ND
MKTF-42	4/11/2023	6892.95	ND	6876.95	16.00	ND
MKTF-42	5/15/2023	6892.95	ND	6876.85	16.10	ND

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Location	Date Measured	Measuring Point Elevation (ft-amsl)	Elevation Product Surface (ft-amsl)	Elevation Water Surface (ft-amsl)	Depth To Water (ft-bmpe)	Depth To Product (ft-bmpe)
MKTF-42	6/1/2023	6892.95	ND	6877.00	15.95	ND
MKTF-42	7/25/2023	6892.95	ND	6877.15	15.80	ND
MKTF-42	8/21/2023	6892.95	ND	6876.62	16.33	ND
MKTF-42	9/6/2023	6892.95	ND	6876.66	16.29	ND
MKTF-43	3/6/2023	6876.90	ND	6868.37	8.53	ND
MKTF-43	4/11/2023	6876.90	ND	6868.65	8.25	ND
MKTF-43	5/15/2023	6876.90	ND	6868.60	8.30	ND
MKTF-43	6/1/2023	6876.90	ND	6870.23	6.67	ND
MKTF-43	7/25/2023	6876.90	ND	6870.28	6.62	ND
MKTF-43	8/21/2023	6876.90	ND	6870.58	6.32	ND
MKTF-43	9/6/2023	6876.90	ND	6870.55	6.35	ND
MKTF-44	3/6/2023	6869.95	ND	6835.81	34.14	ND
MKTF-44	4/11/2023	6869.95	ND	6831.22	38.73	ND
MKTF-44	5/15/2023	6869.95	ND	6835.83	34.12	ND
MKTF-44	6/1/2023	6869.95	ND	6837.83	32.12	ND
MKTF-44	7/25/2023	6869.95	ND	6837.95	32.00	ND
MKTF-44	8/21/2023	6869.95	ND	6834.73	35.22	ND
MKTF-44	9/6/2023	6869.95	ND	6834.75	35.20	ND
MKTF-45	3/7/2023	6949.59	6934.75	6934.69	14.90	14.84
MKTF-45	4/12/2023	6949.59	6935.30	6935.29	14.30	14.29
MKTF-45	5/15/2023	6949.59	6935.45	6935.44	14.15	14.14
MKTF-45	6/2/2023	6949.59	ND	6935.07	14.52	ND
MKTF-45	7/25/2023	6949.59	ND	6935.09	14.50	ND
MKTF-45	8/22/2023	6949.59	6934.87	6934.82	14.77	14.72
MKTF-45	9/6/2023	6949.59	6934.84	6934.81	14.78	14.75
MKTF-46	3/6/2023	6957.60	ND	6944.58	13.02	ND
MKTF-46	4/12/2023	6957.60	ND	6945.42	12.18	ND
MKTF-46	5/15/2023	6957.60	ND	6945.36	12.24	ND
MKTF-46	6/1/2023	6957.60	ND	6945.55	12.05	ND
MKTF-46	7/25/2023	6957.60	ND	6945.40	12.20	ND
MKTF-46	8/21/2023	6957.60	ND	6945.25	12.35	ND
MKTF-46	9/6/2023	6957.60	ND	6945.25	12.35	ND
MKTF-47	3/7/2023	6959.09	6948.69	6948.66	10.43	10.40
MKTF-47	4/12/2023	6959.09	6949.11	6949.09	10.00	9.98
MKTF-47	5/15/2023	6959.09	6949.11	6949.06	10.03	9.98
MKTF-47	6/2/2023	6959.09	6949.10	6949.08	10.01	9.99
MKTF-47	7/25/2023	6959.09	6949.06	6949.04	10.05	10.03
MKTF-47	8/18/2023	6959.09	ND	6949.67	9.42	ND
MKTF-47	9/6/2023	6959.09	ND	6949.67	9.42	ND
MKTF-48	3/7/2023	6961.73	6947.60	6947.58	14.15	14.13
MKTF-48	4/12/2023	6961.73	6947.63	6947.60	14.13	14.10

ATTACHMENT A-2. 2023 FLUID LEVEL DATA FOR MKTF WELLS
GALLUP REFINERY, GALLUP, NEW MEXICO

Location	Date Measured	Measuring Point Elevation (ft-amsl)	Elevation Product Surface (ft-amsl)	Elevation Water Surface (ft-amsl)	Depth To Water (ft-bmpe)	Depth To Product (ft-bmpe)
MKTF-48	5/15/2023	6961.73	6947.58	6947.54	14.19	14.15
MKTF-48	6/2/2023	6961.73	6948.04	6948.02	13.71	13.69
MKTF-48	7/25/2023	6961.73	6948.23	6948.16	13.57	13.50
MKTF-48	8/23/2023	6961.73	6948.11	6947.98	13.75	13.62
MKTF-48	9/6/2023	6961.73	6948.13	6948.00	13.73	13.60
MKTF-49	1/30/2023	6946.76	ND	6924.26	22.50	ND
MKTF-49	2/27/2023	6946.76	ND	6924.38	22.38	ND
MKTF-49	3/31/2023	6946.76	ND	6932.75	14.01	ND
MKTF-49	4/12/2023	6946.76	6926.24	6923.91	22.85	20.52
MKTF-49	5/15/2023	6946.76	6924.98	6924.08	22.68	21.78
MKTF-49	6/2/2023	6946.76	6925.25	6924.38	22.38	21.51
MKTF-49	7/25/2023	6946.76	6924.96	6924.01	22.75	21.80
MKTF-49	8/21/2023	6946.76	6924.44	6923.62	23.14	22.32
MKTF-49	9/6/2023	6946.76	6924.46	6923.66	23.10	22.30
MKTF-50	3/31/2023	6942.82	6927.02	6926.75	16.07	15.80
MKTF-50	4/12/2023	6942.82	6927.17	6926.81	16.01	15.65
MKTF-50	5/15/2023	6942.82	6930.34	6929.92	12.90	12.48
MKTF-50	6/2/2023	6942.82	6927.09	6926.71	16.11	15.73
MKTF-50	7/25/2023	6942.82	6927.12	6926.67	16.15	15.70
MKTF-50	8/23/2023	6942.82	6925.43	6925.07	17.75	17.39
MKTF-50	9/6/2023	6942.82	6925.47	6925.10	17.72	17.35

Definitions:

amsl = above mean sea level

bmpe = below measuring point elevation
DRY = no water detected
ft = feet
MKTF = Market Tank Farm
ND = not detected

ATTACHMENT A-3. WELL INFORMATION - SURVEY DATA, SCREENED INTERVAL, STRATIGRAPHIC UNIT
NON-MKTF WELLS
GALLUP REFINERY, GALLUP, NEW MEXICO

Well ID	Sample Date	Installation Date	Casing Diameter (in)	Surface Elevation (ft-amsl)	Well Casing Rim Elevation (ft-amsl)	Stick-up length (ft)	Well Casing Bottom Elevation (ft-amsl)	Total Well Depth (ft-bmpe)	Depth to SPH (ft-bmpe)	SPH Thickness (ft)	DTW (ft-bmpe)	GW Elevation (ft-amsl)	Corrected Water Table [1] Elevation (ft-amsl)	Screened Interval Depth Top to Bottom (ft-bmpe)	Aquifer
BW-1A	9/5/2023	11/10/03	2	6,883.17	6885.12	1.95	6,847.50	43.70	ND	NA	42.87	6842.25	NA	30 - 35	Alluvial/Fluvial Upper Sand
BW-1B	9/5/2023	10/28/03	2	6,883.17	6885.78	2.61	6,818.33	73.38	ND	NA	73.01	6812.77	NA	54.6 - 64.6	Chinle/Alluvium
BW-1C	9/5/2023	11/10/03	2	6,883.17	6885.68	2.51	6,749.29	145.29	ND	NA	13.38	6872.3	NA	125 -135	Sonsela
BW-2A	9/5/2023	11/10/03	2	6,871.88	6874.69	2.81	6,807.12	67.21	ND	NA	39.35	6835.34	NA	55 - 65	Alluvial/Fluvial Upper Sand
BW-2B	9/5/2023	10/28/03	2	6,871.66	6874.50	2.84	6,782.24	92.26	ND	NA	28.9	6845.6	NA	80 - 90	Chinle/Alluvium
BW-2C	9/5/2023	10/28/03	2	6,872.90	6875.30	2.40	6,722.46	149.10	ND	NA	21.33	6853.97	NA	139.5 - 149.5	Sonsela
BW-3A	9/5/2023	06/15/04	2	6,875.94	6878.39	2.45	6,826.04	53.30	ND	NA	Dry	Dry	NA	39.5 - 49.5	Alluvial/Fluvial Upper Sand
BW-3B	9/5/2023	10/15/03	2	6,876.16	6878.59	2.43	6,809.19	69.54	ND	NA	33.85	6844.74	NA	63 - 73	Chinle/Alluvium
BW-3C	9/5/2023	07/20/04	2	6,875.72	6877.95	2.23	6,723.40	150.20	ND	NA	8.44	6869.51	NA	144.5 - 154.5	Sonsela
BW-4A	9/5/2023	06/29/17	2	6,869.28	6873.18	3.90	6,908.18	38.90	ND	NA	Dry	Dry	NA	21 - 36	Alluvial/Fluvial Upper Sand
BW-4B	12/22/2022	06/29/17	2	6,869.45	6873.23	2.79	6,932.95	63.50	ND	NA	47.85	6825.38	NA	41 - 61	Chinle/Alluvium
BW-4B	9/5/2023	06/29/17	2	6,869.45	6873.23	3.78	6,932.95	63.50	ND	NA	35.42	6837.81	NA	41 - 61	Chinle/Alluvium
BW-5A	12/1/2022	06/29/17	2	6,873.18	6877.00	3.82	6,896.58	23.40	ND	NA	Dry	Dry	NA	10 - 20	Alluvial/Fluvial Upper Sand
BW-5A	9/5/2023	06/29/17	2	6,873.18	6877.00	3.82	6,896.58	23.40	ND	NA	Dry	Dry	NA	10 - 20	Alluvial/Fluvial Upper Sand
BW-5B	12/1/2022	06/29/17	2	6,873.30	6876.80	3.50	6,932.75	59.45	ND	NA	10.3	6866.52	NA	46 - 58	Chinle/Alluvium
BW-5B	12/11/2022	06/29/17	2	6,873.30	6876.83	2.54	6,934.75	61.45	ND	NA	10.3	6866.52	NA	49 - 58	Chinle/Alluvium
BW-5B	12/22/2022	06/29/17	2	6,873.30	6876.82	2.54	6,934.75	61.45	ND	NA	10.15	6866.67	NA	48 - 58	Chinle/Alluvium
BW-5B	3/6/2023	06/29/17	2	6,873.30	6876.81	3.51	6,933.75	60.45	ND	NA	13.05	6863.77	NA	47 - 58	Chinle/Alluvium
BW-5B	6/1/2023	06/29/17	2	6,873.30	6876.82	2.54	6,934.75	61.45	ND	NA	12.9	6863.92	NA	48 - 58	Chinle/Alluvium
BW-5B	9/5/2023	06/29/17	2	6,873.30	6876.82	3.52	6,934.75	61.45	ND	NA	11.11	6865.71	NA	48 - 58	Chinle/Alluvium
BW-5C	12/1/2022	06/29/17	2	6,872.92	6876.85	3.01	6,949.27	76.35	ND	NA	11.08	6865.77	NA	64.3-74.30	Sonsela
BW-5C	12/6/2022	06/29/17	2	6,872.92	6876.85	3.01	6,949.27	76.35	ND	NA	4.17	6872.68	NA	64.3-74.30	Sonsela
BW-5C	12/11/2022	06/29/17	2	6,872.92	6876.85	3.01	6,949.27	76.35	ND	NA	4.08	6872.77	NA	64.3-74.30	Sonsela
BW-5C	3/6/2023	06/29/17	2	6,872.92	6876.85	3.01	6,949.27	76.35	ND	NA	2.85	6874	NA	64.3-74.30	Sonsela
BW-5C	6/1/2023	06/29/17	2	6,872.92	6876.85	3.93	6,949.27	76.35	ND	NA	2.55	6874.3	NA	64.3-74.30	Sonsela
BW-5C	9/5/2023	06/29/17	2	6,872.92	6876.85	3.93	6,949.27	76.35	ND	NA	3.93	6872.92	NA	64.3-74.30	Sonsela
GWM-1	12/1/2022	07/08/04	2	6,910.22	6912.61	2.39	6,886.41	26.65	21.01	2.07	23.08	6889.53	6891.19	17.5 - 23.5	Chinle/Alluvium
GWM-1	12/6/2022	07/08/04	2	6,910.22	6912.61	2.39	6,886.41	26.45	21.01	2.07	23.08	6889.53	6891.19	17.5 - 23.5	Chinle/Alluvium
GWM-1	3/31/2023	07/08/04	2	6,910.22	6912.61	2.39	6,886.41	26.65	20.9	2.05	22.95	6889.66	6891.30	17.5 - 23.5	Chinle/Alluvium
GWM-1	4/13/2023	07/08/04	2	6,910.22	6912.61	2.39	6,886.41	26.65	20.88	2.07	22.95	6889.66	6891.32	17.5 - 23.5	Chinle/Alluvium
GWM-1	5/15/2023	07/08/04	2	6,910.22	6912.61	2.39	6,886.41	26.65	20.86	2.09	22.95	6889.66	6891.33	17.5 - 23.5	Chinle/Alluvium
GWM-1	6/2/2023	07/08/04	2	6,910.22	6912.61	2.39	6,886.41	26.65	20.9	2.13	23.03	6889.58	6891.28	17.5 - 23.5	Chinle/Alluvium
GWM-1	7/24/2023	07/08/04	2	6,910.22	6912.61	2.39	6,886.41	26.65	20.9	2.1	23	6889.61	6891.29	17.5 - 23.5	Chinle/Alluvium
GWM-1	8/18/2023	07/08/04	2	6,910.22	6912.61	2.39	6,886.41	26.45	20.88	2.1	22.98	6889.63	6891.31	17.5 - 23.5	Chinle/Alluvium
GWM-1	9/5/2023	07/08/04	2	6,910.22	6912.61	2.39	6,886.41	26.65	20.9	2.1	23	6889.61	6891.29	17.5 - 23.5	Chinle/Alluvium

ATTACHMENT A-3. WELL INFORMATION - SURVEY DATA, SCREENED INTERVAL, STRATIGRAPHIC UNIT
NON-MKTF WELLS
GALLUP REFINERY, GALLUP, NEW MEXICO

Well ID	Sample Date	Installation Date	Casing Diameter (in)	Surface Elevation (ft-amsl)	Well Casing Rim Elevation (ft-amsl)	Stick-up length (ft)	Well Casing Bottom Elevation (ft-amsl)	Total Well Depth (ft-bmpe)	Depth to SPH (ft-bmpe)	SPH Thickness (ft)	DTW (ft-bmpe)	GW Elevation (ft-amsl)	Corrected Water Table [1] Elevation (ft-amsl)	Screened Interval Depth Top to Bottom (ft-bmpe)	Aquifer
GWM-2	12/1/2022	09/25/05	2	6,910.32	6913.09	2.77	6,894.28	18.08	ND	NA	Dry	Dry	NA	3.2 - 16.2	Chinle/Alluvium
GWM-2	12/6/2022	09/25/05	2	6,910.32	6913.09	2.77	6,894.28	18.08	ND	NA	Dry	Dry	NA	3.2 - 16.2	Chinle/Alluvium
GWM-2	3/31/2023	09/25/05	2	6,910.32	6913.09	2.77	6,894.28	18.08	ND	NA	Dry	Dry	NA	3.2 - 16.2	Chinle/Alluvium
GWM-2	4/13/2023	09/25/05	2	6,910.32	6913.09	2.77	6,894.28	18.08	ND	NA	Dry	Dry	NA	3.2 - 16.2	Chinle/Alluvium
GWM-2	5/15/2023	09/25/05	2	6,910.32	6913.09	2.77	6,894.28	18.08	ND	NA	Dry	Dry	NA	3.2 - 16.2	Chinle/Alluvium
GWM-2	6/2/2023	09/25/05	2	6,910.32	6913.09	2.77	6,894.28	18.08	ND	NA	Dry	Dry	NA	3.2 - 16.2	Chinle/Alluvium
GWM-2	7/24/2023	09/25/05	2	6,910.32	6913.09	2.77	6,894.28	18.08	ND	NA	Dry	Dry	NA	3.2 - 16.2	Chinle/Alluvium
GWM-2	8/18/2023	09/25/05	2	6,910.32	6913.09	2.77	6,894.28	18.08	ND	NA	Dry	Dry	NA	3.2 - 16.2	Chinle/Alluvium
GWM-2	9/5/2023	09/25/05	2	6,910.32	6913.09	2.77	6,894.28	18.08	ND	NA	Dry	Dry	NA	3.2 - 16.2	Chinle/Alluvium
GWM-3	12/1/2022	09/25/05	2	6,907.35	6910.25	2.90	6,892.45	19.15	ND	NA	Dry	Dry	NA	3 - 15	Chinle/Alluvium
GWM-3	12/6/2022	09/25/05	2	6,907.35	6910.25	2.90	6,892.45	19.15	ND	NA	Dry	Dry	NA	3 - 15	Chinle/Alluvium
GWM-3	3/31/2023	09/25/05	2	6,907.35	6910.25	2.90	6,892.45	19.15	ND	NA	Dry	Dry	NA	3 - 15	Chinle/Alluvium
GWM-3	4/13/2023	09/25/05	2	6,907.35	6910.25	2.90	6,892.45	19.15	ND	NA	Dry	Dry	NA	3 - 15	Chinle/Alluvium
GWM-3	5/15/2023	09/25/05	2	6,907.35	6910.25	2.90	6,892.45	19.15	ND	NA	Dry	Dry	NA	3 - 15	Chinle/Alluvium
GWM-3	6/2/2023	09/25/05	2	6,907.35	6910.25	2.90	6,892.45	19.15	ND	NA	Dry	Dry	NA	3 - 15	Chinle/Alluvium
GWM-3	7/24/2023	09/25/05	2	6,907.35	6910.25	2.90	6,892.45	19.15	ND	NA	Dry	Dry	NA	3 - 15	Chinle/Alluvium
GWM-3	8/18/2023	09/25/05	2	6,907.35	6910.25	2.90	6,892.45	19.15	ND	NA	Dry	Dry	NA	3 - 15	Chinle/Alluvium
GWM-3	9/5/2023	09/25/05	2	6,907.35	6910.25	2.90	6,892.45	19.15	ND	NA	Dry	Dry	NA	3 - 15	Chinle/Alluvium
KA-3	12/1/2022	06/11/07	2	6,913.29	6912.52	-0.77	6,889.32	23.20	ND	NA	11.12	6901.4	NA	15 - 25	Chinle/Alluvium
KA-3	12/7/2022	06/11/07	2	6,913.29	6912.52	-0.77	6,889.32	23.20	ND	NA	11.12	6901.4	NA	15 - 25	Chinle/Alluvium
KA-3	3/7/2023	06/11/07	2	6,913.29	6912.52	-0.77	6,889.32	23.20	ND	NA	10.55	6901.97	NA	15 - 25	Chinle/Alluvium
KA-3	4/12/2023	06/11/07	2	6,913.29	6912.52	-0.77	6,889.32	23.20	ND	NA	10.44	6902.08	NA	15 - 25	Chinle/Alluvium
KA-3	5/15/2023	06/11/07	2	6,913.29	6912.52	-0.77	6,889.32	23.20	ND	NA	10.42	6902.1	NA	15 - 25	Chinle/Alluvium
KA-3	6/2/2023	06/11/07	2	6,913.29	6912.52	-0.77	6,889.32	23.20	ND	NA	10.66	6901.86	NA	15 - 25	Chinle/Alluvium
KA-3	7/24/2023	06/11/07	2	6,913.29	6912.52	-0.77	6,889.32	23.20	ND	NA	10.55	6901.97	NA	15 - 25	Chinle/Alluvium
KA-3	8/18/2023	06/11/07	2	6,913.29	6912.52	-0.77	6,889.32	23.20	ND	NA	10.61	6901.91	NA	15 - 25	Chinle/Alluvium
KA-3	9/5/2023	06/11/07	2	6,913.29	6912.52	-0.77	6,889.32	23.20	ND	NA	10.65	6901.87	NA	15 - 25	Chinle/Alluvium
MW-1	9/7/2023	10/14/81	5	6,876.63	6878.12	1.49	6,747.29	135.30	ND	NA	8.03	6870.09	NA	117.72 - 127.72	Sonsela
MW-2	9/7/2023	10/15/81	5	6,878.39	6880.30	1.91	6,742.82	138.20	ND	NA	13.7	6866.6	NA	112 - 122	Sonsela
MW-4	9/7/2023	10/16/81	5	6,879.89	6881.63	1.74	6,759.91	125.90	ND	NA	9.13	6872.5	NA	101 - 121	Sonsela
MW-5	9/7/2023	07/21/86	4	6,880.20	6882.83	2.63	6,752.00	133.00	ND	NA	13.58	6869.25	NA	115 - 125	Sonsela

ATTACHMENT A-3. WELL INFORMATION - SURVEY DATA, SCREENED INTERVAL, STRATIGRAPHIC UNIT
NON-MKTF WELLS
GALLUP REFINERY, GALLUP, NEW MEXICO

Well ID	Sample Date	Installation Date	Casing Diameter (in)	Surface Elevation (ft-amsl)	Well Casing Rim Elevation (ft-amsl)	Stick-up length (ft)	Well Casing Bottom Elevation (ft-amsl)	Total Well Depth (ft-bmpe)	Depth to SPH (ft-bmpe)	SPH Thickness (ft)	DTW (ft-bmpe)	GW Elevation (ft-amsl)	Corrected Water Table [1] Elevation (ft-amsl)	Screened Interval Depth Top to Bottom (ft-bmpe)	Aquifer
NAPIS-1	12/1/2022	03/14/08	2	6,913.62	6913.86	0.24	6,900.33	13.58	7.63	0.05	7.68	6906.18	6906.22	3.7 - 13.7	Chinle/Alluvium
NAPIS-1	12/6/2022	03/14/08	2	6,913.62	6913.86	0.24	6,900.33	13.58	7.63	0.05	7.68	6906.18	6906.22	3.7 - 13.7	Chinle/Alluvium
NAPIS-1	3/7/2023	03/14/08	2	6,913.62	6913.86	0.24	6,900.33	13.76	7.58	0.06	7.64	6906.22	6906.27	3.7 - 13.7	Chinle/Alluvium
NAPIS-1	4/13/2023	03/14/08	2	6,913.62	6913.86	0.24	6,900.33	13.58	7.66	0.11	7.77	6906.09	6906.18	3.7 - 13.7	Chinle/Alluvium
NAPIS-1	5/15/2023	03/14/08	2	6,913.62	6913.86	0.24	6,900.33	13.58	7.69	0.01	7.7	6906.16	6906.17	3.7 - 13.7	Chinle/Alluvium
NAPIS-1	6/2/2023	03/14/08	2	6,913.62	6913.86	0.24	6,900.33	13.58	7.62	0.06	7.68	6906.18	6906.23	3.7 - 13.7	Chinle/Alluvium
NAPIS-1	7/25/2023	03/14/08	2	6,913.62	6913.86	0.24	6,900.33	13.58	7.65	0.05	7.7	6906.16	6906.20	3.7 - 13.7	Chinle/Alluvium
NAPIS-1	8/18/2023	03/14/08	2	6,913.62	6913.86	0.24	6,900.33	13.58	7.58	0.06	7.64	6906.22	6906.27	3.7 - 13.7	Chinle/Alluvium
NAPIS-1	9/7/2023	03/14/08	2	6,913.62	6913.86	0.24	6,900.33	13.58	7.58	0.02	7.6	6906.26	6906.28	3.7 - 13.7	Chinle/Alluvium
NAPIS-2	12/1/2022	03/14/08	2	6,913.40	6912.65	-0.75	6,899.04	14.61	ND	NA	9.93	6902.72	NA	4.2 - 14.2	Chinle/Alluvium
NAPIS-2	12/14/2022	03/14/08	2	6,913.40	6912.65	-0.75	6,899.04	14.60	ND	NA	9.93	6902.72	NA	4.2 - 14.2	Chinle/Alluvium
NAPIS-2	3/7/2023	03/14/08	2	6,913.40	6912.65	-0.75	6,899.04	14.60	ND	NA	9.21	6903.44	NA	4.2 - 14.2	Chinle/Alluvium
NAPIS-2	4/13/2023	03/14/08	2	6,913.40	6912.65	-0.75	6,899.04	14.60	ND	NA	9.19	6903.46	NA	4.2 - 14.2	Chinle/Alluvium
NAPIS-2	5/15/2023	03/14/08	2	6,913.40	6912.65	-0.75	6,899.04	14.60	ND	NA	9.45	6903.2	NA	4.2 - 14.2	Chinle/Alluvium
NAPIS-2	6/2/2023	03/14/08	2	6,913.40	6912.65	-0.75	6,899.04	14.60	ND	NA	10.23	6902.42	NA	4.2 - 14.2	Chinle/Alluvium
NAPIS-2	7/25/2023	03/14/08	2	6,913.40	6912.65	-0.75	6,899.04	14.60	ND	NA	10.28	6902.37	NA	4.2 - 14.2	Chinle/Alluvium
NAPIS-2	8/18/2023	03/14/08	2	6,913.40	6912.65	-0.75	6,899.04	14.60	ND	NA	10.21	6902.44	NA	4.2 - 14.2	Chinle/Alluvium
NAPIS-2	9/7/2023	03/14/08	2	6,913.40	6912.65	-0.75	6,899.04	14.61	ND	NA	10.15	6902.5	NA	4.2 - 14.2	Chinle/Alluvium
NAPIS-3	12/1/2022	03/14/08	2	6,913.38	6912.76	-0.62	6,882.34	31.50	ND	NA	9.93	6902.83	NA	25.4 - 30-4	Chinle/Alluvium
NAPIS-3	12/14/2022	03/14/08	2	6,913.38	6912.76	-0.62	6,882.34	31.50	ND	NA	9.93	6902.83	NA	25.4 - 30-4	Chinle/Alluvium
NAPIS-3	3/7/2023	03/14/08	2	6,913.38	6912.76	-0.62	6,882.34	31.50	ND	NA	9	6903.76	NA	25.4 - 30-4	Chinle/Alluvium
NAPIS-3	4/13/2023	03/14/08	2	6,913.38	6912.76	-0.62	6,882.34	31.50	ND	NA	9.05	6903.71	NA	25.4 - 30-4	Chinle/Alluvium
NAPIS-3	5/15/2023	03/14/08	2	6,913.38	6912.76	-0.62	6,882.34	31.50	ND	NA	9.15	6903.61	NA	25.4 - 30-4	Chinle/Alluvium
NAPIS-3	6/2/2023	03/14/08	2	6,913.38	6912.76	-0.62	6,882.34	31.50	ND	NA	9.2	6903.56	NA	25.4 - 30-4	Chinle/Alluvium
NAPIS-3	7/25/2023	03/14/08	2	6,913.38	6912.76	-0.62	6,882.34	31.50	ND	NA	9.3	6903.46	NA	25.4 - 30-4	Chinle/Alluvium
NAPIS-3	8/18/2023	03/14/08	2	6,913.38	6912.76	-0.62	6,882.34	31.50	ND	NA	9.27	6903.49	NA	25.4 - 30-4	Chinle/Alluvium
NAPIS-3	9/7/2023	03/14/08	2	6,913.38	6912.76	-0.62	6,882.34	31.50	ND	NA	9.25	6903.51	NA	25.4 - 30-4	Chinle/Alluvium
OAPIS-1	12/1/2022	07/17/12	2	6,914.37	6916.73	2.36	6,888.37	28.00	ND	NA	12.35	6904.38	NA	16 - 26	Chinle/Alluvium
OAPIS-1	12/11/2022	07/17/12	2	6,914.37	6916.73	2.36	6,888.37	28.00	ND	NA	12.35	6904.38	NA	16 - 26	Chinle/Alluvium
OAPIS-1	12/15/2022	07/17/12	2	6,914.37	6916.73	2.36	6,888.37	28.00	ND	NA	12.52	6904.21	NA	16 - 26	Chinle/Alluvium
OAPIS-1	3/7/2023	07/17/12	2	6,914.37	6916.73	2.36	6,888.37	28.00	ND	NA	13.1	6903.63	NA	16 - 26	Chinle/Alluvium
OAPIS-1	4/13/2023	07/17/12	2	6,914.37	6916.73	2.36	6,888.37	28.00	ND	NA	12.96	6903.77	NA	16 - 26	Chinle/Alluvium
OAPIS-1	5/15/2023	07/17/12	2	6,914.37	6916.73	2.36	6,888.37	28.00	ND	NA	13.03	6903.7	NA	16 - 26	Chinle/Alluvium
OAPIS-1	6/2/2023	07/17/12	2	6,914.37	6916.73	2.36	6,888.37	28.00	ND	NA	12.55	6904.18	NA	16 - 26	Chinle/Alluvium
OAPIS-1	7/25/2023	07/17/12	2	6,914.37	6916.73	2.36	6,888.37	28.00	ND	NA	12.58	6904.15	NA	16 - 26	Chinle/Alluvium
OAPIS-1	8/23/2023	07/17/12	2	6,914.37	6916.73	2.36	6,888.37	28.00	ND	NA	12.5	6904.23	NA	16 - 26	Chinle/Alluvium
OAPIS-1	9/7/2023	07/17/12	2	6,914.37	6916.73	2.36	6,888.37	28.00	ND	NA	12.48	6904.25	NA	16 - 26	Chinle/Alluvium

ATTACHMENT A-3. WELL INFORMATION - SURVEY DATA, SCREENED INTERVAL, STRATIGRAPHIC UNIT
NON-MKTF WELLS
GALLUP REFINERY, GALLUP, NEW MEXICO

Well ID	Sample Date	Installation Date	Casing Diameter (in)	Surface Elevation (ft-amsl)	Well Casing Rim Elevation (ft-amsl)	Stick-up length (ft)	Well Casing Bottom Elevation (ft-amsl)	Total Well Depth (ft-bmpe)	Depth to SPH (ft-bmpe)	SPH Thickness (ft)	DTW (ft-bmpe)	GW Elevation (ft-amsl)	Corrected Water Table [1] Elevation (ft-amsl)	Screened Interval Depth Top to Bottom (ft-bmpe)	Aquifer
OW-1	12/1/2022	01/05/81	4	6,866.32	6866.62	0.30	6,772.07	99.39	ND	NA	1.5	NA	NA	89.3 - 99.3	Sonsela
OW-1	12/12/2022	01/05/81	4	6,866.32	6866.62	0.30	6,772.07	99.39	ND	NA	1.5	6865.12	NA	89.3 - 99.3	Sonsela
OW-1	3/6/2023	01/05/81	4	6,866.32	6866.62	0.30	6,772.07	99.39	ND	NA	1.86	NA	NA	89.3 - 99.3	Sonsela
OW-1	6/1/2023	01/05/81	4	6,866.32	6866.62	0.30	6,772.07	99.39	ND	NA	1.73	NA	NA	89.3 - 99.3	Sonsela
OW-1	9/7/2023	01/05/81	4	6,866.32	6866.62	0.30	6,772.07	99.39	ND	NA	1.87	6864.75	NA	89.3 - 99.3	Sonsela
OW-10	12/1/2022	11/25/80	4	6,873.67	6874.91	1.24	6,814.58	66.30	ND	NA	7.96	6866.95	NA	40 - 60	Sonsela
OW-10	12/22/2022	11/25/80	4	6,873.67	6874.91	1.24	6,814.58	66.30	ND	NA	7.96	6866.95	NA	40 - 60	Sonsela
OW-10	3/6/2023	11/25/80	4	6,873.67	6874.91	1.24	6,814.58	66.30	ND	NA	6.03	6868.88	NA	40 - 60	Sonsela
OW-10	6/1/2023	11/25/80	4	6,873.67	6874.91	1.24	6,814.58	66.30	ND	NA	5.62	6869.29	NA	40 - 60	Sonsela
OW-10	9/7/2023	11/25/80	4	6,873.67	6874.91	1.24	6,814.58	66.30	ND	NA	7.73	6867.18	NA	40 - 60	Sonsela
OW-11	12/6/2022	09/25/81	4	6,922.05	6923.51	1.46	6,857.72	65.83	18.83	0.07	18.9	6904.61	6904.67	43 - 65	Sonsela
OW-11	12/11/2022	09/25/81	4	6,922.05	6923.51	1.46	6,857.72	65.83	18.87	0.11	18.98	6904.53	6904.62	43 - 65	Sonsela
OW-11	9/27/2023	09/25/81	4	6,922.05	6923.51	1.46	6,857.72	65.83	18.19	0.79	18.98	6904.53	6905.16	43 - 65	Sonsela
OW-12	12/1/2022	12/15/80	4	6,939.57	6940.69	1.12	6,811.84	131.20	ND	NA	47.05	6893.64	NA	117.8 - 137.8	Sonsela
OW-12	12/3/2022	12/15/80	4	6,939.57	6940.69	1.12	6,811.84	131.20	ND	NA	47.05	6893.64	NA	117.8 - 137.8	Sonsela
OW-12	12/7/2022	12/15/80	4	6,939.57	6940.69	1.12	6,811.84	131.20	ND	NA	55.6	6885.09	NA	117.8 - 137.8	Sonsela
OW-12	3/7/2023	12/15/80	4	6,939.57	6940.69	1.12	6,811.84	131.20	ND	NA	47.05	6893.64	NA	117.8 - 137.8	Sonsela
OW-12	9/27/2023	12/15/80	4	6,939.57	6940.69	1.12	6,811.84	131.20	ND	NA	48.24	6892.45	NA	117.8 - 137.8	Sonsela
OW-12A	12/1/2022	08/18/21	4	6,943.65	6943.06	-0.59	6,912.65	31.00	ND	NA	26.05	6917.01	NA	16 - 36	Chinle/Alluvium
OW-12A	12/7/2022	08/18/21	4	6,943.65	6943.06	-0.59	6,912.65	31.00	ND	NA	26.05	6917.01	NA	16 - 36	Chinle/Alluvium
OW-12A	3/7/2023	08/18/21	4	6,943.65	6943.06	-0.59	6,912.65	31.00	ND	NA	25.41	6917.65	NA	16 - 36	Chinle/Alluvium
OW-12A	4/13/2023	08/18/21	4	6,943.65	6943.06	-0.59	6,912.65	31.00	ND	NA	25.38	6917.68	NA	16 - 36	Chinle/Alluvium
OW-12A	5/16/2023	08/18/21	4	6,943.65	6943.06	-0.59	6,912.65	31.00	ND	NA	26.12	6916.94	NA	16 - 36	Chinle/Alluvium
OW-12A	6/2/2023	08/18/21	4	6,943.65	6943.06	-0.59	6,912.65	31.00	ND	NA	26.38	6916.68	NA	16 - 36	Chinle/Alluvium
OW-12A	7/25/2023	08/18/21	4	6,943.65	6943.06	-0.59	6,912.65	31.00	ND	NA	26.4	6916.66	NA	16 - 36	Chinle/Alluvium
OW-12A	8/23/2023	08/18/21	4	6,943.65	6943.06	-0.59	6,912.65	31.00	ND	NA	25.85	6917.21	NA	16 - 36	Chinle/Alluvium
OW-12A	9/7/2023	08/18/21	4	6,943.65	6943.06	-0.59	6,912.65	31.00	ND	NA	25.8	6917.26	NA	16 - 36	Chinle/Alluvium
OW-13	12/1/2022	12/10/80	4	6,918.95	6920.07	1.12	6,820.92	91.65	ND	NA	21.88	6898.19	NA	78.2 - 98.2	Sonsela
OW-13	12/6/2022	12/10/80	4	6,918.95	6920.07	1.12	6,820.92	91.65	ND	NA	21.88	6898.19	NA	78.2 - 98.2	Sonsela
OW-13	3/6/2023	12/10/80	4	6,918.95	6920.07	1.12	6,820.92	91.65	ND	NA	21.84	6898.23	NA	78.2 - 98.2	Sonsela
OW-13	6/1/2023	12/10/80	4	6,918.95	6920.07	1.12	6,820.92	91.65	ND	NA	12.55	6907.52	NA	78.2 - 98.2	Sonsela
OW-13	9/7/2023	12/10/80	4	6,918.95	6920.07	1.12	6,820.92	91.65	ND	NA	20.96	6899.11	NA	78.2 - 98.2	Sonsela
OW-14	12/1/2022	12/17/80	4	6,924.55	6926.65	2.10	6,880.13	46.52	ND	NA	25.1	6901.55	NA	35 - 45	Chinle/Alluvium
OW-14	12/6/2022	12/17/80	4	6,924.55	6926.65	2.10	6,880.13	46.52	ND	NA	25.1	6901.55	NA	35 - 45	Chinle/Alluvium
OW-14	3/6/2023	12/17/80	4	6,924.55	6926.65	2.10	6,880.13	46.52	ND	NA	25.08	6901.57	NA	35 - 45	Chinle/Alluvium
OW-14	6/1/2023	12/17/80	4	6,924.55	6926.65	2.10	6,880.13	46.52	ND	NA	25	6901.65	NA	35 - 45	Chinle/Alluvium
OW-14	9/7/2023	12/17/80	4	6,924.55	6926.65	2.10	6,880.13	46.52	ND	NA	23.95	6902.7	NA	35 - 45	Chinle/Alluvium

ATTACHMENT A-3. WELL INFORMATION - SURVEY DATA, SCREENED INTERVAL, STRATIGRAPHIC UNIT
NON-MKTF WELLS
GALLUP REFINERY, GALLUP, NEW MEXICO

Well ID	Sample Date	Installation Date	Casing Diameter (in)	Surface Elevation (ft-amsl)	Well Casing Rim Elevation (ft-amsl)	Stick-up length (ft)	Well Casing Bottom Elevation (ft-amsl)	Total Well Depth (ft-bmpe)	Depth to SPH (ft-bmpe)	SPH Thickness (ft)	DTW (ft-bmpe)	GW Elevation (ft-amsl)	Corrected Water Table [1] Elevation (ft-amsl)	Screened Interval Depth Top to Bottom (ft-bmpe)	Aquifer
OW-29	12/1/2022	08/23/96	4	6,913.89	6917.00	3.11	6,865.92	51.05	ND	NA	18.58	6898.42	NA	37.5 - 47.5	Chinle/Alluvium
OW-29	12/6/2022	08/23/96	4	6,913.89	6917.00	3.11	6,865.92	51.05	ND	NA	18.82	6898.18	NA	37.5 - 47.5	Chinle/Alluvium
OW-29	12/11/2022	08/23/96	4	6,913.89	6917.00	3.11	6,865.92	51.05	ND	NA	18.58	6898.42	NA	37.5 - 47.5	Chinle/Alluvium
OW-29	3/6/2023	08/23/96	4	6,913.89	6917.00	3.11	6,865.92	51.05	ND	NA	18.47	6898.53	NA	37.5 - 47.5	Chinle/Alluvium
OW-29	6/1/2023	08/23/96	4	6,913.89	6917.00	3.11	6,865.92	51.05	ND	NA	18.18	6898.82	NA	37.5 - 47.5	Chinle/Alluvium
OW-29	9/7/2023	08/23/96	4	6,913.89	6917.00	3.11	6,865.92	51.05	ND	NA	18.41	6898.59	NA	37.5 - 47.5	Chinle/Alluvium
OW-30	12/1/2022	08/28/96	4	6,921.81	6924.69	2.88	6,874.79	49.90	ND	NA	22.65	6902.04	NA	37.9 - 47.9	Chinle/Alluvium
OW-30	12/6/2022	08/28/96	4	6,921.81	6924.69	2.88	6,874.79	49.90	ND	NA	22.65	6902.04	NA	37.9 - 47.9	Chinle/Alluvium
OW-30	3/29/2023	08/28/96	4	6,921.81	6924.69	2.88	6,874.79	49.90	ND	NA	23.06	6901.63	NA	37.9 - 47.9	Chinle/Alluvium
OW-30	6/1/2023	08/28/96	4	6,921.81	6924.69	2.88	6,874.79	49.90	ND	NA	23.3	6901.39	NA	37.9 - 47.9	Chinle/Alluvium
OW-30	9/7/2023	08/28/96	4	6,921.81	6924.69	2.88	6,874.79	49.90	ND	NA	22.4	6902.29	NA	37.9 - 47.9	Chinle/Alluvium
OW-50	12/1/2022	10/05/09	2	6,912.63	6914.21	1.58	6,850.21	39.02	ND	NA	16.02	6898.19	NA	48 - 63	Chinle/Alluvium
OW-50	12/6/2022	10/05/09	2	6,912.63	6914.21	1.58	6,850.21	39.02	ND	NA	16.02	6898.19	NA	48 - 63	Chinle/Alluvium
OW-50	3/6/2023	10/05/09	2	6,912.63	6914.21	1.58	6,850.21	39.02	ND	NA	15.95	6898.26	NA	48 - 63	Chinle/Alluvium
OW-50	6/1/2023	10/05/09	2	6,912.63	6914.21	1.58	6,850.21	39.02	ND	NA	15.23	6898.98	NA	48 - 63	Chinle/Alluvium
OW-50	9/6/2023	10/05/09	2	6,912.63	6914.21	1.58	6,850.21	39.02	ND	NA	15.4	6898.81	NA	48 - 63	Chinle/Alluvium
OW-52	12/1/2022	10/06/09	2	6,906.53	6907.68	1.15	6,829.94	40.43	ND	NA	15.15	6892.53	NA	64 - 79	Chinle/Alluvium
OW-52	12/6/2022	10/06/09	2	6,906.53	6907.68	1.15	6,829.94	40.43	ND	NA	15.15	6892.53	NA	64 - 79	Chinle/Alluvium
OW-52	3/6/2023	10/06/09	2	6,906.53	6907.68	1.15	6,829.94	40.43	ND	NA	14.87	6892.81	NA	64 - 79	Chinle/Alluvium
OW-52	6/1/2023	10/06/09	2	6,906.53	6907.68	1.15	6,829.94	40.43	ND	NA	14.19	6893.49	NA	64 - 79	Chinle/Alluvium
OW-52	9/7/2023	10/06/09	2	6,906.53	6907.68	1.15	6,829.94	40.43	ND	NA	14.8	6892.88	NA	64 - 79	Chinle/Alluvium
OW-53	12/1/2022	05/31/16	2	6,911.71	6914.38	2.67	6,945.62	33.91	ND	NA	Dry	Dry	NA	16 - 31	Chinle/Alluvium
OW-53	12/6/2022	05/31/16	2	6,911.71	6914.38	2.67	6,945.62	33.91	ND	NA	Dry	Dry	NA	16 - 31	Chinle/Alluvium
OW-53	3/6/2023	05/31/16	2	6,911.71	6914.38	2.67	6,945.62	33.91	ND	NA	Dry	Dry	NA	16 - 31	Chinle/Alluvium
OW-53	6/1/2023	05/31/16	2	6,911.71	6914.38	2.67	6,945.62	33.91	ND	NA	Dry	Dry	NA	16 - 31	Chinle/Alluvium
OW-53	9/7/2023	05/31/16	2	6,911.71	6914.38	2.67	6,945.62	33.91	ND	NA	Dry	Dry	NA	16 - 31	Chinle/Alluvium
OW-54	12/1/2022	06/01/16	2	6,916.27	6918.92	2.65	6,940.85	24.58	ND	NA	19.13	6899.79	NA	13 - 28	Chinle/Alluvium
OW-54	12/6/2022	06/01/16	2	6,916.27	6918.92	2.65	6,940.85	24.58	ND	NA	19.13	6899.79	NA	13 - 28	Chinle/Alluvium
OW-54	3/6/2023	06/01/16	2	6,916.27	6918.92	2.65	6,940.85	24.58	ND	NA	18.9	6900.02	NA	13 - 28	Chinle/Alluvium
OW-54	6/1/2023	06/01/16	2	6,916.27	6918.92	2.65	6,940.85	24.58	ND	NA	18.53	6900.39	NA	13 - 28	Chinle/Alluvium
OW-54	9/7/2023	06/01/16	2	6,916.27	6918.92	2.65	6,940.85	24.58	ND	NA	19	6899.92	NA	13 - 28	Chinle/Alluvium
OW-55	12/1/2022	06/01/16	2	6,921.02	6923.25	2.23	6,945.50	24.48	ND	NA	19.22	6904.03	NA	13 - 28	Chinle/Alluvium
OW-55	12/6/2022	06/01/16	2	6,921.02	6923.25	2.23	6,945.50	24.48	ND	NA	19.22	6904.03	NA	13 - 28	Chinle/Alluvium
OW-55	3/6/2023	06/01/16	2	6,921.02	6923.25	2.23	6,945.50	24.48	ND	NA	19.23	6904.02	NA	13 - 28	Chinle/Alluvium
OW-55	6/1/2023	06/01/16	2	6,921.02	6923.25	2.23	6,945.50	24.48	ND	NA	18.98	6904.27	NA	13 - 28	Chinle/Alluvium
OW-55	8/21/2023	06/01/16	2	6,921.02	6923.25	2.23	6,945.50	24.48	19.55	2.15	21.7	6901.55	6903.27	13 - 28	Chinle/Alluvium
OW-55	9/6/2023	06/01/16	2	6,921.02	6923.25	2.23	6,945.50	24.48	19.64	2.16	21.8	6901.45	6903.18	13 - 28	Chinle/Alluvium

ATTACHMENT A-3. WELL INFORMATION - SURVEY DATA, SCREENED INTERVAL, STRATIGRAPHIC UNIT
NON-MKTF WELLS
GALLUP REFINERY, GALLUP, NEW MEXICO

Well ID	Sample Date	Installation Date	Casing Diameter (in)	Surface Elevation (ft-amsl)	Well Casing Rim Elevation (ft-amsl)	Stick-up length (ft)	Well Casing Bottom Elevation (ft-amsl)	Total Well Depth (ft-bmpe)	Depth to SPH (ft-bmpe)	SPH Thickness (ft)	DTW (ft-bmpe)	GW Elevation (ft-amsl)	Corrected Water Table [1] Elevation (ft-amsl)	Screened Interval Depth Top to Bottom (ft-bmpe)	Aquifer
OW-56	12/1/2022	06/01/16	2	6,917.61	6920.18	2.57	6,936.19	18.58	ND	NA	14.35	6905.83	NA	6 - 16	Chinle/Alluvium
OW-56	12/6/2022	06/01/16	2	6,917.61	6920.18	2.57	6,936.19	18.58	ND	NA	14.35	6905.83	NA	6 - 16	Chinle/Alluvium
OW-56	3/6/2023	06/01/16	2	6,917.61	6920.18	2.57	6,936.19	18.58	ND	NA	13.3	6906.88	NA	6 - 16	Chinle/Alluvium
OW-56	6/1/2023	06/01/16	2	6,917.61	6920.18	2.57	6,936.19	18.58	ND	NA	12.86	6907.32	NA	6 - 16	Chinle/Alluvium
OW-56	9/7/2023	06/01/16	2	6,917.61	6920.18	2.57	6,936.19	18.58	ND	NA	15.2	6904.98	NA	6 - 16	Chinle/Alluvium
OW-57	12/1/2022	10/05/16	2	6,930.64	6933.10	2.46	6,958.73	28.09	ND	NA	22.93	6910.17	NA	15 - 25	Chinle/Alluvium
OW-57	12/7/2022	10/05/16	2	6,930.64	6933.10	2.46	6,958.73	28.09	ND	NA	22.93	6910.17	NA	15 - 25	Chinle/Alluvium
OW-57	3/7/2023	10/05/16	2	6,930.64	6933.10	2.46	6,958.73	28.09	ND	NA	23.32	6909.78	NA	15 - 25	Chinle/Alluvium
OW-57	4/13/2023	10/05/16	2	6,930.64	6933.10	2.46	6,958.73	28.09	ND	NA	23.26	6909.84	NA	15 - 25	Chinle/Alluvium
OW-57	5/16/2023	10/05/16	2	6,930.64	6933.10	2.46	6,959.03	28.39	ND	NA	23.51	6909.59	NA	15 - 25	Chinle/Alluvium
OW-57	6/2/2023	10/05/16	2	6,930.64	6933.10	2.46	6,958.73	28.09	ND	NA	23.47	6909.63	NA	15 - 25	Chinle/Alluvium
OW-57	7/25/2023	10/05/16	2	6,930.64	6933.10	2.46	6,959.03	28.39	ND	NA	23.33	6909.77	NA	15 - 25	Chinle/Alluvium
OW-57	8/23/2023	10/05/16	2	6,930.64	6933.10	2.46	6,958.73	28.09	ND	NA	23.41	6909.69	NA	15 - 25	Chinle/Alluvium
OW-57	9/7/2023	10/05/16	2	6,930.64	6933.10	2.46	6,958.73	28.09	ND	NA	23.4	6909.7	NA	15 - 25	Chinle/Alluvium
OW-58	12/1/2022	10/03/16	2	6,934.71	6934.50	-0.21	6,982.66	47.95	ND	NA	26.05	6908.45	NA	38 - 48	Chinle/Alluvium
OW-58	12/6/2022	10/03/16	2	6,934.71	6934.50	-0.21	6,982.71	48.00	ND	NA	26.05	6908.45	NA	38 - 48	Chinle/Alluvium
OW-58	3/7/2023	10/03/16	2	6,934.71	6934.50	-0.21	6,982.66	47.95	ND	NA	26.84	6907.66	NA	38 - 48	Chinle/Alluvium
OW-58	4/13/2023	10/03/16	2	6,934.71	6934.50	-0.21	6,982.71	48.00	ND	NA	26.9	6907.6	NA	38 - 48	Chinle/Alluvium
OW-58	5/16/2023	10/03/16	2	6,934.71	6934.50	-0.21	6,982.71	48.00	ND	NA	26.95	6907.55	NA	38 - 48	Chinle/Alluvium
OW-58	6/2/2023	10/03/16	2	6,934.71	6934.50	-0.21	6,982.71	48.00	ND	NA	27.05	6907.45	NA	38 - 48	Chinle/Alluvium
OW-58	7/25/2023	10/03/16	2	6,934.71	6934.50	-0.21	6,982.71	48.00	ND	NA	26.89	6907.61	NA	38 - 48	Chinle/Alluvium
OW-58	8/21/2023	10/03/16	2	6,934.71	6934.50	-0.21	6,982.61	47.90	ND	NA	26.95	6907.55	NA	38 - 48	Chinle/Alluvium
OW-58	9/7/2023	10/03/16	2	6,934.71	6934.50	-0.21	6,982.71	48.00	ND	NA	26.9	6907.6	NA	38 - 48	Chinle/Alluvium
OW-58A	12/1/2022	10/17/19	4	6,933.39	6935.88	2.49	6,969.77	36.38	28.55	1.36	29.91	6905.97	6907.06	25 - 33	Chinle/Alluvium
OW-58A	12/16/2022	10/17/19	4	6,933.39	6935.88	2.49	6,969.24	35.85	28.55	1.36	29.91	6905.97	6907.06	25 - 33	Chinle/Alluvium
OW-58A	3/7/2023	10/17/19	4	6,933.39	6935.88	2.49	6,969.39	36.00	27.65	6.15	33.8	6902.08	6907.00	25 - 33	Chinle/Alluvium
OW-58A	4/13/2023	10/17/19	4	6,933.39	6935.88	2.49	6,969.39	36.00	27.45	6.6	34.05	6901.83	6907.11	25 - 33	Chinle/Alluvium
OW-58A	5/16/2023	10/17/19	4	6,933.39	6935.88	2.49	6,969.77	36.38	27.9	5.64	33.54	6902.34	6906.85	25 - 33	Chinle/Alluvium
OW-58A	6/2/2023	10/17/19	4	6,933.39	6935.88	2.49	6,970.30	36.91	27.93	5.82	33.75	6902.13	6906.79	25 - 33	Chinle/Alluvium
OW-58A	7/25/2023	10/17/19	4	6,933.39	6935.88	2.49	6,969.39	36.00	28.45	5.35	33.8	6902.08	6906.36	25 - 33	Chinle/Alluvium
OW-58A	8/21/2023	10/17/19	4	6,933.39	6935.88	2.49	6,970.30	36.91	28.5	7.2	35.7	6900.18	6905.94	25 - 33	Chinle/Alluvium
OW-58A	9/6/2023	10/17/19	4	6,933.39	6935.88	2.49	6,970.30	36.91	28.44	7.22	35.66	6900.22	6906.00	25 - 33	Chinle/Alluvium
OW-59	12/1/2022	06/29/17	2	6,886.40	6889.73	3.33	6,924.98	38.58	ND	NA	24.12	6865.61	NA	20 - 35	Chinle/Alluvium
OW-59	12/28/2022	06/29/17	2	6,886.40	6889.73	3.33	6,924.95	38.55	ND	NA	24.12	6865.61	NA	20 - 35	Chinle/Alluvium
OW-59	3/6/2023	06/29/17	2	6,886.40	6889.73	3.33	6,924.95	38.55	ND	NA	23.78	6865.95	NA	20 - 35	Chinle/Alluvium
OW-59	6/1/2023	06/29/17	2	6,886.40	6889.73	3.33	6,924.92	38.52	ND	NA	23.2	6866.53	NA	20 - 35	Chinle/Alluvium
OW-59	9/7/2023	06/29/17	2	6,886.40	6889.73	3.33	6,924.92	38.52	ND	NA	24.55	6865.18	NA	20 - 35	Chinle/Alluvium

ATTACHMENT A-3. WELL INFORMATION - SURVEY DATA, SCREENED INTERVAL, STRATIGRAPHIC UNIT
NON-MKTF WELLS
GALLUP REFINERY, GALLUP, NEW MEXICO

Well ID	Sample Date	Installation Date	Casing Diameter (in)	Surface Elevation (ft-amsl)	Well Casing Rim Elevation (ft-amsl)	Stick-up length (ft)	Well Casing Bottom Elevation (ft-amsl)	Total Well Depth (ft-bmpe)	Depth to SPH (ft-bmpe)	SPH Thickness (ft)	DTW (ft-bmpe)	GW Elevation (ft-amsl)	Corrected Water Table [1] Elevation (ft-amsl)	Screened Interval Depth Top to Bottom (ft-bmpe)	Aquifer
OW-60	12/1/2022	06/29/17	2	6,889.93	6893.51	3.58	6,935.63	45.70	ND	NA	17.03	6876.48	NA	25 - 45	Chinle/Alluvium
OW-60	12/28/2022	06/29/17	2	6,889.93	6893.51	3.58	6,935.63	45.70	ND	NA	17.03	6876.48	NA	25 - 45	Chinle/Alluvium
OW-60	3/6/2023	06/29/17	2	6,889.93	6893.51	3.58	6,935.63	45.70	ND	NA	16.26	6877.25	NA	25 - 45	Chinle/Alluvium
OW-60	6/1/2023	06/29/17	2	6,889.93	6893.51	3.58	6,935.63	45.70	ND	NA	16.03	6877.48	NA	25 - 45	Chinle/Alluvium
OW-60	9/7/2023	06/29/17	2	6,889.93	6893.51	3.58	6,935.63	45.70	ND	NA	17.21	6876.3	NA	25 - 45	Chinle/Alluvium
OW-61	12/1/2022	03/14/18	4	6,959.29	6963.57	4.28	6,990.62	31.33	24.98	1.16	26.14	6937.43	6938.36	8 - 28	Chinle/Alluvium
OW-61	12/6/2022	03/14/18	4	6,959.29	6963.57	4.28	6,991.14	31.85	24.98	1.16	26.14	6937.43	6938.36	8 - 28	Chinle/Alluvium
OW-61	3/6/2023	03/14/18	4	6,959.29	6963.57	4.28	6,990.62	31.33	25.05	1.11	26.16	6937.41	6938.30	8 - 28	Chinle/Alluvium
OW-61	4/13/2023	03/14/18	4	6,959.29	6963.57	4.28	6,991.14	31.85	24.95	3.95	28.9	6934.67	6937.83	8 - 28	Chinle/Alluvium
OW-61	5/16/2023	03/14/18	4	6,959.29	6963.57	4.28	6,991.14	31.85	25.02	3.93	28.95	6934.62	6937.76	8 - 28	Chinle/Alluvium
OW-61	6/2/2023	03/14/18	4	6,959.29	6963.57	4.28	6,991.14	31.85	24.95	1.21	26.16	6937.41	6938.38	8 - 28	Chinle/Alluvium
OW-61	7/25/2023	03/14/18	4	6,959.29	6963.57	4.28	6,991.14	31.85	24.98	1.22	26.2	6937.37	6938.35	8 - 28	Chinle/Alluvium
OW-61	8/21/2023	03/14/18	4	6,959.29	6963.57	4.28	6,991.66	32.37	25.15	0.94	26.09	6937.48	6938.23	8 - 28	Chinle/Alluvium
OW-61	9/6/2023	03/14/18	4	6,959.29	6963.57	4.28	6,991.14	31.85	25.1	0.93	26.03	6937.54	6938.28	8 - 28	Chinle/Alluvium
OW-62	12/1/2022	03/15/18	4	6,933.21	6937.36	4.15	6,964.87	31.66	23.83	0.42	24.25	6913.11	6913.45	8 - 28	Chinle/Alluvium
OW-62	12/6/2022	03/15/18	4	6,933.21	6937.36	4.15	6,965.26	32.05	23.83	0.42	24.25	6913.11	6913.45	8 - 28	Chinle/Alluvium
OW-62	3/31/2023	03/15/18	4	6,933.21	6937.36	4.15	6,965.26	32.05	23.53	0.4	23.93	6913.43	6913.75	8 - 28	Chinle/Alluvium
OW-62	4/13/2023	03/15/18	4	6,933.21	6937.36	4.15	6,964.48	31.27	23.6	0.4	24	6913.36	6913.68	8 - 28	Chinle/Alluvium
OW-62	5/16/2023	03/15/18	4	6,933.21	6937.36	4.15	6,965.26	32.05	23.92	0.38	24.3	6913.06	6913.36	8 - 28	Chinle/Alluvium
OW-62	6/2/2023	03/15/18	4	6,933.21	6937.36	4.15	6,964.87	31.66	23.62	0.39	24.01	6913.35	6913.66	8 - 28	Chinle/Alluvium
OW-62	7/25/2023	03/15/18	4	6,933.21	6937.36	4.15	6,965.26	32.05	23.6	0.4	24	6913.36	6913.68	8 - 28	Chinle/Alluvium
OW-62	8/23/2023	03/15/18	4	6,933.21	6937.36	4.15	6,965.26	32.05	24.1	0.87	24.97	6912.39	6913.09	8 - 28	Chinle/Alluvium
OW-62	9/6/2023	03/15/18	4	6,933.21	6937.36	4.15	6,965.26	32.05	24.03	0.87	24.9	6912.46	6913.16	8 - 28	Chinle/Alluvium
OW-63	12/1/2022	03/14/18	4	6,930.87	6935.06	4.19	6,963.09	32.22	ND	NA	23.02	6912.04	NA	9 - 29	Chinle/Alluvium
OW-63	12/6/2022	03/14/18	4	6,930.87	6935.06	4.19	6,962.92	32.05	ND	NA	23.02	6912.04	NA	9 - 29	Chinle/Alluvium
OW-63	3/7/2023	03/14/18	4	6,930.87	6935.06	4.19	6,963.09	32.22	ND	NA	23.36	6911.7	NA	9 - 29	Chinle/Alluvium
OW-63	4/13/2023	03/14/18	4	6,930.87	6935.06	4.19	6,962.92	32.05	ND	NA	23.28	6911.78	NA	9 - 29	Chinle/Alluvium
OW-63	5/16/2023	03/14/18	4	6,930.87	6935.06	4.19	6,962.92	32.05	ND	NA	23.44	6911.62	NA	9 - 29	Chinle/Alluvium
OW-63	6/2/2023	03/14/18	4	6,930.87	6935.06	4.19	6,962.92	32.05	ND	NA	23.7	6911.36	NA	9 - 29	Chinle/Alluvium
OW-63	7/25/2023	03/14/18	4	6,930.87	6935.06	4.19	6,962.92	32.05	ND	NA	23.65	6911.41	NA	9 - 29	Chinle/Alluvium
OW-63	8/23/2023	03/14/18	4	6,930.87	6935.06	4.19	6,963.26	32.39	ND	NA	23.6	6911.46	NA	9 - 29	Chinle/Alluvium
OW-63	9/7/2023	03/14/18	4	6,930.87	6935.06	4.19	6,962.92	32.05	ND	NA	23.58	6911.48	NA	9 - 29	Chinle/Alluvium

ATTACHMENT A-3. WELL INFORMATION - SURVEY DATA, SCREENED INTERVAL, STRATIGRAPHIC UNIT
NON-MKTF WELLS
GALLUP REFINERY, GALLUP, NEW MEXICO

Well ID	Sample Date	Installation Date	Casing Diameter (in)	Surface Elevation (ft-amsl)	Well Casing Rim Elevation (ft-amsl)	Stick-up length (ft)	Well Casing Bottom Elevation (ft-amsl)	Total Well Depth (ft-bmpe)	Depth to SPH (ft-bmpe)	SPH Thickness (ft)	DTW (ft-bmpe)	GW Elevation (ft-amsl)	Corrected Water Table [1] Elevation (ft-amsl)	Screened Interval Depth Top to Bottom (ft-bmpe)	Aquifer
OW-64	12/1/2022	03/16/18	4	6,943.32	6947.40	4.08	6,970.67	27.35	ND	NA	7.97	6939.43	NA	4 - 24	Chinle/Alluvium
OW-64	12/6/2022	03/16/18	4	6,943.32	6947.40	4.08	6,970.67	27.35	ND	NA	7.97	6939.43	NA	4 - 24	Chinle/Alluvium
OW-64	3/7/2023	03/16/18	4	6,943.32	6947.40	4.08	6,970.67	27.35	ND	NA	7.5	6939.9	NA	4 - 24	Chinle/Alluvium
OW-64	4/13/2023	03/16/18	4	6,943.32	6947.40	4.08	6,970.67	27.35	ND	NA	7.8	6939.6	NA	4 - 24	Chinle/Alluvium
OW-64	5/16/2023	03/16/18	4	6,943.32	6947.40	4.08	6,970.67	27.35	ND	NA	7.96	6939.44	NA	4 - 24	Chinle/Alluvium
OW-64	6/2/2023	03/16/18	4	6,943.32	6947.40	4.08	6,970.67	27.35	ND	NA	8.04	6939.36	NA	4 - 24	Chinle/Alluvium
OW-64	7/25/2023	03/16/18	4	6,943.32	6947.40	4.08	6,970.67	27.35	ND	NA	8.1	6939.3	NA	4 - 24	Chinle/Alluvium
OW-64	8/23/2023	03/16/18	4	6,943.32	6947.40	4.08	6,970.67	27.35	ND	NA	8.03	6939.37	NA	4 - 24	Chinle/Alluvium
OW-64	9/7/2023	03/16/18	4	6,943.32	6947.40	4.08	6,970.67	27.35	ND	NA	8	6939.4	NA	4 - 24	Chinle/Alluvium
OW-65	12/1/2022	03/12/18	4	6,949.95	6954.05	4.10	6,992.45	42.50	32.42	0.22	32.64	6921.41	6921.59	17 - 37	Chinle/Alluvium
OW-65	12/6/2022	03/12/18	4	6,949.95	6954.05	4.10	6,992.75	42.80	32.42	0.22	32.64	6921.41	6921.59	17 - 37	Chinle/Alluvium
OW-65	3/7/2023	03/12/18	4	6,949.95	6954.05	4.10	6,992.45	42.50	32.8	0.32	33.12	6920.93	6921.19	17 - 37	Chinle/Alluvium
OW-65	4/13/2023	03/12/18	4	6,949.95	6954.05	4.10	6,992.75	42.80	31.95	1.13	33.08	6920.97	6921.87	17 - 37	Chinle/Alluvium
OW-65	5/16/2023	03/12/18	4	6,949.95	6954.05	4.10	6,992.75	42.80	32.9	0.12	33.02	6921.03	6921.13	17 - 37	Chinle/Alluvium
OW-65	6/2/2023	03/12/18	4	6,949.95	6954.05	4.10	6,992.75	42.80	33.36	0.17	33.53	6920.52	6920.66	17 - 37	Chinle/Alluvium
OW-65	7/25/2023	03/12/18	4	6,949.95	6954.05	4.10	6,992.75	42.80	33.33	0.24	33.57	6920.48	6920.67	17 - 37	Chinle/Alluvium
OW-65	8/21/2023	03/12/18	4	6,949.95	6954.05	4.10	6,992.75	42.80	33.85	0.15	34	6920.05	6920.17	17 - 37	Chinle/Alluvium
OW-65	9/6/2023	03/12/18	4	6,949.95	6954.05	4.10	6,992.15	42.20	33.8	0.16	33.96	6920.09	6920.22	17 - 37	Chinle/Alluvium
OW-66	12/1/2022	07/19/21	2	6,919.80	6922.35	2.55	6,894.80	25.00	ND	NA	19	6903.35	NA	10 - 25	Chinle/Alluvium
OW-66	12/27/2022	07/19/21	2	6,919.80	6922.35	2.55	6,894.80	25.00	ND	NA	19	6903.35	NA	10 - 25	Chinle/Alluvium
OW-66	3/6/2023	07/19/21	2	6,919.80	6922.35	2.55	6,894.80	25.00	18.3	1.85	20.15	6902.2	6903.68	10 - 25	Chinle/Alluvium
OW-66	4/13/2023	07/19/21	2	6,919.80	6922.35	2.55	6,894.80	25.00	18.33	2.02	20.35	6902	6903.62	10 - 25	Chinle/Alluvium
OW-66	5/16/2023	07/19/21	2	6,919.80	6922.35	2.55	6,894.80	25.00	18.29	2.03	20.32	6902.03	6903.65	10 - 25	Chinle/Alluvium
OW-66	6/2/2023	07/19/21	2	6,919.80	6922.35	2.55	6,894.80	25.00	18.25	2.04	20.29	6902.06	6903.69	10 - 25	Chinle/Alluvium
OW-66	7/11/2023	07/19/21	2	6,919.80	6922.35	2.55	6,894.80	25.00	18.85	2.05	20.9	6901.45	6903.09	10 - 25	Chinle/Alluvium
OW-66	8/21/2023	07/19/21	2	6,919.80	6922.35	2.55	6,894.80	25.00	19.17	1.93	21.1	6901.25	6902.79	10 - 25	Chinle/Alluvium
OW-66	9/6/2023	07/19/21	2	6,919.80	6922.35	2.55	6,894.80	25.00	19.25	1.95	21.2	6901.15	6902.71	10 - 25	Chinle/Alluvium
OW-67	12/1/2022	07/20/21	2	6,900.73	6903.29	2.56	6,875.73	25.00	ND	NA	12.7	6890.59	NA	10 - 25	Chinle/Alluvium
OW-67	12/28/2022	07/20/21	2	6,900.73	6903.29	2.56	6,875.73	25.00	ND	NA	12.7	6890.59	NA	10 - 25	Chinle/Alluvium
OW-67	3/6/2023	07/20/21	2	6,900.73	6903.29	2.56	6,875.73	25.00	ND	NA	12.5	6890.79	NA	10 - 25	Chinle/Alluvium
OW-67	6/2/2023	07/20/21	2	6,900.73	6903.29	2.56	6,875.73	25.00	ND	NA	12.34	6890.95	NA	10 - 25	Chinle/Alluvium
OW-67	9/7/2023	07/20/21	2	6,900.73	6903.29	2.56	6,875.73	25.00	ND	NA	13.15	6890.14	NA	10 - 25	Chinle/Alluvium
OW-68	12/1/2022	07/21/21	2	6,888.68	6891.51	2.83	6,863.68	25.00	ND	NA	18.66	6872.85	NA	5 - 25	Chinle/Alluvium
OW-68	12/28/2022	07/21/21	2	6,888.68	6891.51	2.83	6,863.68	25.00	ND	NA	18.66	6872.85	NA	5 - 25	Chinle/Alluvium
OW-68	3/6/2023	07/21/21	2	6,888.68	6891.51	2.83	6,863.68	25.00	ND	NA	14.04	6877.47	NA	5 - 25	Chinle/Alluvium
OW-68	6/2/2023	07/21/21	2	6,888.68	6891.51	2.83	6,863.68	25.00	ND	NA	13.77	6877.74	NA	5 - 25	Chinle/Alluvium
OW-68	9/7/2023	07/21/21	2	6,888.68	6891.51	2.83	6,863.68	25.00	ND	NA	18.33	6873.18	NA	5 - 25	Chinle/Alluvium

ATTACHMENT A-3. WELL INFORMATION - SURVEY DATA, SCREENED INTERVAL, STRATIGRAPHIC UNIT
NON-MKTF WELLS
GALLUP REFINERY, GALLUP, NEW MEXICO

Well ID	Sample Date	Installation Date	Casing Diameter (in)	Surface Elevation (ft-amsl)	Well Casing Rim Elevation (ft-amsl)	Stick-up length (ft)	Well Casing Bottom Elevation (ft-amsl)	Total Well Depth (ft-bmpe)	Depth to SPH (ft-bmpe)	SPH Thickness (ft)	DTW (ft-bmpe)	GW Elevation (ft-amsl)	Corrected Water Table [1] Elevation (ft-amsl)	Screened Interval Depth Top to Bottom (ft-bmpe)	Aquifer
OW-70	12/1/2022	08/17/21	4	6,943.07	6945.95	2.88	6,912.07	31.00	ND	NA	31.95	6914	NA	16 - 36	Chinle/Alluvium
OW-70	12/14/2022	08/17/21	4	6,943.07	6945.95	2.88	6,912.07	31.00	ND	NA	31.95	6914	NA	16 - 36	Chinle/Alluvium
OW-70	3/7/2023	08/17/21	4	6,943.07	6945.95	2.88	6,912.07	31.00	ND	NA	32.59	6913.36	NA	16 - 36	Chinle/Alluvium
OW-70	4/13/2023	08/17/21	4	6,943.07	6945.95	2.88	6,912.07	31.00	ND	NA	31.98	6913.97	NA	16 - 36	Chinle/Alluvium
OW-70	5/16/2023	08/17/21	4	6,943.07	6945.95	2.88	6,912.07	31.00	ND	NA	32.12	6913.83	NA	16 - 36	Chinle/Alluvium
OW-70	6/2/2023	08/17/21	4	6,943.07	6945.95	2.88	6,912.07	31.00	ND	NA	32.63	6913.32	NA	16 - 36	Chinle/Alluvium
OW-70	7/25/2023	08/17/21	4	6,943.07	6945.95	2.88	6,912.07	31.00	ND	NA	32.52	6913.43	NA	16 - 36	Chinle/Alluvium
OW-70	8/23/2023	08/17/21	4	6,943.07	6945.95	2.88	6,912.07	31.00	ND	NA	33.03	6912.92	NA	16 - 36	Chinle/Alluvium
OW-70	9/7/2023	08/17/21	4	6,943.07	6945.95	2.88	6,912.07	31.00	ND	NA	33	6912.95	NA	16 - 36	Chinle/Alluvium
RW-1	12/1/2022	03/28/95	4	6,942.86	6946.06	3.20	6,903.02	43.45	31.67	0.22	31.89	6914.17	6914.35	25 - 40	Chinle/Alluvium
RW-1	12/9/2022	03/28/95	4	6,942.86	6946.06	3.20	6,903.02	43.45	31.67	0.22	31.89	6914.17	6914.35	25 - 40	Chinle/Alluvium
RW-1	3/31/2023	03/28/95	4	6,942.86	6946.06	3.20	6,903.02	43.45	31.54	0.06	31.6	6914.46	6914.51	25 - 40	Chinle/Alluvium
RW-1	4/13/2023	03/28/95	4	6,942.86	6946.06	3.20	6,903.02	43.45	32.1	0.07	32.17	6913.89	6913.95	25 - 40	Chinle/Alluvium
RW-1	5/16/2023	03/28/95	4	6,942.86	6946.06	3.20	6,903.02	43.45	32.17	0.07	32.24	6913.82	6913.88	25 - 40	Chinle/Alluvium
RW-1	6/2/2023	03/28/95	4	6,942.86	6946.06	3.20	6,903.02	43.45	32.15	0.04	32.19	6913.87	6913.90	25 - 40	Chinle/Alluvium
RW-1	7/18/2023	03/28/95	4	6,942.86	6946.06	3.20	6,903.02	43.45	31.82	3.68	35.5	6910.56	6913.50	25 - 40	Chinle/Alluvium
RW-1	8/21/2023	03/28/95	4	6,942.86	6946.06	3.20	6,903.02	43.45	32.05	3.63	35.68	6910.38	6913.28	25 - 40	Chinle/Alluvium
RW-1	9/6/2023	03/28/95	4	6,942.86	6946.06	3.20	6,903.02	43.45	32	3.6	35.6	6910.46	6913.34	25 - 40	Chinle/Alluvium
RW-2	12/1/2022	03/29/95	4	6,926.40	6928.53	2.13	6,888.73	40.00	24.27	2.18	26.45	6902.08	6903.82	26.1 - 36.1	Chinle/Alluvium
RW-2R	12/9/2022	08/13/21	4	6,931.04	6934.21	3.17	6,899.54	31.50	24.27	2.18	26.45	6907.76	6909.50	11.5 - 31.5	Chinle/Alluvium
RW-2R	3/31/2023	08/13/21	4	6,931.04	6934.21	3.17	6,899.54	31.50	23.9	2.2	26.1	6908.11	6909.87	11.5 - 31.5	Chinle/Alluvium
RW-2R	4/13/2023	08/13/21	4	6,931.04	6934.21	3.17	6,899.54	31.50	23.75	2.21	25.96	6908.25	6910.02	11.5 - 31.5	Chinle/Alluvium
RW-2R	5/16/2023	08/13/21	4	6,931.04	6934.21	3.17	6,899.54	31.50	24.95	1.95	26.9	6907.31	6908.87	11.5 - 31.5	Chinle/Alluvium
RW-2R	6/2/2023	08/13/21	4	6,931.04	6934.21	3.17	6,899.54	31.50	25.4	0.3	25.7	6908.51	6908.75	11.5 - 31.5	Chinle/Alluvium
RW-2R	7/10/2023	08/13/21	4	6,931.04	6934.21	3.17	6,899.54	31.50	25.65	0.15	25.8	6908.41	6908.53	11.5 - 31.5	Chinle/Alluvium
RW-2R	8/21/2023	08/13/21	4	6,931.04	6934.21	3.17	6,899.54	31.50	26	0.1	26.1	6908.11	6908.19	11.5 - 31.5	Chinle/Alluvium
RW-2R	9/6/2023	08/13/21	4	6,931.04	6934.21	3.17	6,899.54	31.50	25.95	0.11	26.06	6908.15	6908.24	11.5 - 31.5	Chinle/Alluvium
RW-5	12/1/2022	08/27/97	4	6,941.53	6943.57	2.04	6,903.98	39.51	31.55	1.78	33.33	6910.24	6911.66	29.5 - 39.5	Chinle/Alluvium
RW-5	12/9/2022	08/27/97	4	6,941.53	6943.57	2.04	6,903.98	39.51	31.55	1.78	33.33	6910.24	6911.66	29.5 - 39.5	Chinle/Alluvium
RW-5	3/31/2023	08/27/97	4	6,941.53	6943.57	2.04	6,903.98	39.51	31.92	1.38	33.3	6910.27	6911.37	29.5 - 39.5	Chinle/Alluvium
RW-5	4/13/2023	08/27/97	4	6,941.53	6943.57	2.04	6,903.98	39.51	31.95	1.41	33.36	6910.21	6911.34	29.5 - 39.5	Chinle/Alluvium
RW-5	5/16/2023	08/27/97	4	6,941.53	6943.57	2.04	6,903.98	39.51	30.1	3.4	33.5	6910.07	6912.79	29.5 - 39.5	Chinle/Alluvium
RW-5	6/2/2023	08/27/97	4	6,941.53	6943.57	2.04	6,903.98	39.51	30.11	3.37	33.48	6910.09	6912.79	29.5 - 39.5	Chinle/Alluvium
RW-5	7/11/2023	08/27/97	4	6,941.53	6943.57	2.04	6,903.98	39.51	32.4	1.44	33.84	6909.73	6910.88	29.5 - 39.5	Chinle/Alluvium
RW-5	8/21/2023	08/27/97	4	6,941.53	6943.57	2.04	6,903.98	39.51	32.55	1.2	33.75	6909.82	6910.78	29.5 - 39.5	Chinle/Alluvium
RW-5	9/6/2023	08/27/97	4	6,941.53	6943.57	2.04	6,903.98	39.51	32.5	1.22	33.72	6909.85	6910.83	29.5 - 39.5	Chinle/Alluvium

ATTACHMENT A-3. WELL INFORMATION - SURVEY DATA, SCREENED INTERVAL, STRATIGRAPHIC UNIT
NON-MKTF WELLS
GALLUP REFINERY, GALLUP, NEW MEXICO

Well ID	Sample Date	Installation Date	Casing Diameter (in)	Surface Elevation (ft-amsl)	Well Casing Rim Elevation (ft-amsl)	Stick-up length (ft)	Well Casing Bottom Elevation (ft-amsl)	Total Well Depth (ft-bmpe)	Depth to SPH (ft-bmpe)	SPH Thickness (ft)	DTW (ft-bmpe)	GW Elevation (ft-amsl)	Corrected Water Table [1] Elevation (ft-amsl)	Screened Interval Depth Top to Bottom (ft-bmpe)	Aquifer
RW-6	12/1/2022	08/27/97	4	6,941.96	6944.01	2.05	6,903.11	40.85	31.75	1.78	33.53	6910.48	6911.90	28.5 - 38.5	Chinle/Alluvium
RW-6	12/9/2022	08/27/97	4	6,941.96	6944.01	2.05	6,903.11	40.85	31.75	1.78	33.53	6910.48	6911.90	28.5 - 38.5	Chinle/Alluvium
RW-6	3/31/2023	08/27/97	4	6,941.96	6944.01	2.05	6,903.11	40.85	32.11	1.64	33.75	6910.26	6911.57	28.5 - 38.5	Chinle/Alluvium
RW-6	4/13/2023	08/27/97	4	6,941.96	6944.01	2.05	6,903.11	40.85	32.2	1.55	33.75	6910.26	6911.50	28.5 - 38.5	Chinle/Alluvium
RW-6	5/16/2023	08/27/97	4	6,941.96	6944.01	2.05	6,903.11	40.85	32.35	1.55	33.9	6910.11	6911.35	28.5 - 38.5	Chinle/Alluvium
RW-6	6/2/2023	08/27/97	4	6,941.96	6944.01	2.05	6,903.11	40.85	32.31	1.54	33.85	6910.16	6911.39	28.5 - 38.5	Chinle/Alluvium
RW-6	7/11/2023	08/27/97	4	6,941.96	6944.01	2.05	6,903.11	40.85	32.78	1.34	34.12	6909.89	6910.96	28.5 - 38.5	Chinle/Alluvium
RW-6	8/21/2023	08/27/97	4	6,941.96	6944.01	2.05	6,903.11	40.85	32.75	1.5	34.25	6909.76	6910.96	28.5 - 38.5	Chinle/Alluvium
RW-6	9/6/2023	08/27/97	4	6,941.96	6944.01	2.05	6,903.11	40.85	32.73	1.47	34.2	6909.81	6910.99	28.5 - 38.5	Chinle/Alluvium
STP1-NW	12/1/2022	05/06/14	2	6,904.50	6904.47	-0.03	6,854.47	50.28	ND	NA	20.35	6884.12	NA	20 - 50	Chinle/Alluvium
STP1-NW	12/11/2022	05/06/14	2	6,904.50	6904.47	-0.03	6,854.47	50.28	ND	NA	20.75	6883.72	NA	20 - 50	Chinle/Alluvium
STP1-NW	12/15/2022	05/06/14	2	6,904.50	6904.47	-0.03	6,854.47	50.28	ND	NA	21.25	6883.22	NA	20 - 50	Chinle/Alluvium
STP1-NW	4/12/2023	05/06/14	2	6,904.50	6904.47	-0.03	6,854.47	50.28	ND	NA	20.43	NA	NA	20 - 50	Chinle/Alluvium
STP1-NW	5/15/2023	05/06/14	2	6,904.50	6904.47	-0.03	6,854.47	50.28	ND	NA	20.51	NA	NA	20 - 50	Chinle/Alluvium
STP1-NW	6/2/2023	05/06/14	2	6,904.50	6904.47	-0.03	6,854.47	50.28	ND	NA	20.78	6883.69	NA	20 - 50	Chinle/Alluvium
STP1-NW	7/25/2023	05/06/14	2	6,904.50	6904.47	-0.03	6,854.47	50.28	ND	NA	20.55	6883.92	NA	20 - 50	Chinle/Alluvium
STP1-NW	8/18/2023	05/06/14	2	6,904.50	6904.47	-0.03	6,854.47	50.28	ND	NA	21.02	6883.45	NA	20 - 50	Chinle/Alluvium
STP1-NW	9/7/2023	05/06/14	2	6,904.50	6904.47	-0.03	6,854.47	50.28	ND	NA	21.12	6883.35	NA	20 - 50	Chinle/Alluvium
STP1-SW	12/1/2022	05/06/14	2	6,912.40	6912.38	-0.02	6,854.47	29.25	ND	NA	Dry	Dry	NA	15 - 30	Chinle/Alluvium
STP1-SW	12/6/2022	05/06/14	2	6,912.40	6912.38	-0.02	6,854.47	29.25	ND	NA	Dry	Dry	NA	15 - 30	Chinle/Alluvium
STP1-SW	4/12/2023	05/06/14	2	6,912.40	6912.38	-0.02	6,854.47	29.25	ND	NA	Dry	Dry	NA	15 - 30	Chinle/Alluvium
STP1-SW	5/15/2023	05/06/14	2	6,912.40	6912.38	-0.02	6,854.47	29.25	ND	NA	Dry	Dry	NA	15 - 30	Chinle/Alluvium
STP1-SW	6/2/2023	05/06/14	2	6,912.40	6912.38	-0.02	6,854.47	29.25	ND	NA	Dry	Dry	NA	15 - 30	Chinle/Alluvium
STP1-SW	7/25/2023	05/06/14	2	6,912.40	6912.38	-0.02	6,854.47	29.25	ND	NA	Dry	Dry	NA	15 - 30	Chinle/Alluvium
STP1-SW	8/18/2023	05/06/14	2	6,912.40	6912.38	-0.02	6,854.47	29.25	ND	NA	Dry	Dry	NA	15 - 30	Chinle/Alluvium
STP1-SW	9/7/2023	05/06/14	2	6,912.40	6912.38	-0.02	6,854.47	29.25	ND	NA	Dry	Dry	NA	15 - 30	Chinle/Alluvium

Definitions:
amsl = above mean sea level
bmpe = below measuring point elevation reported as the well casing rim elevation
DRY = no water detected
DTW = depth to water
ft = feet
GW = groundwater
ID = identification
in = inch
NA = not applicable
SPH = separate phase hydrocarbons

Notes:
1. Corrected Water Table Elevation applies only if SPH thickness column measurement exists. (0.8 X SPH thickness + Groundwater Elevation).
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.

ATTACHMENT A-4. WELL INFORMATION - SURVEY DATA, SCREENED INTERVAL, STRATIGRAPHIC UNIT
MKTF WELLS
GALLUP REFINERY, GALLUP, NEW MEXICO

Well ID	Sample Date	Date of Installation	Casing Diameter (in)	Surface Elevation (ft-amsl)	Well Casing Rim Elevation (ft-amsl)	Ground Elevation Inside Steel Sleeve (ft-amsl)	Stick-up length (ft)	Well Casing Bottom Elevation (ft-amsl)	Total Well Depth (ft-bmpe)	Depth to SPH (ft-bmpe)	SPH Thickness (ft)	DTW (ft-bmpe)	GW Elevation (ft-amsl)	Corrected Water Table [1] Elevation (ft-amsl)	Screened Interval Depth Top to Bottom (ft-bmpe)	Stratigraphic unit in which screen exists
MKTF-01R	12/6/2022	11/14/13	4	6,918.28	6920.67	6,920.67	2.39	6,903.25	17.42	3.49	0.06	3.55	6918.07	6918.12	5 - 15	Chinle/Alluvium
MKTF-01R	3/31/2023	11/14/13	4	6,918.28	6920.67	6,920.67	2.39	6,903.19	17.48	3.2	0.07	3.27	6918.35	6918.41	5 - 15	Chinle/Alluvium
MKTF-01R	4/12/2023	11/14/13	4	6,918.28	6920.67	6,920.67	2.39	6,903.25	17.48	3.18	0.06	3.24	6918.38	6918.43	5 - 15	Chinle/Alluvium
MKTF-01R	5/15/2023	11/14/13	4	6,918.28	6920.67	6,920.67	2.39	6,903.25	17.43	3.2	0.05	3.25	6918.37	6918.41	5 - 15	Chinle/Alluvium
MKTF-01R	6/1/2023	11/14/13	4	6,918.28	6920.67	6,920.67	2.39	6,903.19	17.48	3.03	0.07	3.1	6918.52	6918.58	5 - 15	Chinle/Alluvium
MKTF-01R	7/24/2023	07/22/21	2	6,921.82	6921.62	6921.62	-0.20	6,903.52	18.10	3	0.08	3.08	6918.54	6918.60	3 - 18	Chinle/Alluvium
MKTF-01R	8/18/2023	07/22/21	2	6,921.82	6921.62	6921.62	-0.20	6,903.62	18.00	3.08	0.77	3.85	6917.77	6918.39	3 - 18	Chinle/Alluvium
MKTF-01R	9/6/2023	11/14/13	4	6,918.28	6920.67	6,920.67	2.39	6,903.25	17.42	3.1	0.78	3.88	6917.74	6918.36	5 - 15	Chinle/Alluvium
MKTF-02R	12/6/2022	11/14/13	4	6,915.00	6917.45	6,917.18	2.45	6,896.97	20.48	9.98	0.05	10.03	6912.9	6912.94	7 - 17	Chinle/Alluvium
MKTF-02R	3/31/2023	11/14/13	4	6,915.00	6917.45	6,917.18	2.45	6,896.91	20.54	10.07	0.03	10.1	6912.83	6912.85	7 - 17	Chinle/Alluvium
MKTF-02R	4/12/2023	11/14/13	4	6,915.00	6917.45	6,917.18	2.45	6,896.97	20.54	10.13	0.05	10.18	6912.75	6912.79	7 - 17	Chinle/Alluvium
MKTF-02R	5/15/2023	11/14/13	4	6,915.00	6917.45	6,917.18	2.45	6,896.97	20.54	10.15	0.04	10.19	6912.74	6912.77	7 - 17	Chinle/Alluvium
MKTF-02R	6/1/2023	11/14/13	4	6,915.00	6917.45	6,917.18	2.45	6,896.91	20.54	10.01	0.04	10.05	6912.88	6912.91	7 - 17	Chinle/Alluvium
MKTF-02R	7/24/2023	07/22/21	2	6,920.46	6922.93	6922.93	2.47	6,901.44	21.49	9.92	0.05	9.97	6912.96	6913.00	3 - 18	Chinle/Alluvium
MKTF-02R	8/21/2023	07/22/21	2	6,920.46	6922.93	6922.93	2.47	6,901.43	21.50	10.03	0.07	10.1	6912.83	6912.89	3 - 18	Chinle/Alluvium
MKTF-02R	9/6/2023	11/14/13	4	6,915.00	6917.45	6,917.18	2.45	6,896.97	20.48	10.05	0.06	10.11	6912.82	6912.87	7 - 17	Chinle/Alluvium
MKTF-03	12/9/2022	11/07/13	4	6,931.73	6931.69	6,930.85	-0.04	6,913.24	18.45	8.02	2.45	10.47	6921.22	6923.18	3 - 18	Chinle/Alluvium
MKTF-03	3/31/2023	11/07/13	4	6,931.73	6931.69	6,930.85	-0.04	6,913.10	18.59	7.71	0.04	7.75	6923.94	6923.97	3 - 18	Chinle/Alluvium
MKTF-03	4/12/2023	11/07/13	4	6,931.73	6931.69	6,930.85	-0.04	6,913.10	18.59	7.08	3.1	10.18	6921.51	6923.99	3 - 18	Chinle/Alluvium
MKTF-03	5/15/2023	11/07/13	4	6,931.73	6931.69	6,930.85	-0.04	6,913.11	18.58	7.05	3.1	10.15	6921.54	6924.02	3 - 18	Chinle/Alluvium
MKTF-03	6/1/2023	11/07/13	4	6,931.73	6931.69	6,930.85	-0.04	6,913.10	18.59	6.98	2.97	9.95	6921.74	6924.12	3 - 18	Chinle/Alluvium
MKTF-03	7/24/2023	11/07/13	4	6,931.73	6931.69	6,930.85	-0.04	6,913.11	18.58	9.1	1.15	10.25	6921.44	6922.36	3 - 18	Chinle/Alluvium
MKTF-03	8/18/2023	11/07/13	4	6,931.73	6931.69	6,930.85	-0.04	6,913.10	18.59	8.62	1.39	10.01	6921.68	6922.79	3 - 18	Chinle/Alluvium
MKTF-03	9/6/2023	11/07/13	4	6,931.73	6931.69	6,930.85	-0.04	6,913.24	18.45	8.65	1.4	10.05	6921.64	6922.76	3 - 18	Chinle/Alluvium
MKTF-04R	12/6/2022	11/12/13	4	6,933.90	6933.57	6,933.24	-0.33	6,911.36	22.21	9.5	0.05	9.55	6928.41	6928.45	10 - 22	Chinle/Alluvium
MKTF-04R	3/31/2023	11/12/13	4	6,933.90	6933.57	6,933.24	-0.33	6,910.85	22.72	9.26	0.03	9.29	6928.67	6928.69	10 - 22	Chinle/Alluvium
MKTF-04R	4/12/2023	11/12/13	4	6,933.90	6933.57	6,933.24	-0.33	6,910.85	22.72	8.28	0.01	8.29	6929.67	6929.68	10 - 22	Chinle/Alluvium
MKTF-04R	5/15/2023	11/12/13	4	6,933.90	6933.57	6,933.24	-0.33	6,910.85	22.72	8.3	0.01	8.31	6929.65	6929.66	10 - 22	Chinle/Alluvium
MKTF-04R	6/1/2023	11/12/13	4	6,933.90	6933.57	6,933.24	-0.33	6,910.85	22.72	8.18	0.02	8.2	6929.76	6929.78	10 - 22	Chinle/Alluvium
MKTF-04R	7/24/2023	08/16/21	2	6,938.49	6937.96	6937.96	-0.53	6,918.76	19.20	8.15	0.02	8.17	6929.79	6929.81	4 - 19	Chinle/Alluvium
MKTF-04R	8/18/2023	08/16/21	2	6,938.49	6937.96	6937.96	-0.53	6,918.76	19.20	ND	NA	9.91	6928.05	NA	4 - 19	Chinle/Alluvium
MKTF-04R	9/6/2023	11/12/13	4	6,933.90	6933.57	6,933.24	-0.33	6,911.42	22.15	ND	NA	9.96	6928	NA	10 - 22	Chinle/Alluvium
MKTF-05	12/9/2022	11/20/13	4	6,939.49	6942.22	6,941.95	2.73	6,924.47	17.75	15.23	0.53	15.76	6926.46	6926.88	4 - 14	Chinle/Alluvium
MKTF-05	3/31/2023	11/20/13	4	6,939.49	6942.22	6,941.95	2.73	6,924.39	17.83	14.32	1.7	16.02	6926.2	6927.56	4 - 14	Chinle/Alluvium
MKTF-05	4/12/2023	11/20/13	4	6,939.49	6942.22	6,941.95	2.73	6,924.39	17.83	14.26	0.42	14.68	6927.54	6927.88	4 - 14	Chinle/Alluvium
MKTF-05	5/15/2023	11/20/13	4	6,939.49	6942.22	6,941.95	2.73	6,924.42	17.80	14.27	0.43	14.7	6927.52	6927.86	4 - 14	Chinle/Alluvium
MKTF-05	6/1/2023	11/20/13	4	6,939.49	6942.22	6,941.95	2.73	6,924.39	17.83	14.14	0.44	14.58	6927.64	6927.99	4 - 14	Chinle/Alluvium
MKTF-05	7/24/2023	11/20/13	4	6,939.49	6942.22	6,941.95	2.73	6,924.42	17.80	15.84	0.18	16.02	6926.2	6926.34	4 - 14	Chinle/Alluvium

ATTACHMENT A-4. WELL INFORMATION - SURVEY DATA, SCREENED INTERVAL, STRATIGRAPHIC UNIT
MKTF WELLS
GALLUP REFINERY, GALLUP, NEW MEXICO

Well ID	Sample Date	Date of Installation	Casing Diameter (in)	Surface Elevation (ft-amsl)	Well Casing Rim Elevation (ft-amsl)	Ground Elevation Inside Steel Sleeve (ft-amsl)	Stick-up length (ft)	Well Casing Bottom Elevation (ft-amsl)	Total Well Depth (ft-bmpe)	Depth to SPH (ft-bmpe)	SPH Thickness (ft)	DTW (ft-bmpe)	GW Elevation (ft-amsl)	Corrected Water Table [1] Elevation (ft-amsl)	Screened Interval Depth Top to Bottom (ft-bmpe)	Stratigraphic unit in which screen exists
MKTF-05	8/21/2023	11/20/13	4	6,939.49	6942.22	6,941.95	2.73	6,924.39	17.83	15.15	0.45	15.6	6926.62	6926.98	4 - 14	Chinle/Alluvium
MKTF-05	9/6/2023	11/20/13	4	6,939.49	6942.22	6,941.95	2.73	6,924.47	17.75	15.17	0.41	15.58	6926.64	6926.97	4 - 14	Chinle/Alluvium
MKTF-06	12/6/2022	11/11/13	4	6,944.24	6946.81	6,946.63	2.57	6,923.04	23.77	17.55	1.33	18.88	6927.93	6928.99	8 - 20	Chinle/Alluvium
MKTF-06	3/31/2023	11/11/13	4	6,944.24	6946.81	6,946.63	2.57	6,923.02	23.79	18.32	1.18	19.5	6927.31	6928.25	8 - 20	Chinle/Alluvium
MKTF-06	4/12/2023	11/11/13	4	6,944.24	6946.81	6,946.63	2.57	6,923.02	23.79	17.2	1.51	18.71	6928.1	6929.31	8 - 20	Chinle/Alluvium
MKTF-06	5/15/2023	11/11/13	4	6,944.24	6946.81	6,946.63	2.57	6,923.02	23.79	17.18	1.47	18.65	6928.16	6929.34	8 - 20	Chinle/Alluvium
MKTF-06	6/1/2023	11/11/13	4	6,944.24	6946.81	6,946.63	2.57	6,923.02	23.79	17.23	1.46	18.69	6928.12	6929.29	8 - 20	Chinle/Alluvium
MKTF-06	7/24/2023	11/11/13	4	6,944.24	6946.81	6,946.63	2.57	6,923.02	23.79	18.95	1.17	20.12	6926.69	6927.63	8 - 20	Chinle/Alluvium
MKTF-06	8/21/2023	11/11/13	4	6,944.24	6946.81	6,946.63	2.57	6,923.02	23.79	19.7	0.1	19.8	6927.01	6927.09	8 - 20	Chinle/Alluvium
MKTF-06	9/6/2023	11/11/13	4	6,944.24	6946.81	6,946.63	2.57	6,923.04	23.77	19.66	0.09	19.75	6927.06	6927.13	8 - 20	Chinle/Alluvium
MKTF-07	12/9/2022	11/11/13	4	6,944.40	6947.18	6,947.06	2.78	6,929.56	17.62	15.06	0.35	15.41	6931.77	6932.05	4 - 14	Chinle/Alluvium
MKTF-07	3/31/2023	11/11/13	4	6,944.40	6947.18	6,947.06	2.78	6,929.75	17.43	14.53	0.13	14.66	6932.52	6932.62	4 - 14	Chinle/Alluvium
MKTF-07	4/12/2023	11/11/13	4	6,944.40	6947.18	6,947.06	2.78	6,929.52	17.66	14.17	0.03	14.2	6932.98	6933.00	4 - 14	Chinle/Alluvium
MKTF-07	5/16/2023	11/11/13	4	6,944.40	6947.18	6,947.06	2.78	6,929.56	17.62	14.52	0.28	14.8	6932.38	6932.60	4 - 14	Chinle/Alluvium
MKTF-07	6/1/2023	11/11/13	4	6,944.40	6947.18	6,947.06	2.78	6,929.75	17.43	14.6	0.3	14.9	6932.28	6932.52	4 - 14	Chinle/Alluvium
MKTF-07	7/24/2023	11/11/13	4	6,944.40	6947.18	6,947.06	2.78	6,929.52	17.66	14.9	0.1	15	6932.18	6932.26	4 - 14	Chinle/Alluvium
MKTF-07	8/21/2023	11/11/13	4	6,944.40	6947.18	6,947.06	2.78	6,929.75	17.43	14.95	0.05	15	6932.18	6932.22	4 - 14	Chinle/Alluvium
MKTF-07	9/6/2023	11/11/13	4	6,944.40	6947.18	6,947.06	2.78	6,929.75	17.43	14.93	0.08	15.01	6932.17	6932.23	4 - 14	Chinle/Alluvium
MKTF-08	12/6/2022	11/11/13	4	6,944.02	6947.09	6,942.67	3.07	6,925.11	21.98	15.31	3	18.31	6928.78	6931.18	8 - 18	Chinle/Alluvium
MKTF-08	3/31/2023	11/11/13	4	6,944.02	6947.09	6,942.67	3.07	6,925.09	22.00	15.1	1.38	16.48	6930.61	6931.71	8 - 18	Chinle/Alluvium
MKTF-08	4/12/2023	11/11/13	4	6,944.02	6947.09	6,942.67	3.07	6,925.09	22.00	ND	NA	14.54	6932.55	NA	8 - 18	Chinle/Alluvium
MKTF-08	5/16/2023	11/11/13	4	6,944.02	6947.09	6,942.67	3.07	6,925.08	22.01	15.3	0.15	15.45	6931.64	6931.76	8 - 18	Chinle/Alluvium
MKTF-08	6/1/2023	11/11/13	4	6,944.02	6947.09	6,942.67	3.07	6,925.09	22.00	15.23	0.17	15.4	6931.69	6931.83	8 - 18	Chinle/Alluvium
MKTF-08	7/24/2023	11/11/13	4	6,944.02	6947.09	6,942.67	3.07	6,925.08	22.01	15.9	1.14	17.04	6930.05	6930.96	8 - 18	Chinle/Alluvium
MKTF-08	8/21/2023	11/11/13	4	6,944.02	6947.09	6,942.67	3.07	6,925.09	22.00	16	0.95	16.95	6930.14	6930.90	8 - 18	Chinle/Alluvium
MKTF-08	9/6/2023	11/11/13	4	6,944.02	6947.09	6,942.67	3.07	6,925.11	21.98	15.98	0.93	16.91	6930.18	6930.92	8 - 18	Chinle/Alluvium
MKTF-09	12/6/2022	11/11/13	4	6,943.57	6946.50	6,945.90	2.93	6,923.74	22.76	15.32	0.08	15.4	6931.1	6931.16	7 - 19	Chinle/Alluvium
MKTF-09	3/31/2023	11/11/13	4	6,943.57	6946.50	6,945.90	2.93	6,924.09	22.41	15.02	0.06	15.08	6931.42	6931.47	7 - 19	Chinle/Alluvium
MKTF-09	4/12/2023	11/11/13	4	6,943.57	6946.50	6,945.90	2.93	6,924.09	22.41	ND	NA	14.34	6932.16	NA	7 - 19	Chinle/Alluvium
MKTF-09	5/16/2023	11/11/13	4	6,943.57	6946.50	6,945.90	2.93	6,923.72	22.78	ND	NA	14.35	6932.15	NA	7 - 19	Chinle/Alluvium
MKTF-09	6/1/2023	11/11/13	4	6,943.57	6946.50	6,945.90	2.93	6,924.09	22.41	ND	NA	15.7	6930.8	NA	7 - 19	Chinle/Alluvium
MKTF-09	7/24/2023	11/11/13	4	6,943.57	6946.50	6,945.90	2.93	6,923.72	22.78	ND	NA	15.88	6930.62	NA	7 - 19	Chinle/Alluvium
MKTF-09	8/21/2023	11/11/13	4	6,943.57	6946.50	6,945.90	2.93	6,924.09	22.41	ND	NA	16.42	6930.08	NA	7 - 19	Chinle/Alluvium
MKTF-09	9/6/2023	11/11/13	4	6,943.57	6946.50	6,945.90	2.93	6,923.73	22.77	ND	NA	16.4	6930.1	NA	7 - 19	Chinle/Alluvium
MKTF-10	12/6/2022	10/31/13	4	6,937.51	6937.16	6,936.63	-0.35	6,921.17	15.99	8.2	0.09	8.29	6928.87	6928.94	7 - 17	Chinle/Alluvium
MKTF-10	3/31/2023	10/31/13	4	6,937.51	6937.16	6,936.63	-0.35	6,920.75	16.41	7.98	0.12	8.1	6929.06	6929.16	7 - 17	Chinle/Alluvium
MKTF-10	4/12/2023	10/31/13	4	6,937.51	6937.16	6,936.63	-0.35	6,920.66	16.50	7.98	3.35	11.33	6925.83	6928.51	7 - 17	Chinle/Alluvium
MKTF-10	5/16/2023	10/31/13	4	6,937.51	6937.16	6,936.63	-0.35	6,920.75	16.41	8	3.35	11.35	6925.81	6928.49	7 - 17	Chinle/Alluvium

ATTACHMENT A-4. WELL INFORMATION - SURVEY DATA, SCREENED INTERVAL, STRATIGRAPHIC UNIT
MKTF WELLS
GALLUP REFINERY, GALLUP, NEW MEXICO

Well ID	Sample Date	Date of Installation	Casing Diameter (in)	Surface Elevation (ft-amsl)	Well Casing Rim Elevation (ft-amsl)	Ground Elevation Inside Steel Sleeve (ft-amsl)	Stick-up length (ft)	Well Casing Bottom Elevation (ft-amsl)	Total Well Depth (ft-bmpe)	Depth to SPH (ft-bmpe)	SPH Thickness (ft)	DTW (ft-bmpe)	GW Elevation (ft-amsl)	Corrected Water Table [1] Elevation (ft-amsl)	Screened Interval Depth Top to Bottom (ft-bmpe)	Stratigraphic unit in which screen exists
MKTF-10	6/1/2023	10/31/13	4	6,937.51	6937.16	6,936.63	-0.35	6,920.75	16.41	8.03	3.27	11.3	6925.86	6928.48	7 - 17	Chinle/Alluvium
MKTF-10	7/24/2023	10/31/13	4	6,937.51	6937.16	6,936.63	-0.35	6,920.66	16.50	8.09	3.13	11.22	6925.94	6928.44	7 - 17	Chinle/Alluvium
MKTF-10	9/6/2023	10/31/13	4	6,937.51	6937.16	6,936.63	-0.35	6,921.17	15.99	9.41	7.06	16.47	6920.69	6926.34	7 - 17	Chinle/Alluvium
MKTF-11	12/6/2022	10/31/13	4	6,931.61	6931.34	6,930.86	-0.27	6,913.20	18.14	8.77	0.05	8.82	6922.52	6922.56	8 - 18	Chinle/Alluvium
MKTF-11	3/31/2023	10/31/13	4	6,931.61	6931.34	6,930.86	-0.27	6,912.89	18.45	8.6	0.05	8.65	6922.69	6922.73	8 - 18	Chinle/Alluvium
MKTF-11	4/12/2023	10/31/13	4	6,931.61	6931.34	6,930.86	-0.27	6,912.89	18.45	8.11	0.01	8.12	6923.22	6923.23	8 - 18	Chinle/Alluvium
MKTF-11	5/16/2023	10/31/13	4	6,931.61	6931.34	6,930.86	-0.27	6,912.89	18.45	8.1	0.03	8.13	6923.21	6923.23	8 - 18	Chinle/Alluvium
MKTF-11	6/1/2023	10/31/13	4	6,931.61	6931.34	6,930.86	-0.27	6,912.89	18.45	8.08	0.02	8.1	6923.24	6923.26	8 - 18	Chinle/Alluvium
MKTF-11	7/24/2023	10/31/13	4	6,931.61	6931.34	6,930.86	-0.27	6,912.89	18.45	7.98	0.03	8.01	6923.33	6923.35	8 - 18	Chinle/Alluvium
MKTF-11	8/18/2023	10/31/13	4	6,931.61	6931.34	6,930.86	-0.27	6,912.89	18.45	ND	NA	9.2	6922.14	NA	8 - 18	Chinle/Alluvium
MKTF-11	9/6/2023	10/31/13	4	6,931.61	6931.34	6,930.86	-0.27	6,913.20	18.14	ND	NA	9.17	6922.17	NA	8 - 18	Chinle/Alluvium
MKTF-12	12/6/2022	11/07/13	4	6,939.70	6942.11	6,941.88	2.41	6,916.51	25.60	19.95	0.16	20.11	6922	6922.13	12 - 22	Chinle/Alluvium
MKTF-12	3/6/2023	11/07/13	4	6,939.70	6942.11	6,941.88	2.41	6,916.29	25.82	19.05	0.05	19.1	6923.01	6923.05	12 - 22	Chinle/Alluvium
MKTF-12	4/12/2023	11/07/13	4	6,939.70	6942.11	6,941.88	2.41	6,916.29	25.82	18.41	0.04	18.45	6923.66	6923.69	12 - 22	Chinle/Alluvium
MKTF-12	5/15/2023	11/07/13	4	6,939.70	6942.11	6,941.88	2.41	6,916.22	25.89	19.21	0.07	19.28	6922.83	6922.89	12 - 22	Chinle/Alluvium
MKTF-12	6/1/2023	11/07/13	4	6,939.70	6942.11	6,941.88	2.41	6,916.29	25.82	19.52	0.1	19.62	6922.49	6922.57	12 - 22	Chinle/Alluvium
MKTF-12	7/24/2023	11/07/13	4	6,939.70	6942.11	6,941.88	2.41	6,916.22	25.89	19.5	0.08	19.58	6922.53	6922.59	12 - 22	Chinle/Alluvium
MKTF-12	8/22/2023	11/07/13	4	6,939.70	6942.11	6,941.88	2.41	6,916.29	25.82	19.4	0.07	19.47	6922.64	6922.70	12 - 22	Chinle/Alluvium
MKTF-12	9/6/2023	11/07/13	4	6,939.70	6942.11	6,941.88	2.41	6,916.51	25.60	19.43	0.07	19.5	6922.61	6922.67	12 - 22	Chinle/Alluvium
MKTF-13	12/9/2022	11/12/13	4	6,933.67	6935.18	6,934.83	1.51	6,913.93	21.25	14.88	0.82	15.7	6919.48	6920.14	8 - 18	Chinle/Alluvium
MKTF-13	3/7/2023	11/12/13	4	6,933.67	6935.18	6,934.83	1.51	6,913.05	22.13	13.15	3	16.15	6919.03	6921.43	8 - 18	Chinle/Alluvium
MKTF-13	4/12/2023	11/12/13	4	6,933.67	6935.18	6,934.83	1.51	6,913.05	22.13	12.2	4.47	16.67	6918.51	6922.09	8 - 18	Chinle/Alluvium
MKTF-13	5/15/2023	11/12/13	4	6,933.67	6935.18	6,934.83	1.51	6,913.26	21.92	12.58	4.54	17.12	6918.06	6921.69	8 - 18	Chinle/Alluvium
MKTF-13	6/1/2023	11/12/13	4	6,933.67	6935.18	6,934.83	1.51	6,913.05	22.13	13.6	3.59	17.19	6917.99	6920.86	8 - 18	Chinle/Alluvium
MKTF-13	7/24/2023	11/12/13	4	6,933.67	6935.18	6,934.83	1.51	6,913.26	21.92	14.4	3.7	18.1	6917.08	6920.04	8 - 18	Chinle/Alluvium
MKTF-13	8/21/2023	11/12/13	4	6,933.67	6935.18	6,934.83	1.51	6,913.05	22.13	13.4	5.1	18.5	6916.68	6920.76	8 - 18	Chinle/Alluvium
MKTF-13	9/6/2023	11/12/13	4	6,933.67	6935.18	6,934.83	1.51	6,913.93	21.25	13.33	5.1	18.43	6916.75	6920.83	8 - 18	Chinle/Alluvium
MKTF-14	12/9/2022	11/12/13	4	6,925.65	6928.02	6,927.80	2.37	6,910.56	17.46	7.41	0.14	7.55	6920.47	6920.58	4 - 14	Chinle/Alluvium
MKTF-14	3/7/2023	11/12/13	4	6,925.65	6928.02	6,927.80	2.37	6,910.70	17.32	7.5	0.05	7.55	6920.47	6920.51	4 - 14	Chinle/Alluvium
MKTF-14	4/12/2023	11/12/13	4	6,925.65	6928.02	6,927.80	2.37	6,910.70	17.32	7.16	0.03	7.19	6920.83	6920.85	4 - 14	Chinle/Alluvium
MKTF-14	5/15/2023	11/12/13	4	6,925.65	6928.02	6,927.80	2.37	6,910.47	17.55	7.83	1.05	8.88	6919.14	6919.98	4 - 14	Chinle/Alluvium
MKTF-14	6/1/2023	11/12/13	4	6,925.65	6928.02	6,927.80	2.37	6,910.70	17.32	7.93	10.41	18.34	6909.68	6918.01	4 - 14	Chinle/Alluvium
MKTF-14	7/24/2023	11/12/13	4	6,925.65	6928.02	6,927.80	2.37	6,910.47	17.55	8.38	0.62	9	6919.02	6919.52	4 - 14	Chinle/Alluvium
MKTF-14	8/21/2023	11/12/13	4	6,925.65	6928.02	6,927.80	2.37	6,910.70	17.32	7.8	1	8.8	6919.22	6920.02	4 - 14	Chinle/Alluvium
MKTF-14	9/6/2023	11/12/13	4	6,925.65	6928.02	6,927.80	2.37	6,910.56	17.46	7.77	0.98	8.75	6919.27	6920.05	4 - 14	Chinle/Alluvium
MKTF-15	12/6/2022	10/29/13	2	6,943.74	6943.48	6,943.19	-0.26	6,924.00	19.48	13.96	0.63	14.59	6928.89	6929.39	9 - 19	Chinle/Alluvium
MKTF-15	3/31/2023	10/29/13	2	6,943.74	6943.48	6,943.19	-0.26	6,924.30	19.18	13.5	0.93	14.43	6929.05	6929.79	9 - 19	Chinle/Alluvium
MKTF-15	4/12/2023	10/29/13	2	6,943.74	6943.48	6,943.19	-0.26	6,924.30	19.18	13.65	0.39	14.04	6929.44	6929.75	9 - 19	Chinle/Alluvium

ATTACHMENT A-4. WELL INFORMATION - SURVEY DATA, SCREENED INTERVAL, STRATIGRAPHIC UNIT
MKTF WELLS
GALLUP REFINERY, GALLUP, NEW MEXICO

Well ID	Sample Date	Date of Installation	Casing Diameter (in)	Surface Elevation (ft-amsl)	Well Casing Rim Elevation (ft-amsl)	Ground Elevation Inside Steel Sleeve (ft-amsl)	Stick-up length (ft)	Well Casing Bottom Elevation (ft-amsl)	Total Well Depth (ft-bmpe)	Depth to SPH (ft-bmpe)	SPH Thickness (ft)	DTW (ft-bmpe)	GW Elevation (ft-amsl)	Corrected Water Table [1] Elevation (ft-amsl)	Screened Interval Depth Top to Bottom (ft-bmpe)	Stratigraphic unit in which screen exists
MKTF-15	5/16/2023	10/29/13	2	6,943.74	6943.48	6,943.19	-0.26	6,923.96	19.52	14.1	0.2	14.3	6929.18	6929.34	9 - 19	Chinle/Alluvium
MKTF-15	6/1/2023	10/29/13	2	6,943.74	6943.48	6,943.19	-0.26	6,924.30	19.18	14.11	0.22	14.33	6929.15	6929.33	9 - 19	Chinle/Alluvium
MKTF-15	7/24/2023	10/29/13	2	6,943.74	6943.48	6,943.19	-0.26	6,923.96	19.52	14.48	0.64	15.12	6928.36	6928.87	9 - 19	Chinle/Alluvium
MKTF-15	8/18/2023	10/29/13	2	6,943.74	6943.48	6,943.19	-0.26	6,924.30	19.18	14.52	0.81	15.33	6928.15	6928.80	9 - 19	Chinle/Alluvium
MKTF-15	9/6/2023	10/29/13	2	6,943.74	6943.48	6,943.19	-0.26	6,924.00	19.48	14.44	0.76	15.2	6928.28	6928.89	9 - 19	Chinle/Alluvium
MKTF-16	12/6/2022	11/07/13	2	6,951.00	6950.58	6,950.58	-0.42	6,936.48	14.10	ND	NA	10.32	6940.26	NA	4 - 14	Chinle/Alluvium
MKTF-16	3/7/2023	11/07/13	2	6,951.00	6950.58	6,950.58	-0.42	6,939.63	10.95	ND	NA	8.1	6942.48	NA	4 - 14	Chinle/Alluvium
MKTF-16	4/12/2023	11/07/13	2	6,951.00	6950.58	6,950.58	-0.42	6,936.48	14.10	ND	NA	8.75	6941.83	NA	4 - 14	Chinle/Alluvium
MKTF-16	5/16/2023	11/07/13	2	6,951.00	6950.58	6,950.58	-0.42	6,936.48	14.10	ND	NA	8.83	6941.75	NA	4 - 14	Chinle/Alluvium
MKTF-16	6/1/2023	11/07/13	2	6,951.00	6950.58	6,950.58	-0.42	6,939.66	10.92	ND	NA	8.92	6941.66	NA	4 - 14	Chinle/Alluvium
MKTF-16	7/24/2023	11/07/13	2	6,951.00	6950.58	6,950.58	-0.42	6,939.66	10.92	ND	NA	9.02	6941.56	NA	4 - 14	Chinle/Alluvium
MKTF-16	9/6/2023	11/07/13	2	6,951.00	6950.58	6,950.58	-0.42	6,939.66	10.92	ND	NA	5.5	6945.08	NA	4 - 14	Chinle/Alluvium
MKTF-17R	12/6/2022	11/14/13	2	6,945.79	6945.76	6,945.64	-0.03	6,921.65	24.11	12.5	0.1	12.6	6937.6	6937.68	14 - 24	Chinle/Alluvium
MKTF-17R	3/7/2023	11/14/13	2	6,945.79	6945.76	6,945.64	-0.03	6,921.09	24.67	12.7	0.05	12.75	6937.45	6937.49	14 - 24	Chinle/Alluvium
MKTF-17R	4/12/2023	11/14/13	2	6,945.79	6945.76	6,945.64	-0.03	6,921.09	24.67	12.15	0.02	12.17	6938.03	6938.05	14 - 24	Chinle/Alluvium
MKTF-17R	5/15/2023	11/14/13	2	6,945.79	6945.76	6,945.64	-0.03	6,921.10	24.66	12.38	0.17	12.55	6937.65	6937.79	14 - 24	Chinle/Alluvium
MKTF-17R	6/1/2023	11/14/13	2	6,945.79	6945.76	6,945.64	-0.03	6,921.09	24.67	12.38	0.03	12.41	6937.79	6937.81	14 - 24	Chinle/Alluvium
MKTF-17R	7/24/2023	08/14/21	2	6,950.61	6950.20	6948.20	-0.41	6,927.70	20.50	12.65	0.05	12.7	6937.5	6937.54	5 - 20	Chinle/Alluvium
MKTF-17R	8/21/2023	08/14/21	2	6,950.61	6950.20	6948.20	-0.41	6,923.50	24.70	12.7	0.12	12.82	6937.38	6937.48	5 - 20	Chinle/Alluvium
MKTF-17R	9/6/2023	11/14/13	2	6,945.79	6945.76	6,945.64	-0.03	6,921.65	24.11	12.73	0.12	12.85	6937.35	6937.45	14 - 24	Chinle/Alluvium
MKTF-18R	12/5/2022	11/15/13	2	6,950.97	6950.65	6,950.17	-0.32	6,925.27	25.38	ND	NA	10.7	6944.17	NA	17 - 27	Chinle/Alluvium
MKTF-18R	3/7/2023	11/15/13	2	6,950.97	6950.65	6,950.17	-0.32	6,928.92	21.73	ND	NA	11.03	6943.84	NA	17 - 27	Chinle/Alluvium
MKTF-18R	4/12/2023	11/15/13	2	6,950.97	6950.65	6,950.17	-0.32	6,928.92	21.73	ND	NA	10.61	6944.26	NA	17 - 27	Chinle/Alluvium
MKTF-18R	5/15/2023	11/15/13	2	6,950.97	6950.65	6,950.17	-0.32	6,925.15	25.50	ND	NA	10.75	6944.12	NA	17 - 27	Chinle/Alluvium
MKTF-18R	6/1/2023	11/15/13	2	6,950.97	6950.65	6,950.17	-0.32	6,928.92	21.73	ND	NA	10.55	6944.32	NA	17 - 27	Chinle/Alluvium
MKTF-18R	7/24/2023	08/14/21	2	6,955.29	6954.87	6950.87	-0.42	6,925.37	25.50	ND	NA	10.6	6944.27	NA	5 - 25	Chinle/Alluvium
MKTF-18R	8/22/2023	08/14/21	2	6,955.29	6954.87	6950.87	-0.42	6,925.32	25.55	ND	NA	10.51	6944.36	NA	5 - 25	Chinle/Alluvium
MKTF-18R	9/6/2023	11/15/13	2	6,950.97	6950.65	6,950.17	-0.32	6,925.27	25.38	ND	NA	10.46	6944.41	NA	17 - 27	Chinle/Alluvium
MKTF-19	12/6/2022	11/05/13	2	6,944.89	6944.67	6,944.34	-0.22	6,927.20	17.47	15.12	0.32	15.44	6929.23	6929.49	10 - 20	Chinle/Alluvium
MKTF-19	3/7/2023	11/05/13	2	6,944.89	6944.67	6,944.34	-0.22	6,925.43	19.24	14.11	0.43	14.54	6930.13	6930.47	10 - 20	Chinle/Alluvium
MKTF-19	4/12/2023	11/05/13	2	6,944.89	6944.67	6,944.34	-0.22	6,925.43	19.24	13.45	0.38	13.83	6930.84	6931.14	10 - 20	Chinle/Alluvium
MKTF-19	5/15/2023	11/05/13	2	6,944.89	6944.67	6,944.34	-0.22	6,925.29	19.38	13.78	0.42	14.2	6930.47	6930.81	10 - 20	Chinle/Alluvium
MKTF-19	6/1/2023	11/05/13	2	6,944.89	6944.67	6,944.34	-0.22	6,925.43	19.24	13.8	0.13	13.93	6930.74	6930.84	10 - 20	Chinle/Alluvium
MKTF-19	7/24/2023	11/05/13	2	6,944.89	6944.67	6,944.34	-0.22	6,925.29	19.38	14.15	0.23	14.38	6930.29	6930.47	10 - 20	Chinle/Alluvium
MKTF-19	8/21/2023	11/05/13	2	6,944.89	6944.67	6,944.34	-0.22	6,925.43	19.24	14.22	0.26	14.48	6930.19	6930.40	10 - 20	Chinle/Alluvium
MKTF-19	9/6/2023	11/05/13	2	6,944.89	6944.67	6,944.34	-0.22	6,927.20	17.47	14.25	0.27	14.52	6930.15	6930.37	10 - 20	Chinle/Alluvium
MKTF-20	12/6/2022	02/10/14	4	6,951.89	6951.78	6,951.17	-0.11	6,942.95	8.83	ND	NA	Dry	Dry	NA	2 - 10	Chinle/Alluvium
MKTF-20	3/7/2023	02/10/14	4	6,951.89	6951.78	6,951.17	-0.11	6,942.16	9.62	ND	NA	Dry	Dry	NA	2 - 10	Chinle/Alluvium

ATTACHMENT A-4. WELL INFORMATION - SURVEY DATA, SCREENED INTERVAL, STRATIGRAPHIC UNIT
MKTF WELLS
GALLUP REFINERY, GALLUP, NEW MEXICO

Well ID	Sample Date	Date of Installation	Casing Diameter (in)	Surface Elevation (ft-amsl)	Well Casing Rim Elevation (ft-amsl)	Ground Elevation Inside Steel Sleeve (ft-amsl)	Stick-up length (ft)	Well Casing Bottom Elevation (ft-amsl)	Total Well Depth (ft-bmpe)	Depth to SPH (ft-bmpe)	SPH Thickness (ft)	DTW (ft-bmpe)	GW Elevation (ft-amsl)	Corrected Water Table [1] Elevation (ft-amsl)	Screened Interval Depth Top to Bottom (ft-bmpe)	Stratigraphic unit in which screen exists
MKTF-20	4/12/2023	02/10/14	4	6,951.89	6951.78	6,951.17	-0.11	6,942.16	9.62	ND	NA	8.55	6943.23	NA	2 - 10	Chinle/Alluvium
MKTF-20	5/15/2023	02/10/14	4	6,951.89	6951.78	6,951.17	-0.11	6,942.18	9.60	ND	NA	8.56	6943.22	NA	2 - 10	Chinle/Alluvium
MKTF-20	6/1/2023	02/10/14	4	6,951.89	6951.78	6,951.17	-0.11	6,942.16	9.62	ND	NA	8.5	6943.28	NA	2 - 10	Chinle/Alluvium
MKTF-20	7/24/2023	02/10/14	4	6,951.89	6951.78	6,951.17	-0.11	6,942.18	9.60	ND	NA	8.4	6943.38	NA	2 - 10	Chinle/Alluvium
MKTF-20	8/18/2023	02/10/14	4	6,951.89	6951.78	6,951.17	-0.11	6,942.16	9.62	ND	NA	9.71	6942.07	NA	2 - 10	Chinle/Alluvium
MKTF-20	9/6/2023	02/10/14	4	6,951.89	6951.78	6,951.17	-0.11	6,942.95	8.83	ND	NA	9.73	6942.05	NA	2 - 10	Chinle/Alluvium
MKTF-21	12/6/2022	02/10/14	4	6,952.68	6952.57	6,952.00	-0.11	6,943.74	8.83	ND	NA	Dry	Dry	NA	2 - 10	Chinle/Alluvium
MKTF-21	3/7/2023	02/10/14	4	6,952.68	6952.57	6,952.00	-0.11	6,943.73	8.84	ND	NA	8.33	6944.24	NA	2 - 10	Chinle/Alluvium
MKTF-21	4/12/2023	02/10/14	4	6,952.68	6952.57	6,952.00	-0.11	6,943.73	8.84	ND	NA	Dry	Dry	NA	2 - 10	Chinle/Alluvium
MKTF-21	5/15/2023	02/10/14	4	6,952.68	6952.57	6,952.00	-0.11	6,943.77	8.80	ND	NA	Dry	Dry	NA	2 - 10	Chinle/Alluvium
MKTF-21	6/1/2023	02/10/14	4	6,952.68	6952.57	6,952.00	-0.11	6,943.73	8.84	ND	NA	Dry	Dry	NA	2 - 10	Chinle/Alluvium
MKTF-21	7/24/2023	02/10/14	4	6,952.68	6952.57	6,952.00	-0.11	6,943.77	8.80	ND	NA	Dry	Dry	NA	2 - 10	Chinle/Alluvium
MKTF-21	8/23/2023	02/10/14	4	6,952.68	6952.57	6,952.00	-0.11	6,943.73	8.84	ND	NA	Dry	Dry	NA	2 - 10	Chinle/Alluvium
MKTF-21	9/6/2023	02/10/14	4	6,952.68	6952.57	6,952.00	-0.11	6,943.74	8.83	ND	NA	ND	Dry	NA	2 - 10	Chinle/Alluvium
MKTF-22	12/6/2022	11/08/13	2	6,939.76	6942.31	6,938.57	2.55	6,907.06	35.25	25.76	1.81	27.57	6914.74	6916.19	22 - 32	Chinle/Alluvium
MKTF-22	3/6/2023	11/08/13	2	6,939.76	6942.31	6,938.57	2.55	6,907.22	35.09	25.85	1.82	27.67	6914.64	6916.10	22 - 32	Chinle/Alluvium
MKTF-22	4/12/2023	11/08/13	2	6,939.76	6942.31	6,938.57	2.55	6,907.22	35.09	25.53	1.91	27.44	6914.87	6916.40	22 - 32	Chinle/Alluvium
MKTF-22	5/15/2023	11/08/13	2	6,939.76	6942.31	6,938.57	2.55	6,907.22	35.09	25.8	1.87	27.67	6914.64	6916.14	22 - 32	Chinle/Alluvium
MKTF-22	6/1/2023	11/08/13	2	6,939.76	6942.31	6,938.57	2.55	6,907.22	35.09	25.71	2.32	28.03	6914.28	6916.14	22 - 32	Chinle/Alluvium
MKTF-22	7/24/2023	11/08/13	2	6,939.76	6942.31	6,938.57	2.55	6,907.22	35.09	26.1	2.12	28.22	6914.09	6915.79	22 - 32	Chinle/Alluvium
MKTF-22	8/21/2023	11/08/13	2	6,939.76	6942.31	6,938.57	2.55	6,907.22	35.09	25.2	2.25	27.45	6914.86	6916.66	22 - 32	Chinle/Alluvium
MKTF-22	9/6/2023	11/08/13	2	6,939.76	6942.31	6,938.57	2.55	6,907.06	35.25	25.25	2.25	27.5	6914.81	6916.61	22 - 32	Chinle/Alluvium
MKTF-23	12/6/2022	11/04/13	2	6,927.23	6929.98	6,925.79	2.75	6,909.62	20.36	14.31	0.09	14.4	6915.58	6915.65	7 - 17	Chinle/Alluvium
MKTF-23	3/7/2023	11/04/13	2	6,927.23	6929.98	6,925.79	2.75	6,909.96	20.02	14.9	0.02	14.92	6915.06	6915.08	7 - 17	Chinle/Alluvium
MKTF-23	4/12/2023	11/04/13	2	6,927.23	6929.98	6,925.79	2.75	6,909.96	20.02	14.88	0.02	14.9	6915.08	6915.10	7 - 17	Chinle/Alluvium
MKTF-23	5/15/2023	11/04/13	2	6,927.23	6929.98	6,925.79	2.75	6,909.59	20.39	15.1	0.01	15.11	6914.87	6914.88	7 - 17	Chinle/Alluvium
MKTF-23	6/1/2023	11/04/13	2	6,927.23	6929.98	6,925.79	2.75	6,909.96	20.02	15.14	0.01	15.15	6914.83	6914.84	7 - 17	Chinle/Alluvium
MKTF-23	7/24/2023	11/04/13	2	6,927.23	6929.98	6,925.79	2.75	6,909.59	20.39	15.1	0.02	15.12	6914.86	6914.88	7 - 17	Chinle/Alluvium
MKTF-23	8/23/2023	11/04/13	2	6,927.23	6929.98	6,925.79	2.75	6,909.96	20.02	15.16	0.04	15.2	6914.78	6914.81	7 - 17	Chinle/Alluvium
MKTF-23	9/6/2023	11/04/13	2	6,927.23	6929.98	6,925.79	2.75	6,909.62	20.36	15.15	0.05	15.2	6914.78	6914.82	7 - 17	Chinle/Alluvium
MKTF-24	12/6/2022	10/29/13	2	6,926.07	6928.72	6,924.62	2.65	6,898.25	30.47	23.77	0.05	23.82	6904.9	6904.94	18 - 28	Chinle/Alluvium
MKTF-24	3/31/2023	10/29/13	2	6,926.07	6928.72	6,924.62	2.65	6,897.59	31.13	23.24	0.04	23.28	6905.44	6905.47	18 - 28	Chinle/Alluvium
MKTF-24	4/13/2023	10/29/13	2	6,926.07	6928.72	6,924.62	2.65	6,897.59	31.13	23.12	0.03	23.15	6905.57	6905.59	18 - 28	Chinle/Alluvium
MKTF-24	5/15/2023	10/29/13	2	6,926.07	6928.72	6,924.62	2.65	6,897.54	31.18	23.1	0.04	23.14	6905.58	6905.61	18 - 28	Chinle/Alluvium
MKTF-24	6/2/2023	10/29/13	2	6,926.07	6928.72	6,924.62	2.65	6,897.59	31.13	23.06	0.09	23.15	6905.57	6905.64	18 - 28	Chinle/Alluvium
MKTF-24	7/24/2023	10/29/13	2	6,926.07	6928.72	6,924.62	2.65	6,897.54	31.18	23.12	0.08	23.2	6905.52	6905.58	18 - 28	Chinle/Alluvium
MKTF-24	8/23/2023	10/29/13	2	6,926.07	6928.72	6,924.62	2.65	6,897.59	31.13	ND	NA	24.72	6904	NA	18 - 28	Chinle/Alluvium
MKTF-24	9/6/2023	10/29/13	2	6,926.07	6928.72	6,924.62	2.65	6,898.25	30.47	ND	NA	24.75	6903.97	NA	18 - 28	Chinle/Alluvium

ATTACHMENT A-4. WELL INFORMATION - SURVEY DATA, SCREENED INTERVAL, STRATIGRAPHIC UNIT
MKTF WELLS
GALLUP REFINERY, GALLUP, NEW MEXICO

Well ID	Sample Date	Date of Installation	Casing Diameter (in)	Surface Elevation (ft-amsl)	Well Casing Rim Elevation (ft-amsl)	Ground Elevation Inside Steel Sleeve (ft-amsl)	Stick-up length (ft)	Well Casing Bottom Elevation (ft-amsl)	Total Well Depth (ft-bmpe)	Depth to SPH (ft-bmpe)	SPH Thickness (ft)	DTW (ft-bmpe)	GW Elevation (ft-amsl)	Corrected Water Table [1] Elevation (ft-amsl)	Screened Interval Depth Top to Bottom (ft-bmpe)	Stratigraphic unit in which screen exists
MKTF-25	12/6/2022	10/30/13	2	6,913.35	6916.19	6,911.79	2.84	6,896.76	19.43	13.64	0.04	13.68	6902.51	6902.54	6 - 16	Chinle/Alluvium
MKTF-25	3/31/2023	10/30/13	2	6,913.35	6916.19	6,911.79	2.84	6,896.10	20.09	13.5	0.05	13.55	6902.64	6902.68	6 - 16	Chinle/Alluvium
MKTF-25	4/13/2023	10/30/13	2	6,913.35	6916.19	6,911.79	2.84	6,896.10	20.09	13.6	0.04	13.64	6902.55	6902.58	6 - 16	Chinle/Alluvium
MKTF-25	5/15/2023	10/30/13	2	6,913.35	6916.19	6,911.79	2.84	6,895.81	20.38	13.63	0.04	13.67	6902.52	6902.55	6 - 16	Chinle/Alluvium
MKTF-25	6/2/2023	10/30/13	2	6,913.35	6916.19	6,911.79	2.84	6,896.10	20.09	13.55	0.05	13.6	6902.59	6902.63	6 - 16	Chinle/Alluvium
MKTF-25	7/24/2023	10/30/13	2	6,913.35	6916.19	6,911.79	2.84	6,895.81	20.38	13.33	0.25	13.58	6902.61	6902.81	6 - 16	Chinle/Alluvium
MKTF-25	8/23/2023	10/30/13	2	6,913.35	6916.19	6,911.79	2.84	6,896.10	20.09	ND	NA	14.66	6901.53	NA	6 - 16	Chinle/Alluvium
MKTF-25	9/6/2023	10/30/13	2	6,913.35	6916.19	6,911.79	2.84	6,896.76	19.43	ND	NA	14.65	6901.54	NA	6 - 16	Chinle/Alluvium
MKTF-26	12/6/2022	10/30/13	2	6,912.55	6915.31	6,911.35	2.76	6,898.16	16.85	9.03	0.07	9.1	6906.21	6906.27	4 - 14	Chinle/Alluvium
MKTF-26	3/31/2023	10/30/13	2	6,912.55	6915.31	6,911.35	2.76	6,898.16	17.15	8.88	0.07	8.95	6906.36	6906.42	4 - 14	Chinle/Alluvium
MKTF-26	4/13/2023	10/30/13	2	6,912.55	6915.31	6,911.35	2.76	6,898.16	16.85	8.9	0.07	8.97	6906.34	6906.40	4 - 14	Chinle/Alluvium
MKTF-26	5/16/2023	10/30/13	2	6,912.55	6915.31	6,911.35	2.76	6,898.16	17.16	8.98	0.07	9.05	6906.26	6906.32	4 - 14	Chinle/Alluvium
MKTF-26	6/2/2023	10/30/13	2	6,912.55	6915.31	6,911.35	2.76	6,898.16	16.85	8.66	0.09	8.75	6906.56	6906.63	4 - 14	Chinle/Alluvium
MKTF-26	7/24/2023	10/30/13	2	6,912.55	6915.31	6,911.35	2.76	6,898.16	17.16	8.71	0.09	8.8	6906.51	6906.58	4 - 14	Chinle/Alluvium
MKTF-26	8/23/2023	10/30/13	2	6,912.55	6915.31	6,911.35	2.76	6,898.16	16.85	ND	NA	10.38	6904.93	NA	4 - 14	Chinle/Alluvium
MKTF-26	9/6/2023	10/30/13	2	6,912.55	6915.31	6,911.35	2.76	6,898.16	17.15	ND	NA	10.35	6904.96	NA	4 - 14	Chinle/Alluvium
MKTF-27	12/8/2022	10/30/13	2	6,915.36	6917.90	6,914.18	2.54	6,903.18	14.72	ND	NA	6.81	6911.09	NA	1 - 12	Chinle/Alluvium
MKTF-27	3/7/2023	10/30/13	2	6,915.36	6917.90	6,914.18	2.54	6,903.18	14.72	ND	NA	6.4	6911.5	NA	1 - 12	Chinle/Alluvium
MKTF-27	4/13/2023	10/30/13	2	6,915.36	6917.90	6,914.18	2.54	6,903.18	14.72	ND	NA	6.54	6911.36	NA	1 - 12	Chinle/Alluvium
MKTF-27	5/16/2023	10/30/13	2	6,915.36	6917.90	6,914.18	2.54	6,903.16	14.74	ND	NA	6.75	6911.15	NA	1 - 12	Chinle/Alluvium
MKTF-27	6/2/2023	10/30/13	2	6,915.36	6917.90	6,914.18	2.54	6,903.18	14.72	ND	NA	6.88	6911.02	NA	1 - 12	Chinle/Alluvium
MKTF-27	7/24/2023	10/30/13	2	6,915.36	6917.90	6,914.18	2.54	6,903.16	14.74	ND	NA	6.75	6911.15	NA	1 - 12	Chinle/Alluvium
MKTF-27	8/23/2023	10/30/13	2	6,915.36	6917.90	6,914.18	2.54	6,903.18	14.72	ND	NA	7.75	6910.15	NA	1 - 12	Chinle/Alluvium
MKTF-27	9/6/2023	10/30/13	2	6,915.36	6917.90	6,914.18	2.54	6,903.18	14.72	ND	NA	7.73	6910.17	NA	1 - 12	Chinle/Alluvium
MKTF-28	12/8/2022	04/02/14	2	6,918.67	6921.52	6,917.51	2.85	6,905.36	16.17	ND	NA	10.25	6911.27	NA	3 - 13	Chinle/Alluvium
MKTF-28	3/7/2023	04/02/14	2	6,918.67	6921.52	6,917.51	2.85	6,905.36	16.16	ND	NA	8.27	6913.25	NA	3 - 13	Chinle/Alluvium
MKTF-28	4/13/2023	04/02/14	2	6,918.67	6921.52	6,917.51	2.85	6,905.36	16.17	ND	NA	8.3	6913.22	NA	3 - 13	Chinle/Alluvium
MKTF-28	5/16/2023	04/02/14	2	6,918.67	6921.52	6,917.51	2.85	6,905.36	16.16	ND	NA	8.33	6913.19	NA	3 - 13	Chinle/Alluvium
MKTF-28	6/2/2023	04/02/14	2	6,918.67	6921.52	6,917.51	2.85	6,905.36	16.17	ND	NA	8.19	6913.33	NA	3 - 13	Chinle/Alluvium
MKTF-28	7/24/2023	04/02/14	2	6,918.67	6921.52	6,917.51	2.85	6,905.36	16.16	ND	NA	8.1	6913.42	NA	3 - 13	Chinle/Alluvium
MKTF-28	8/23/2023	04/02/14	2	6,918.67	6921.52	6,917.51	2.85	6,905.36	16.17	ND	NA	8.05	6913.47	NA	3 - 13	Chinle/Alluvium
MKTF-28	9/6/2023	04/02/14	2	6,918.67	6921.52	6,917.51	2.85	6,905.36	16.16	ND	NA	8.01	6913.51	NA	3 - 13	Chinle/Alluvium
MKTF-29	12/9/2022	04/02/14	2	6,898.83	6901.62	6,897.67	2.79	6,878.84	22.78	ND	NA	6.25	6895.37	NA	10 - 20	Chinle/Alluvium
MKTF-29	3/7/2023	04/02/14	2	6,898.83	6901.62	6,897.67	2.79	6,878.84	22.78	ND	NA	5.62	6896	NA	10 - 20	Chinle/Alluvium
MKTF-29	4/13/2023	04/02/14	2	6,898.83	6901.62	6,897.67	2.79	6,878.77	22.85	ND	NA	5.75	6895.87	NA	10 - 20	Chinle/Alluvium
MKTF-29	5/16/2023	04/02/14	2	6,898.83	6901.62	6,897.67	2.79	6,878.78	22.84	ND	NA	5.8	6895.82	NA	10 - 20	Chinle/Alluvium
MKTF-29	6/2/2023	04/02/14	2	6,898.83	6901.62	6,897.67	2.79	6,878.84	22.78	ND	NA	5.77	6895.85	NA	10 - 20	Chinle/Alluvium
MKTF-29	7/24/2023	04/02/14	2	6,898.83	6901.62	6,897.67	2.79	6,878.77	22.85	ND	NA	5.77	6895.85	NA	10 - 20	Chinle/Alluvium

ATTACHMENT A-4. WELL INFORMATION - SURVEY DATA, SCREENED INTERVAL, STRATIGRAPHIC UNIT
MKTF WELLS
GALLUP REFINERY, GALLUP, NEW MEXICO

Well ID	Sample Date	Date of Installation	Casing Diameter (in)	Surface Elevation (ft-amsl)	Well Casing Rim Elevation (ft-amsl)	Ground Elevation Inside Steel Sleeve (ft-amsl)	Stick-up length (ft)	Well Casing Bottom Elevation (ft-amsl)	Total Well Depth (ft-bmpe)	Depth to SPH (ft-bmpe)	SPH Thickness (ft)	DTW (ft-bmpe)	GW Elevation (ft-amsl)	Corrected Water Table [1] Elevation (ft-amsl)	Screened Interval Depth Top to Bottom (ft-bmpe)	Stratigraphic unit in which screen exists
MKTF-29	8/23/2023	04/02/14	2	6,898.83	6901.62	6,897.67	2.79	6,878.84	22.78	ND	NA	5.63	6895.99	NA	10 - 20	Chinle/Alluvium
MKTF-29	9/6/2023	04/02/14	2	6,898.83	6901.62	6,897.67	2.79	6,878.78	22.84	ND	NA	5.6	6896.02	NA	10 - 20	Chinle/Alluvium
MKTF-30	12/29/2022	04/01/14	2	6,898.10	6900.80	6,896.68	2.70	6,877.58	23.22	ND	NA	16.42	6884.38	NA	10 - 20	Chinle/Alluvium
MKTF-30	3/7/2023	04/01/14	2	6,898.10	6900.80	6,896.68	2.70	6,877.60	23.20	ND	NA	15.65	6885.15	NA	10 - 20	Chinle/Alluvium
MKTF-30	4/13/2023	04/01/14	2	6,898.10	6900.80	6,896.68	2.70	6,877.58	23.22	ND	NA	15.55	6885.25	NA	10 - 20	Chinle/Alluvium
MKTF-30	5/16/2023	04/01/14	2	6,898.10	6900.80	6,896.68	2.70	6,877.58	23.22	ND	NA	15.8	6885	NA	10 - 20	Chinle/Alluvium
MKTF-30	6/2/2023	04/01/14	2	6,898.10	6900.80	6,896.68	2.70	6,877.58	23.22	ND	NA	15.19	6885.61	NA	10 - 20	Chinle/Alluvium
MKTF-30	7/24/2023	04/01/14	2	6,898.10	6900.80	6,896.68	2.70	6,877.58	23.22	ND	NA	15.15	6885.65	NA	10 - 20	Chinle/Alluvium
MKTF-30	8/23/2023	04/01/14	2	6,898.10	6900.80	6,896.68	2.70	6,877.58	23.22	ND	NA	15.07	6885.73	NA	10 - 20	Chinle/Alluvium
MKTF-30	9/6/2023	04/01/14	2	6,898.10	6900.80	6,896.68	2.70	6,877.60	23.20	ND	NA	15.1	6885.7	NA	10 - 20	Chinle/Alluvium
MKTF-31	12/8/2022	04/01/14	2	6,904.26	6906.87	6,903.11	2.61	6,887.53	19.34	ND	NA	9.65	6897.22	NA	6 - 21	Chinle/Alluvium
MKTF-31	3/7/2023	04/01/14	2	6,904.26	6906.87	6,903.11	2.61	6,884.06	22.81	ND	NA	9.45	6897.42	NA	6 - 21	Chinle/Alluvium
MKTF-31	4/13/2023	04/01/14	2	6,904.26	6906.87	6,903.11	2.61	6,887.53	19.34	ND	NA	9.51	6897.36	NA	6 - 21	Chinle/Alluvium
MKTF-31	5/15/2023	04/01/14	2	6,904.26	6906.87	6,903.11	2.61	6,887.50	19.37	ND	NA	9.68	6897.19	NA	6 - 21	Chinle/Alluvium
MKTF-31	6/1/2023	04/01/14	2	6,904.26	6906.87	6,903.11	2.61	6,887.53	19.34	9.17	1.45	10.62	6896.25	6897.41	6 - 21	Chinle/Alluvium
MKTF-31	7/24/2023	04/01/14	2	6,904.26	6906.87	6,903.11	2.61	6,887.50	19.37	ND	NA	9.4	6897.47	NA	6 - 21	Chinle/Alluvium
MKTF-31	8/23/2023	04/01/14	2	6,904.26	6906.87	6,903.11	2.61	6,887.53	19.34	ND	NA	9.52	6897.35	NA	6 - 21	Chinle/Alluvium
MKTF-31	9/6/2023	04/01/14	2	6,904.26	6906.87	6,903.11	2.61	6,884.06	22.81	ND	NA	9.48	6897.39	NA	6 - 21	Chinle/Alluvium
MKTF-32	12/6/2022	03/31/14	2	6,908.44	6911.11	6,907.16	2.67	6,883.36	27.75	ND	NA	9.81	6901.3	NA	9- 25	Chinle/Alluvium
MKTF-32	3/6/2023	03/31/14	2	6,908.44	6911.11	6,907.16	2.67	6,883.65	27.46	ND	NA	14.48	6896.63	NA	9- 26	Chinle/Alluvium
MKTF-32	4/11/2023	03/31/14	2	6,908.44	6911.11	6,907.16	2.67	6,883.65	27.46	ND	NA	14.25	6896.86	NA	9- 26	Chinle/Alluvium
MKTF-32	5/15/2023	03/31/14	2	6,908.44	6911.11	6,907.16	2.67	6,883.29	27.82	ND	NA	14.38	6896.73	NA	9- 26	Chinle/Alluvium
MKTF-32	6/1/2023	03/31/14	2	6,908.44	6911.11	6,907.16	2.67	6,883.65	27.46	ND	NA	14.58	6896.53	NA	9- 26	Chinle/Alluvium
MKTF-32	7/24/2023	03/31/14	2	6,908.44	6911.11	6,907.16	2.67	6,883.29	27.82	ND	NA	14.58	6896.53	NA	9- 26	Chinle/Alluvium
MKTF-32	8/21/2023	03/31/14	2	6,908.44	6911.11	6,907.16	2.67	6,883.65	27.46	ND	NA	15.05	6896.06	NA	9- 26	Chinle/Alluvium
MKTF-32	9/6/2023	03/31/14	2	6,908.44	6911.11	6,907.16	2.67	6,883.36	27.75	ND	NA	15	6896.11	NA	10 - 24	Chinle/Alluvium
MKTF-33	12/6/2022	04/03/14	2	6,936.59	6939.75	6,936.59	3.16	6,906.60	33.15	23.48	0.07	23.55	6916.2	6916.26	20 - 30	Chinle/Alluvium
MKTF-33	3/6/2023	04/03/14	2	6,936.59	6939.75	6,936.59	3.16	6,906.55	33.20	23.3	0.04	23.34	6916.41	6916.44	20 - 30	Chinle/Alluvium
MKTF-33	4/11/2023	04/03/14	2	6,936.59	6939.75	6,936.59	3.16	6,906.60	33.15	23	0.05	23.05	6916.7	6916.74	20 - 30	Chinle/Alluvium
MKTF-33	5/15/2023	04/03/14	2	6,936.59	6939.75	6,936.59	3.16	6,906.18	33.57	ND	NA	23.15	6916.6	NA	20 - 30	Chinle/Alluvium
MKTF-33	6/2/2023	04/03/14	2	6,936.59	6939.75	6,936.59	3.16	6,906.60	33.15	ND	NA	23.17	6916.58	NA	20 - 30	Chinle/Alluvium
MKTF-33	7/24/2023	04/03/14	2	6,936.59	6939.75	6,936.59	3.16	6,906.18	33.57	ND	NA	23.1	6916.65	NA	20 - 30	Chinle/Alluvium
MKTF-33	8/21/2023	04/03/14	2	6,936.59	6939.75	6,936.59	3.16	6,906.60	33.15	23.71	0.02	23.73	6916.02	6916.04	20 - 30	Chinle/Alluvium
MKTF-33	9/6/2023	04/03/14	2	6,936.59	6939.75	6,936.59	3.16	6,906.55	33.20	23.66	0.03	23.69	6916.06	6916.08	20 - 30	Chinle/Alluvium
MKTF-34	12/6/2022	03/31/14	2	6,942.42	6945.35	3,943.52	2.93	6,917.59	27.76	18.75	0.07	18.82	6926.53	6926.59	9 - 24	Chinle/Alluvium
MKTF-34	3/6/2023	03/31/14	2	6,942.42	6945.35	3,943.52	2.93	6,917.65	27.70	11.36	0.01	11.37	6933.98	6933.99	9 - 24	Chinle/Alluvium
MKTF-34	4/12/2023	03/31/14	2	6,942.42	6945.35	3,943.52	2.93	6,917.59	27.76	16.74	0.01	16.75	6928.6	6928.61	9 - 24	Chinle/Alluvium
MKTF-34	5/15/2023	03/31/14	2	6,942.42	6945.35	3,943.52	2.93	6,917.57	27.78	ND	NA	15.74	6929.61	NA	9 - 24	Chinle/Alluvium

ATTACHMENT A-4. WELL INFORMATION - SURVEY DATA, SCREENED INTERVAL, STRATIGRAPHIC UNIT
MKTF WELLS
GALLUP REFINERY, GALLUP, NEW MEXICO

Well ID	Sample Date	Date of Installation	Casing Diameter (in)	Surface Elevation (ft-amsl)	Well Casing Rim Elevation (ft-amsl)	Ground Elevation Inside Steel Sleeve (ft-amsl)	Stick-up length (ft)	Well Casing Bottom Elevation (ft-amsl)	Total Well Depth (ft-bmpe)	Depth to SPH (ft-bmpe)	SPH Thickness (ft)	DTW (ft-bmpe)	GW Elevation (ft-amsl)	Corrected Water Table [1] Elevation (ft-amsl)	Screened Interval Depth Top to Bottom (ft-bmpe)	Stratigraphic unit in which screen exists
MKTF-34	6/2/2023	03/31/14	2	6,942.42	6945.35	3,943.52	2.93	6,917.59	27.76	ND	NA	19.4	6925.95	NA	9 - 24	Chinle/Alluvium
MKTF-34	7/24/2023	03/31/14	2	6,942.42	6945.35	3,943.52	2.93	6,917.57	27.78	ND	NA	19.3	6926.05	NA	9 - 24	Chinle/Alluvium
MKTF-34	8/21/2023	03/31/14	2	6,942.42	6945.35	3,943.52	2.93	6,917.59	27.76	ND	NA	20.47	6924.88	NA	9 - 24	Chinle/Alluvium
MKTF-34	9/6/2023	03/31/14	2	6,942.42	6945.35	3,943.52	2.93	6,917.65	27.70	ND	NA	20.44	6924.91	NA	9 - 24	Chinle/Alluvium
MKTF-35	12/6/2022	11/19/14	2	6,951.90	6951.65	6,951.25	-0.25	6,935.42	16.23	10.01	0.04	10.05	6941.6	6941.63	6 - 16	Chinle/Alluvium
MKTF-35	3/7/2023	11/19/14	2	6,951.90	6951.65	6,951.25	-0.25	6,935.20	16.45	10.07	0.07	10.14	6941.51	6941.57	6 - 16	Chinle/Alluvium
MKTF-35	4/12/2023	11/19/14	2	6,951.90	6951.65	6,951.25	-0.25	6,935.42	16.23	9.73	0.01	9.74	6941.91	6941.92	6 - 16	Chinle/Alluvium
MKTF-35	5/16/2023	11/19/14	2	6,951.90	6951.65	6,951.25	-0.25	6,935.26	16.39	9.8	0.02	9.82	6941.83	6941.85	6 - 16	Chinle/Alluvium
MKTF-35	6/2/2023	11/19/14	2	6,951.90	6951.65	6,951.25	-0.25	6,935.42	16.23	ND	NA	9.65	6942	NA	6 - 16	Chinle/Alluvium
MKTF-35	7/24/2023	11/19/14	2	6,951.90	6951.65	6,951.25	-0.25	6,935.26	16.39	ND	NA	9.7	6941.95	NA	6 - 16	Chinle/Alluvium
MKTF-35	8/22/2023	11/19/14	2	6,951.90	6951.65	6,951.25	-0.25	6,935.42	16.23	ND	NA	9.71	6941.94	NA	6 - 16	Chinle/Alluvium
MKTF-35	9/6/2023	11/19/14	2	6,951.90	6951.65	6,951.25	-0.25	6,935.20	16.45	ND	NA	9.66	6941.99	NA	6 - 16	Chinle/Alluvium
MKTF-36	12/6/2022	11/19/14	2	6,953.90	6950.12	6,949.87	-3.78	6,934.54	15.58	8.4	0.08	8.48	6941.64	6941.70	5 - 15	Chinle/Alluvium
MKTF-36	3/7/2023	11/19/14	2	6,953.90	6950.12	6,949.87	-3.78	6,934.51	15.61	9.21	0.14	9.35	6940.77	6940.88	5 - 15	Chinle/Alluvium
MKTF-36	4/12/2023	11/19/14	2	6,953.90	6950.12	6,949.87	-3.78	6,934.54	15.58	ND	NA	8.91	6941.21	NA	5 - 15	Chinle/Alluvium
MKTF-36	5/16/2023	11/19/14	2	6,953.90	6950.12	6,949.87	-3.78	6,934.54	15.58	ND	NA	8.98	6941.14	NA	5 - 15	Chinle/Alluvium
MKTF-36	6/2/2023	11/19/14	2	6,953.90	6950.12	6,949.87	-3.78	6,934.54	15.58	8.7	0.01	8.71	6941.41	6941.42	5 - 15	Chinle/Alluvium
MKTF-36	7/24/2023	11/19/14	2	6,953.90	6950.12	6,949.87	-3.78	6,934.54	15.58	8.88	0.02	8.9	6941.22	6941.24	5 - 15	Chinle/Alluvium
MKTF-36	8/22/2023	11/19/14	2	6,953.90	6950.12	6,949.87	-3.78	6,934.54	15.58	8.82	0.14	8.96	6941.16	6941.27	5 - 15	Chinle/Alluvium
MKTF-36	9/6/2023	11/19/14	2	6,953.90	6950.12	6,949.87	-3.78	6,934.51	15.61	8.85	0.15	9	6941.12	6941.24	5 - 15	Chinle/Alluvium
MKTF-37	12/6/2022	11/18/14	2	6,959.07	6958.87	6,958.62	-0.20	6,934.33	24.54	10.6	0.04	10.64	6948.23	6948.26	4 - 24	Chinle/Alluvium
MKTF-37	3/7/2023	11/18/14	2	6,959.07	6958.87	6,958.62	-0.20	6,934.27	24.60	11.09	0.02	11.11	6947.76	6947.78	4 - 24	Chinle/Alluvium
MKTF-37	4/12/2023	11/18/14	2	6,959.07	6958.87	6,958.62	-0.20	6,934.26	24.61	10.5	0.01	10.51	6948.36	6948.37	4 - 24	Chinle/Alluvium
MKTF-37	5/16/2023	11/18/14	2	6,959.07	6958.87	6,958.62	-0.20	6,934.19	24.68	10.61	0.01	10.62	6948.25	6948.26	4 - 24	Chinle/Alluvium
MKTF-37	6/2/2023	11/18/14	2	6,959.07	6958.87	6,958.62	-0.20	6,934.33	24.54	10.49	0.01	10.5	6948.37	6948.38	4 - 24	Chinle/Alluvium
MKTF-37	7/24/2023	11/18/14	2	6,959.07	6958.87	6,958.62	-0.20	6,934.33	24.54	10.45	0.02	10.47	6948.4	6948.42	4 - 24	Chinle/Alluvium
MKTF-37	8/18/2023	11/18/14	2	6,959.07	6958.87	6,958.62	-0.20	6,934.26	24.61	ND	NA	10.26	6948.61	NA	4 - 24	Chinle/Alluvium
MKTF-37	9/6/2023	11/18/14	2	6,959.07	6958.87	6,958.62	-0.20	6,934.27	24.60	ND	NA	10.24	6948.63	NA	4 - 24	Chinle/Alluvium
MKTF-38	12/5/2022	11/20/14	2	6,955.17	6954.89	6,954.54	-0.28	6,934.58	20.31	ND	NA	10.32	6944.57	NA	5 - 20	Chinle/Alluvium
MKTF-38	3/7/2023	11/20/14	2	6,955.17	6954.89	6,954.54	-0.28	6,933.59	21.30	ND	NA	10.65	6944.24	NA	5 - 20	Chinle/Alluvium
MKTF-38	4/12/2023	11/20/14	2	6,955.17	6954.89	6,954.54	-0.28	6,934.71	20.18	ND	NA	10.11	6944.78	NA	5 - 20	Chinle/Alluvium
MKTF-38	5/16/2023	11/20/14	2	6,955.17	6954.89	6,954.54	-0.28	6,934.71	20.18	ND	NA	10.15	6944.74	NA	5 - 20	Chinle/Alluvium
MKTF-38	6/2/2023	11/20/14	2	6,955.17	6954.89	6,954.54	-0.28	6,933.59	21.30	ND	NA	10.1	6944.79	NA	5 - 20	Chinle/Alluvium
MKTF-38	7/24/2023	11/20/14	2	6,955.17	6954.89	6,954.54	-0.28	6,934.71	20.18	ND	NA	10.06	6944.83	NA	5 - 20	Chinle/Alluvium
MKTF-38	8/18/2023	11/20/14	2	6,955.17	6954.89	6,954.54	-0.28	6,934.56	20.33	ND	NA	9.96	6944.93	NA	5 - 20	Chinle/Alluvium
MKTF-38	9/6/2023	11/20/14	2	6,955.17	6954.89	6,954.54	-0.28	6,934.71	20.18	ND	NA	9.99	6944.9	NA	5 - 20	Chinle/Alluvium
MKTF-39	12/6/2022	11/14/14	2	6,953.97	6953.75	6,953.12	-0.22	6,939.56	15.19	10.52	0.15	10.67	6943.08	6943.20	5 - 15	Chinle/Alluvium
MKTF-39	3/7/2023	11/14/14	2	6,953.97	6953.75	6,953.12	-0.22	6,939.56	14.19	10.58	0.72	11.3	6942.45	6943.03	5 - 15	Chinle/Alluvium

ATTACHMENT A-4. WELL INFORMATION - SURVEY DATA, SCREENED INTERVAL, STRATIGRAPHIC UNIT
MKTF WELLS
GALLUP REFINERY, GALLUP, NEW MEXICO

Well ID	Sample Date	Date of Installation	Casing Diameter (in)	Surface Elevation (ft-amsl)	Well Casing Rim Elevation (ft-amsl)	Ground Elevation Inside Steel Sleeve (ft-amsl)	Stick-up length (ft)	Well Casing Bottom Elevation (ft-amsl)	Total Well Depth (ft-bmpe)	Depth to SPH (ft-bmpe)	SPH Thickness (ft)	DTW (ft-bmpe)	GW Elevation (ft-amsl)	Corrected Water Table [1] Elevation (ft-amsl)	Screened Interval Depth Top to Bottom (ft-bmpe)	Stratigraphic unit in which screen exists
MKTF-39	4/12/2023	11/14/14	2	6,953.97	6953.75	6,953.12	-0.22	6,939.56	14.19	10.22	0.51	10.73	6943.02	6943.43	5 - 15	Chinle/Alluvium
MKTF-39	5/15/2023	11/14/14	2	6,953.97	6953.75	6,953.12	-0.22	6,939.56	14.19	10.38	0.42	10.8	6942.95	6943.29	5 - 15	Chinle/Alluvium
MKTF-39	6/2/2023	11/14/14	2	6,953.97	6953.75	6,953.12	-0.22	6,939.56	15.19	9.98	0.42	10.4	6943.35	6943.69	5 - 15	Chinle/Alluvium
MKTF-39	7/24/2023	11/14/14	2	6,953.97	6953.75	6,953.12	-0.22	6,938.75	15.00	10.23	0.58	10.81	6942.94	6943.40	5 - 15	Chinle/Alluvium
MKTF-39	8/18/2023	11/14/14	2	6,953.97	6953.75	6,953.12	-0.22	6,938.55	15.20	10.42	0.54	10.96	6942.79	6943.22	5 - 15	Chinle/Alluvium
MKTF-39	9/6/2023	11/14/14	2	6,953.97	6953.75	6,953.12	-0.22	6,939.56	14.19	10.45	0.58	11.03	6942.72	6943.18	5 - 15	Chinle/Alluvium
MKTF-40	12/8/2022	11/13/14	2	6,891.35	6894.33	6,890.48	2.98	6,870.67	23.66	ND	NA	14.21	6880.12	NA	5 - 20	Chinle/Alluvium
MKTF-40	3/7/2023	11/13/14	2	6,891.35	6894.33	6,890.48	2.98	6,870.67	23.66	ND	NA	14.22	6880.11	NA	5 - 20	Chinle/Alluvium
MKTF-40	4/12/2023	11/13/14	2	6,891.35	6894.33	6,890.48	2.98	6,870.67	23.66	ND	NA	14.1	6880.23	NA	5 - 20	Chinle/Alluvium
MKTF-40	5/16/2023	11/13/14	2	6,891.35	6894.33	6,890.48	2.98	6,870.67	23.66	ND	NA	14.12	6880.21	NA	5 - 20	Chinle/Alluvium
MKTF-40	6/2/2023	11/13/14	2	6,891.35	6894.33	6,890.48	2.98	6,870.66	23.67	ND	NA	13.89	6880.44	NA	5 - 20	Chinle/Alluvium
MKTF-40	7/24/2023	11/13/14	2	6,891.35	6894.33	6,890.48	2.98	6,870.69	23.64	ND	NA	14.01	6880.32	NA	5 - 20	Chinle/Alluvium
MKTF-40	9/6/2023	11/13/14	2	6,891.35	6894.33	6,890.48	2.98	6,870.69	23.64	ND	NA	20.65	6873.68	NA	5 - 20	Chinle/Alluvium
MKTF-41	12/29/2022	11/14/14	2	6,891.11	6893.64	6,889.80	2.53	6,853.84	39.80	ND	NA	21.18	6872.46	NA	22 - 37	Chinle/Alluvium
MKTF-41	3/6/2023	11/14/14	2	6,891.11	6893.64	6,889.80	2.53	6,853.98	39.66	ND	NA	20.89	6872.75	NA	22 - 37	Chinle/Alluvium
MKTF-41	4/11/2023	11/14/14	2	6,891.11	6893.64	6,889.80	2.53	6,853.98	39.66	ND	NA	20.76	6872.88	NA	22 - 37	Chinle/Alluvium
MKTF-41	5/16/2023	11/14/14	2	6,891.11	6893.64	6,889.80	2.53	6,853.98	39.66	ND	NA	20.91	6872.73	NA	22 - 37	Chinle/Alluvium
MKTF-41	6/1/2023	11/14/14	2	6,891.11	6893.64	6,889.80	2.53	6,853.84	39.80	ND	NA	20.45	6873.19	NA	22 - 37	Chinle/Alluvium
MKTF-41	7/24/2023	11/14/14	2	6,891.11	6893.64	6,889.80	2.53	6,853.54	40.10	ND	NA	20.51	6873.13	NA	22 - 37	Chinle/Alluvium
MKTF-41	8/21/2023	11/14/14	2	6,891.11	6893.64	6,889.80	2.53	6,853.54	40.10	ND	NA	21.34	6872.3	NA	22 - 37	Chinle/Alluvium
MKTF-41	9/6/2023	11/14/14	2	6,891.11	6893.64	6,889.80	2.53	6,853.98	39.66	ND	NA	21.3	6872.34	NA	22 - 37	Chinle/Alluvium
MKTF-42	3/6/2023	11/12/14	2	6,890.42	6892.95	6,888.75	2.53	6,859.85	33.10	ND	NA	16.03	6876.92	NA	10 - 30	Chinle/Alluvium
MKTF-42	4/11/2023	11/12/14	2	6,890.42	6892.95	6,888.75	2.53	6,860.00	32.95	ND	NA	16	6876.95	NA	10 - 30	Chinle/Alluvium
MKTF-42	5/15/2023	11/12/14	2	6,890.42	6892.95	6,888.75	2.53	6,859.85	33.10	ND	NA	16.1	6876.85	NA	10 - 30	Chinle/Alluvium
MKTF-42	6/1/2023	11/12/14	2	6,890.42	6892.95	6,888.75	2.53	6,859.85	33.10	ND	NA	15.95	6877	NA	10 - 30	Chinle/Alluvium
MKTF-42	7/25/2023	11/12/14	2	6,890.42	6892.95	6,888.75	2.53	6,859.80	33.15	ND	NA	15.8	6877.15	NA	10 - 30	Chinle/Alluvium
MKTF-42	8/21/2023	11/12/14	2	6,890.42	6892.95	6,888.75	2.53	6,859.80	33.15	ND	NA	16.33	6876.62	NA	10 - 30	Chinle/Alluvium
MKTF-42	9/6/2023	11/12/14	2	6,890.42	6892.95	6,888.75	2.53	6,859.85	33.10	ND	NA	16.29	6876.66	NA	10 - 30	Chinle/Alluvium
MKTF-43	12/22/2022	11/11/14	2	6,874.12	6876.90	6,873.22	2.78	6,860.68	16.22	ND	NA	8.1	6868.8	NA	2 - 12	Chinle/Alluvium
MKTF-43	3/6/2023	11/11/14	2	6,874.12	6876.90	6,873.22	2.78	6,860.68	16.22	ND	NA	8.53	6868.37	NA	2 - 12	Chinle/Alluvium
MKTF-43	4/11/2023	11/11/14	2	6,874.12	6876.90	6,873.22	2.78	6,859.98	16.92	ND	NA	8.25	6868.65	NA	2 - 12	Chinle/Alluvium
MKTF-43	5/15/2023	11/11/14	2	6,874.12	6876.90	6,873.22	2.78	6,860.68	16.22	ND	NA	8.3	6868.6	NA	2 - 12	Chinle/Alluvium
MKTF-43	6/1/2023	11/11/14	2	6,874.12	6876.90	6,873.22	2.78	6,860.68	16.22	ND	NA	6.67	6870.23	NA	2 - 12	Chinle/Alluvium
MKTF-43	7/25/2023	11/11/14	2	6,874.12	6876.90	6,873.22	2.78	6,861.47	15.43	ND	NA	6.62	6870.28	NA	2 - 12	Chinle/Alluvium
MKTF-43	8/21/2023	11/12/14	2	6,890.42	6892.95	6,888.75	2.53	6,860.00	32.95	ND	NA	6.32	6870.58	NA	10 - 30	Chinle/Alluvium
MKTF-43	9/6/2023	11/11/14	2	6,874.12	6876.90	6,873.22	2.78	6,861.47	15.43	ND	NA	6.35	6870.55	NA	2 - 12	Chinle/Alluvium
MKTF-44	12/22/2022	11/11/14	2	6,867.41	6869.95	6,866.06	2.54	6,818.56	51.39	ND	NA	36.52	6833.43	NA	38 - 48	Chinle/Alluvium
MKTF-44	3/6/2023	11/11/14	2	6,867.41	6869.95	6,866.06	2.54	6,818.00	51.95	ND	NA	34.14	6835.81	NA	38 - 48	Chinle/Alluvium

ATTACHMENT A-4. WELL INFORMATION - SURVEY DATA, SCREENED INTERVAL, STRATIGRAPHIC UNIT
MKTF WELLS
GALLUP REFINERY, GALLUP, NEW MEXICO

Well ID	Sample Date	Date of Installation	Casing Diameter (in)	Surface Elevation (ft-amsl)	Well Casing Rim Elevation (ft-amsl)	Ground Elevation Inside Steel Sleeve (ft-amsl)	Stick-up length (ft)	Well Casing Bottom Elevation (ft-amsl)	Total Well Depth (ft-bmpe)	Depth to SPH (ft-bmpe)	SPH Thickness (ft)	DTW (ft-bmpe)	GW Elevation (ft-amsl)	Corrected Water Table [1] Elevation (ft-amsl)	Screened Interval Depth Top to Bottom (ft-bmpe)	Stratigraphic unit in which screen exists
MKTF-44	4/11/2023	11/11/14	2	6,867.41	6869.95	6,866.06	2.54	6,818.80	51.15	ND	NA	38.73	6831.22	NA	38 - 48	Chinle/Alluvium
MKTF-44	5/15/2023	11/11/14	2	6,867.41	6869.95	6,866.06	2.54	6,818.00	51.95	ND	NA	34.12	6835.83	NA	38 - 48	Chinle/Alluvium
MKTF-44	6/1/2023	11/11/14	2	6,867.41	6869.95	6,866.06	2.54	6,818.56	51.39	ND	NA	32.12	6837.83	NA	38 - 48	Chinle/Alluvium
MKTF-44	7/25/2023	11/11/14	2	6,867.41	6869.95	6,866.06	2.54	6,818.80	51.15	ND	NA	32	6837.95	NA	38 - 48	Chinle/Alluvium
MKTF-44	8/21/2023	11/11/14	2	6,874.12	6876.90	6,873.22	2.78	6,859.98	16.92	ND	NA	35.22	6834.73	NA	2 - 12	Chinle/Alluvium
MKTF-44	9/6/2023	11/11/14	2	6,867.41	6869.95	6,866.06	2.54	6,818.80	51.15	ND	NA	35.2	6834.75	NA	38 - 48	Chinle/Alluvium
MKTF-45	12/9/2022	Pre-existing	4	6,948.63	6949.59	6,948.27	0.96	6,919.35	30.24	15.01	0.1	15.11	6934.48	6934.56	Unknown	Chinle/Alluvium
MKTF-45	3/7/2023	Pre-existing	4	6,948.63	6949.59	6,948.27	0.96	6,919.14	30.45	14.84	0.06	14.9	6934.69	6934.74	Unknown	Chinle/Alluvium
MKTF-45	4/12/2023	Pre-existing	4	6,948.63	6949.59	6,948.27	0.96	6,912.14	37.45	14.29	0.01	14.3	6935.29	6935.30	Unknown	Chinle/Alluvium
MKTF-45	5/15/2023	Pre-existing	4	6,948.63	6949.59	6,948.27	0.96	6,912.14	37.45	14.14	0.01	14.15	6935.44	6935.45	Unknown	Chinle/Alluvium
MKTF-45	6/2/2023	Pre-existing	4	6,948.63	6949.59	6,948.27	0.96	6,919.14	30.45	ND	NA	14.52	6935.07	NA	Unknown	Chinle/Alluvium
MKTF-45	7/25/2023	Pre-existing	4	6,948.63	6949.59	6,948.27	0.96	6,912.14	37.45	ND	NA	14.5	6935.09	NA	Unknown	Chinle/Alluvium
MKTF-45	8/22/2023	Pre-existing	4	6,948.63	6949.59	6,948.27	0.96	6,919.35	30.24	14.72	0.05	14.77	6934.82	6934.86	Unknown	Chinle/Alluvium
MKTF-45	9/6/2023	Pre-existing	4	6,948.63	6949.59	6,948.27	0.96	6,912.14	37.45	14.75	0.03	14.78	6934.81	6934.83	Unknown	Chinle/Alluvium
MKTF-46	12/6/2022	10/12/19	2	6,954.73	6957.60	6,866.06	2.87	6,936.30	21.30	ND	NA	12.2	6945.4	NA	3 - 18	Chinle/Alluvium
MKTF-46	3/6/2023	10/12/19	2	6,954.73	6957.60	6,866.06	2.87	6,932.31	25.29	ND	NA	13.02	6944.58	NA	3 - 18	Chinle/Alluvium
MKTF-46	4/12/2023	10/12/19	2	6,954.73	6957.60	6,866.06	2.87	6,932.31	25.29	ND	NA	12.18	6945.42	NA	3 - 18	Chinle/Alluvium
MKTF-46	5/15/2023	10/12/19	2	6,954.73	6957.60	6,866.06	2.87	6,932.31	25.29	ND	NA	12.24	6945.36	NA	3 - 18	Chinle/Alluvium
MKTF-46	6/1/2023	10/12/19	2	6,954.73	6957.60	6,866.06	2.87	6,936.30	21.30	ND	NA	12.05	6945.55	NA	3 - 18	Chinle/Alluvium
MKTF-46	7/25/2023	10/12/19	2	6,954.73	6957.60	6,866.06	2.87	6,939.60	18.00	ND	NA	12.2	6945.4	NA	3 - 18	Chinle/Alluvium
MKTF-46	8/21/2023	10/12/19	2	6,954.73	6957.60	6,866.06	2.87	6,939.60	18.00	ND	NA	12.35	6945.25	NA	3 - 18	Chinle/Alluvium
MKTF-46	9/6/2023	10/12/19	2	6,954.73	6957.60	6,866.06	2.87	6,932.31	25.29	ND	NA	12.35	6945.25	NA	3 - 18	Chinle/Alluvium
MKTF-47	12/6/2022	10/14/19	2	6,959.51	6959.09	6,866.06	-0.42	6,944.79	14.31	11.16	0.09	11.25	6947.84	6947.91	4 - 14	Chinle/Alluvium
MKTF-47	3/7/2023	10/14/19	2	6,959.51	6959.09	6,866.06	-0.42	6,944.79	14.31	10.4	0.03	10.43	6948.66	6948.68	4 - 14	Chinle/Alluvium
MKTF-47	4/12/2023	10/14/19	2	6,959.51	6959.09	6,866.06	-0.42	6,944.79	14.31	9.98	0.02	10	6949.09	6949.11	4 - 14	Chinle/Alluvium
MKTF-47	5/15/2023	10/14/19	2	6,959.51	6959.09	6,866.06	-0.42	6,944.79	14.31	9.98	0.05	10.03	6949.06	6949.10	4 - 14	Chinle/Alluvium
MKTF-47	6/2/2023	10/14/19	2	6,959.51	6959.09	6,866.06	-0.42	6,944.79	14.31	9.99	0.02	10.01	6949.08	6949.10	4 - 14	Chinle/Alluvium
MKTF-47	7/25/2023	10/14/19	2	6,959.51	6959.09	6,866.06	-0.42	6,944.79	14.00	10.03	0.02	10.05	6949.04	6949.06	4 - 14	Chinle/Alluvium
MKTF-47	8/18/2023	10/14/19	2	6,959.51	6959.09	6,866.06	-0.42	6,944.79	14.00	ND	NA	9.42	6949.67	NA	4 - 14	Chinle/Alluvium
MKTF-47	9/6/2023	10/14/19	2	6,959.51	6959.09	6,866.06	-0.42	6,944.79	14.31	ND	NA	9.42	6949.67	NA	4 - 14	Chinle/Alluvium
MKTF-48	12/6/2022	10/14/19	2	6,959.24	6961.73	6,866.06	2.49	6,940.81	18.00	14	0.04	14.04	6947.69	6947.72	2 - 17	Chinle/Alluvium
MKTF-48	3/7/2023	10/14/19	2	6,959.24	6961.73	6,866.06	2.49	6,940.81	18.00	14.13	0.02	14.15	6947.58	6947.60	2 - 17	Chinle/Alluvium
MKTF-48	4/12/2023	10/14/19	2	6,959.24	6961.73	6,866.06	2.49	6,940.81	19.91	14.1	0.03	14.13	6947.6	6947.62	2 - 17	Chinle/Alluvium
MKTF-48	5/15/2023	10/14/19	2	6,959.24	6961.73	6,866.06	2.49	6,940.81	19.91	14.15	0.04	14.19	6947.54	6947.57	2 - 17	Chinle/Alluvium
MKTF-48	6/2/2023	10/14/19	2	6,959.24	6961.73	6,866.06	2.49	6,940.81	20.94	13.69	0.02	13.71	6948.02	6948.04	2 - 17	Chinle/Alluvium
MKTF-48	7/25/2023	10/14/19	2	6,959.24	6961.73	6,866.06	2.49	6,940.81	19.91	13.5	0.07	13.57	6948.16	6948.22	2 - 17	Chinle/Alluvium
MKTF-48	8/23/2023	10/14/19	2	6,959.24	6961.73	6,866.06	2.49	6,940.81	19.91	13.62	0.13	13.75	6947.98	6948.08	2 - 17	Chinle/Alluvium
MKTF-48	9/6/2023	10/14/19	2	6,959.24	6961.73	6,866.06	2.49	6,940.81	20.94	13.6	0.13	13.73	6948	6948.10	2 - 17	Chinle/Alluvium

ATTACHMENT A-4. WELL INFORMATION - SURVEY DATA, SCREENED INTERVAL, STRATIGRAPHIC UNIT
MKTF WELLS
GALLUP REFINERY, GALLUP, NEW MEXICO

Well ID	Sample Date	Date of Installation	Casing Diameter (in)	Surface Elevation (ft-amsl)	Well Casing Rim Elevation (ft-amsl)	Ground Elevation Inside Steel Sleeve (ft-amsl)	Stick-up length (ft)	Well Casing Bottom Elevation (ft-amsl)	Total Well Depth (ft-bmpe)	Depth to SPH (ft-bmpe)	SPH Thickness (ft)	DTW (ft-bmpe)	GW Elevation (ft-amsl)	Corrected Water Table [1] Elevation (ft-amsl)	Screened Interval Depth Top to Bottom (ft-bmpe)	Stratigraphic unit in which screen exists
MKTF-49	12/6/2022	10/15/19	2	6,944.00	6946.76	6,866.06	2.76	6,921.86	28.00	21.34	1.14	22.48	6924.28	6925.19	5 - 25	Chinle/Alluvium
MKTF-49	1/30/2023	10/15/19	2	6,944.00	6946.76	6,866.06	2.76	6,921.86	28.00	NA	NA	22.5	6924.26	NA	5 - 25	Chinle/Alluvium
MKTF-49	2/27/2023	10/15/19	2	6,944.00	6946.76	6,866.06	2.76	6,921.86	24.96	NA	NA	22.38	6924.38	NA	5 - 25	Chinle/Alluvium
MKTF-49	3/31/2023	10/15/19	2	6,944.00	6946.76	6,866.06	2.76	6,921.86	24.96	NA	NA	14.01	6932.75	NA	5 - 25	Chinle/Alluvium
MKTF-49	4/12/2023	10/15/19	2	6,944.00	6946.76	6,866.06	2.76	6,921.86	24.97	20.52	2.33	22.85	6923.91	6925.77	5 - 25	Chinle/Alluvium
MKTF-49	5/15/2023	10/15/19	2	6,944.00	6946.76	6,866.06	2.76	6,921.86	24.96	21.78	0.9	22.68	6924.08	6924.80	5 - 25	Chinle/Alluvium
MKTF-49	6/2/2023	10/16/19	2	6,939.68	6942.82	6,948.27	3.14	6,921.17	26.00	21.51	0.87	22.38	6924.38	6925.08	3 - 18	Chinle/Alluvium
MKTF-49	7/25/2023	10/15/19	2	6,944.00	6946.76	6,866.06	2.76	6,921.86	28.00	21.8	0.95	22.75	6924.01	6924.77	5 - 25	Chinle/Alluvium
MKTF-49	8/21/2023	10/15/19	2	6,944.00	6946.76	6,866.06	2.76	6,921.86	28.00	22.32	0.82	23.14	6923.62	6924.28	5 - 25	Chinle/Alluvium
MKTF-49	9/6/2023	10/15/19	2	6,944.00	6946.76	6,866.06	2.76	6,921.86	24.96	22.3	0.8	23.1	6923.66	6924.30	5 - 25	Chinle/Alluvium
MKTF-50	12/6/2022	10/16/19	2	6,939.68	6942.82	6,948.27	3.14	6,921.17	26.00	NA	NA	16.03	6926.79	NA	3 - 18	Chinle/Alluvium
MKTF-50	3/31/2023	10/16/19	2	6,939.68	6942.82	6,948.27	3.14	6,921.17	22.64	15.8	0.27	16.07	6926.75	6926.97	3 - 18	Chinle/Alluvium
MKTF-50	4/12/2023	10/16/19	2	6,939.68	6942.82	6,948.27	3.14	6,921.17	22.64	15.65	0.36	16.01	6926.81	6927.10	3 - 18	Chinle/Alluvium
MKTF-50	5/15/2023	10/16/19	2	6,939.68	6942.82	6,948.27	3.14	6,921.17	21.63	12.48	0.42	12.9	6929.92	6930.26	3 - 18	Chinle/Alluvium
MKTF-50	6/2/2023	10/16/19	2	6,939.68	6942.82	6,948.27	3.14	6,921.17	22.64	15.73	0.38	16.11	6926.71	6927.01	3 - 18	Chinle/Alluvium
MKTF-50	7/25/2023	10/16/19	2	6,939.68	6942.82	6,948.27	3.14	6,921.17	26.00	15.7	0.45	16.15	6926.67	6927.03	3 - 18	Chinle/Alluvium
MKTF-50	8/23/2023	10/16/19	2	6,939.68	6942.82	6,948.27	3.14	6,921.17	22.64	17.39	0.36	17.75	6925.07	6925.36	3 - 18	Chinle/Alluvium
MKTF-50	9/6/2023	10/16/19	2	6,939.68	6942.82	6,948.27	3.14	6,921.17	26.00	17.35	0.37	17.72	6925.1	6925.40	3 - 18	Chinle/Alluvium

Definitions:
amsl = above mean sea level
bmpe = below measuring point elevation reported as the well casing rim elevation
DRY = no water detected
DTW = depth to water
ft = feet
GW = groundwater
ID = identification
in = inch
NA = not applicable
SPH = separate phase hydrocarbons

Note:
1. Corrected Water Table Elevation applies only if SPH thickness column measurement exists. (0.8 X SPH thickness + Groundwater Elevation)
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.

ATTACHMENT A-5. WELL INFORMATION - SURVEY DATA, SCREENED INTERVAL, STRATIGRAPHIC UNIT
ARTESIAN WATER WELLS
GALLUP REFINERY, GALLUP, NEW MEXICO

Well ID	Date of Installation	Submersible pump depth (ft bgs)	Casing Diameter (in)	Well Head Elevation Mark* (North) (ft)	Well Head Elevation Mark* (West) (ft)	Well Head Elevation Mark* (Z) (ft)	Measuring Point Description	Total Well Depth (ft bgs)
PW-2	9/24/1956	800	16.0	3300.40	4694.28	162.78	1st Discharge tee or elbow	1075.00
PW-3	4/1979	900	14.0	2932.83	1387.79	248.00	1st Discharge tee or elbow	1030.00
PW-4	11/12/1999	750	12.0 [2]	1895.73	2979.78	178.51	1st Discharge tee or elbow	1076.00 [3]

Well ID	Well Casing Bottom Elevation (ft)[1]	Stratigraphic unit	Aquifer
PW-2	2225.40	Chinle	San Andreas/Yeso Aquifer
PW-3	1902.83	Chinle	San Andreas/Yeso Aquifer
PW-4	819.73	Chinle	San Andreas/Yeso Aquifer

bgs = below ground surface
ft = feet
ID = identification
in = inch
MSL = mean sea level
* Basis of survey Refinery Control Point at 1000W, 2575N, plant elevation = 254.87 ft and MSL elevation = 6959.41 ft

Notes:
1) Well Casing Bottom Elevation using Well Head Elevation Mark (North) as a reference point.
2) Actual well casing diameter is 12 inches. The 176 ft of 24 in steel casing is the actual cemented support for development of the well.
3) The total well depth is 1020 ft at a casing diameter of 12.0 in with additional 56 ft x 7-7/8 in diameter open exploratory hole which was accounted for as total well depth of 1076 ft.

Appendix B-2 – Per- and Polyfluoroalkyl Substances Sampling Standard Operating Procedures

memorandum

To: Trihydro Employees
From: Mitch Olson
Date: September 2, 2022
Re: PFAS Sampling Standard Operating Procedure

1.0 INTRODUCTION

This standard operating procedure (SOP) establishes protocols for Trihydro employees and subcontractors to be followed when collecting samples for per- and polyfluoroalkyl substances (PFAS). This SOP includes general PFAS sampling procedures as well as procedures for specific activities including sampling of drinking water, groundwater, surface water/sediment, soils, and other media.

This PFAS SOP is divided into the following Sections:

Although PFAS sampling procedures are generally similar to conventional sampling, several aspects of sampling and analysis for PFAS are unique, and following these PFAS-specific procedures is critical. PFAS-specific procedures are necessary due to their high tendency for sample cross-contamination, which is related to the following characteristics:

- Extremely low environmental concentrations of interest
- Large numbers of individual analytes that may be present in environmental samples
- Potential presence in many standard sampling materials, especially in Teflon® or polytetrafluoroethylene (PTFE)
- Presence in everyday materials including food packaging and clothing
- Greater scrutiny of results than for other contaminants

The objective of this SOP is to establish general PFAS sampling procedures to guide PFAS sampling events across the company, provide defensible PFAS data, and remain consistent with current PFAS sampling guidance and best practices.

Due to anticipated/ongoing changes in procedures and the state of the science for PFAS, this SOP will be reviewed and/or updated annually, at a minimum, during the first quarter of each calendar year. Project teams need to use the most recent version of this document before planning and implementation of field work.

1.1 PFAS BACKGROUND

Since the 1950s, PFAS have been incorporated into many consumer and industrial products. One of the many historical uses is in firefighting foams ("Aqueous Film Forming Foams," or AFFF). AFFF products may be used for fire suppression at facilities where Class B fires (i.e., those involving flammable liquids and gases) may be a concern, including airports, firefighting training areas, and other facilities where flammable hydrocarbons are present. PFAS have also been used for widespread industries including non-stick material (e.g., Teflon®) manufacturing, metal plating, paper/fabric production, plastics, semiconductors, aerospace industries, and in processes such as mist/dust suppression. Environmental releases of PFAS compounds have resulted from their historical uses in AFFF and industrial processes.

In total, the chemical class of PFAS includes thousands of individual compounds. The most well-known and widely regulated of these compounds include perfluorooctanoic acid (PFOA) and perfluoroalkyl sulfonate (PFOS). The United States Environmental Protection Agency (EPA) released final Health Advisory (HA) levels for these compounds of 70 parts per trillion (ppt) (i.e., 0.070 parts per billion); in June 2022, the EPA released updated interim HA levels of 0.004 ppt and 0.020 ppt for PFOA and PFOS, respectively. The EPA also released final HA values for two additional PFAS compounds, perfluorobutane sulfonate (PFBS) and hexafluoropropylene oxide (HFPO) dimer acid (otherwise known as GenX) of 10 and 2,000 ppt, respectively. Furthermore, several states have established their own standard values for PFAS in drinking water, surface water, and soils (ITRC 2022). Many states have adopted values lower than the EPA HA levels.

PFAS also exhibit unique chemical and physical properties, with important implications for sample collection. The molecular structure includes a nonpolar/fluorinated tail and a non-fluorinated head. The polar/nonpolar structure makes PFAS function as surfactants (e.g., substances that decrease a liquid's surface tension), and are prone to accumulate at air/water interfaces (especially where foam may be formed). Because of this tendency to accumulate at interfaces, surface/stormwater sampling should avoid interfaces, if possible, to avoid high-biased sample data. In terms of sampling, PFAS are considered to be "sticky" in that they may temporarily sorb to sampling materials, which increases the risk of cross contamination if procedures described herein are not strictly observed.

1.2 PFAS SAMPLING GUIDANCE DOCUMENTS

The SOP presented herein has been developed in consideration of select state-specific guidance documents as well as the Interstate Regulatory Guidance Council (ITRC). Additional guidance may need to be referenced for site-specific circumstances, for example, several states have published independent guidance documents (in addition to the California and Michigan documents noted herein). PFAS sampling and analytical guidance documents include the following:

- Per- and Polyfluoroalkyl Substances (PFAS) Sampling Guidelines for Non-Drinking Water published by the California State Water Quality Control Board (The Water Boards) Division of Water Quality in September 2020 (The Water Boards 2020).
- General PFAS Sampling Guidance published by the Michigan Department of Environmental Quality (MDEQ) in October 2018 (MDEQ 2018).
- ITRC's guidance document, *Technical Resources for Addressing Environmental Releases of Per- and Polyfluorinated Compounds (PFAS)*, Chapter 11, Sampling and Analytical Methods, provides detailed information on sampling protocols (ITRC 2022).

2.0 PFAS SAMPLING TRAINING REQUIREMENTS

Due to the need for specialized procedures used for PFAS sampling, only personnel who have completed Trihydro's training program should collect environmental samples for PFAS. Trihydro's PFAS sampling training program includes the following elements:

- Initial office-based training conducted by one or more members of the Trihydro PFAS technical team, including PFAS background, overview of this SOP, and discussion of unique aspects of PFAS sampling with a detailed discussion of the material compatibility table. Training should include discussion of procedures commensurate with sampling to be conducted. Office-based training will cover items in the checklist (Attachment A) and is anticipated to require 1 hour for drinking/waste-water sampling conducted above ground (e.g., from spigots) and 1-2 hours for environmental sampling including soils, sediment, surface water, groundwater. The office-based training is considered sufficient for personnel collecting tapwater/spigot sampling; personnel conducting environmental sampling (e.g., groundwater, surface water, soils, and sediment) must complete on-site training.
- On-site training will be led by an experienced PFAS sampler. Experienced PFAS samplers will use the Field Training Checklist included as Attachment B of this SOP to ensure that the applicable aspects of PFAS field techniques are discussed during the on-site training event.
- Annual refreshers will consist of office-based training/discussion to share information learned throughout the company during PFAS sampling events, updates in terms of standard methods, and to provide feedback on lessons learned.

3.0 General PFAS Sampling Procedures

This section provides general information on PFAS sampling procedures, to be used for all PFAS sampling activities. In general, collection of PFAS samples follows similar procedures to those employed for conventional sampling; however, due to the unique properties of PFAS discussed in Section 1, there are several key aspects of PFAS sampling that warrant additional attention. This SOP focuses on areas where PFAS sampling requires different considerations than conventional sampling procedures. PFAS may be present in a wide variety of commercial products including common household items (e.g., food wrappers, Gore-Tex® or other waterproof fabrics, stain-resistant fabrics, cosmetics, sunscreens, and moisturizing lotions). Table 1 presents a list of sampling materials that are prohibited or acceptable, following The California Water Boards 2020, MDEQ 2018, and ITRC 2022 guidance. **It is very important that PFAS-compatible materials are used and that sampling procedures follow protocols to minimize risk of cross contamination.** This section provides guidance on how to manage sampling to minimize risks of PFAS contamination. PFAS sampling procedures for specific media types are provided in subsequent sections.

While planning for PFAS sampling, the following guidelines should be kept in mind:

- Plan ahead to ensure materials and procedures can be properly vetted for PFAS compatibility
- For PFAS field sampling, include extra time, such that the field crew does not have to rush
- Simplify procedures and minimize clutter to reduce cross-contamination risks

3.1 CLOTHING AND PERSONAL CARE PRODUCTS

The sample collection team should be aware of clothing compatibility (per Table 1) with PFAS sampling. PFAS are present in waterproof and stainproof fabrics, and may be present in new clothing, regardless of whether clothing is considered "waterproof". Clothing worn during PFAS sampling should meet the following criteria:

- All clothing should be well-laundered, i.e., washed at least six times after purchase.
- Before sampling, clothing should be laundered without fabric softener or dryer sheets.
- For clothing and jackets worn during PFAS sampling, cotton or synthetic fabrics are acceptable, if the fabrics are not treated to be water/stain resistant (and all clothing regardless of material must be well laundered).
- Clothing containing Gore-Tex® (or similar waterproofing) should not be present at the field site; if traveling, such clothing should not be packed next to clothing that will be worn for sampling.
- Waterproof clothing made with polyurethane, PVC, wax-coated fabrics, rubber, or neoprene (e.g., *Helly Hansen Storm Waterproof Rain Jacket*, with a shell made of PVC) is acceptable.

- Do not use unnecessary personal care products on the day of sampling (e.g., nail polish, cologne/perfume, lotions); wash hands with soap and water after applying personal care products on the day of sampling.

3.2 PFAS SAMPLING HEALTH AND SAFETY CONSIDERATIONS

In some circumstances, personal protective equipment (PPE) requirements may create conflicts with the PFAS sampling compatible materials shown in Table 1. Such conflicts should be identified during the planning/work-plan development process so they can be managed. **Do not sacrifice PPE requirements for PFAS sample collection.** Through planning, a solution can generally be found. For example, waterproof steel-toed workboots may be covered by overshoes made of polyvinyl chloride (PVC) or similar PFAS-compatible materials. Sunblock, insect repellant, and/or related materials should be applied ahead of time and hands washed with soap and water after these are applied.

Potential health-and-safety/PFAS conflicts and resolutions should be documented in field notes. The sampler should be conscientious about potential pathways between these products and the sample, and look for ways to eliminate these pathways.

3.3 SAMPLING EQUIPMENT AND MATERIALS

PFAS are potentially present in many common sampling materials; Table 1 provides a summary of materials that are compatible/incompatible with PFAS sampling. Many common sampling materials are not compatible with PFAS, thus it is important that the sampling team is familiar with this table.

Materials that are useful to have on-site for PFAS sampling include the following:

- Polyethylene (PE) sheeting (and scissors to cut the sheeting)
- Packing tape to attach sheeting to sample preparation surfaces (optional)
- Sample staging table (optional)
- Nitrile gloves - excess quantity for frequent changing of gloves
- Ziploc bags - excess quantity for sample containers, double-bagged ice, and separating/containing sampling equipment
- Untreated paper towels - excess quantity for general use
- Waste containers (e.g., contractor bags) to ensure that waste materials may be removed from the sample processing area immediately after being generated, thus avoiding unnecessary clutter
- Loose leaf paper, pre-printed for recording sample log information
- PFAS-compatible pens, such as a Uni-ball Power Tank RT Retractable Ballpoint Pen

If decontamination is required, purchase PFAS-free water from the laboratory along with the sample container order. PFAS-free water may be expected to cost approximately $20 per liter. If a large volume (e.g., multiple gallons) of decontamination water is required, a local water source may be used only if tested and verified to be 'PFAS-free' ahead of time.

3.4 SAMPLING CONTAINERS

Sampling containers provided by the laboratory for PFAS analysis consist of polypropylene or high-density polyethylene (HDPE). Glass containers are never suitable for PFAS analysis of water samples, as PFAS can adsorb onto glass; glass containers are not ideal for soil sampling, but may be used if nothing else is available. Teflon-lined lids are not acceptable for PFAS sampling. Before sampling, confirm PFAS compatibility, including sample-container composition with the selected analytical laboratory. For drinking water samples, USEPA method 537.1 requires 250 milliliters (mL) per sample container and USEPA Method 533 requires 100-250 mL per sample container; laboratories generally require two containers per sample. Volume requirements may vary per laboratory requirements; confirm with laboratory before sampling. Requirements for preservatives (Trizma® buffer or ammonium acetate) are discussed in Section 8.3.

For non-drinking water matrices, the absence of USEPA-promulgated analytical methods allows for flexibility in the sample quantity and preservation; required quantities, bottles, and preservatives should be confirmed with the analytical laboratory prior to field activities.

3.5 SAMPLING AREA PREPARATION

To minimize the potential for cross contamination, designate separate sampling and preparation spaces within the work area. For PFAS sampling of all media types, the following area preparation steps can facilitate successful PFAS sampling:

- Remove unnecessary materials from the sampling area. This includes materials that are part of the sampling event but are not needed for sample collection (e.g., field notes).
- Under certain circumstances (e.g., residential water sampling), a Ziploc bag may be used to transport/store sampling containers and sampling materials. These materials must be disposed of after a single use and are <u>not</u> to be used at multiple locations.
- Consider using disposable PE sheeting to setup a workspace for sampling equipment. For small, localized sample collection (e.g., from a spigot) use PE sheeting or untreated paper towels to setup a workspace.
- For certain types of sampling, a portable/collapsible table may be used, with PE sheeting used to cover the table. Packaging tape is acceptable to secure PE sheeting, as long as the tape is applied beneath the table surface and does not contact sample containers during processing. The top of a

cooler may also be used for equipment storage, if covered by PE/untreated paper towels or thoroughly decontaminated.

- Have an excess quantity of nitrile gloves accessible; gloves are to be changed frequently, including as a last step before sample collection. Gloves should be kept in the box (or in a clean Ziploc bag) until use and should not be carried in a pocket, or in a similar uncontrolled manner. Avoid handling of the nitrile glove box after donning clean nitrile gloves.
- Make sure personnel that are not equipped for PFAS sampling remain outside of the immediate sampling area (at least 6 feet away).

Preparing sample containers and coolers before the event:

- Always wear clean nitrile gloves while handling sample containers and PFAS-free water containers, even when organizing before the sampling event.
- Preparing bottle sets before the sampling event is helpful to minimize handling of containers required in the field. Preparation might include grouping of bottle sets in Ziploc bags. Sample container labels may be filled out (with all information except sample time) and applied ahead of time. Ziploc bags can be labeled using an Ultra-Fine point sharpie or Uni-ball Power Tank RT Retractable Ballpoint Pen.
- Ensure that sample containers are controlled through the entire preparation process. They may be in a cooler, placed in Ziploc bags, or placed on PE sheeting. Sample containers should be stored in a liner-bag or Ziploc bag within the cooler. Do not place sample containers on 'uncontrolled' surfaces, such as the exposed lid of a cooler, the tailgate of a truck, or a carpeted floor, unless the surface is decontaminated or covered with PE sheeting or clean, untreated paper towels.
- Prepare separate coolers for clean/empty sample containers and filled containers such that clean/empty and filled containers are not mixed in a single cooler.

3.6 SAMPLE COLLECTION AND HANDLING

PFAS are sticky, in that they tend to adhere to solid surfaces, and therefore may be transferred from source to sample during the handling process. The following presents a list of sampling dos and don'ts that mitigate this cross-contamination risk.

Do	Don't
Change gloves frequently, including immediately before sampling.	Touch anything besides sample containers with final pair of nitrile gloves.
Keep sample containers controlled through the entire sampling process, and keep containers closed/sealed until filling with a sample.	Put sample containers or sampling equipment on the ground or in contact with any surface that cannot be shown to be free of PFAS.
Have at least two coolers, one for unused sampling containers and one for the PFAS samples.	Put PFAS samples in a cooler with unused sampling containers.
Practice good housekeeping by keeping sample collection area clean and free of used paper towels, gloves, sampled media (soil and water).	Bring items into the sample collection area that are not necessary to the process of sample collection (notebooks, work plans, food/drink containers, etc.). Water bottles for hydration are allowable at the sampling site, but should be kept in the car and out of the sampling/staging area.
When sampling liquids, fill the container to the shoulder. Some headspace is preferred.	Field filter the PFAS sample. If filtration is required, notify the laboratory.
Collect PFAS samples first, then other samples. This minimizes contact of PFAS samples with the handling of other sampling containers.	Intermingle PFAS and non-PFAS sample containers.
Remove excess sample media (soil, sediment or water) to the extent practicable from the exterior of sample containers to minimize cross contamination in cooler and at laboratory.	Rinse reusable sampling equipment with regular tap water. After a thorough decontamination, rinse with PFAS free water.

3.7 SAMPLE SHIPMENT

PFAS samples also have unique requirements for packaging and shipment. Additional considerations for PFAS sample shipment include use of additional Ziploc bags to mitigate cross-contamination potential during sample handling or during shipment. All sample sets should be packaged in separate Ziploc bags; the two (or more) containers filled for each sample set can be placed in a single sealed bag. If high PFAS concentrations are expected, samples containers may be double-bagged to minimize cross-contamination risk in the cooler (under such circumstances a trip blank should be included, as described in Section 8.4). PFAS samples are shipped to the analytical laboratory in a cooler, via expedited delivery or overnight shipping if possible, following similar protocols used for conventional sampling. Finally, as with conventional sampling, the samples must be received by the laboratory at 4±2 degrees Celsius (°C) or as required by the sample method specified in the work plan. For cooling of samples during shipment, use water-based ice instead of gel ice (e.g., Blue Ice). Under circumstances where gel ice may be needed, make sure the gel ice is double bagged in Ziploc bags and/or properly decontaminated, with an equipment blank collected. Even water-based ice is a potential PFAS source within the coolers, therefore the ice must be double-bagged in Ziploc (or similar) bags. Clean nitrile gloves should be worn while handling ice, and should be changed prior to handling sample containers.

Additional considerations for PFAS sampling in specific matrices (drinking water, groundwater, surface water/sediment, and other media types) are provided in the following sections:

- Section 4 Drinking Water and Supply Well Sampling
- Section 5 Groundwater Sampling
- Section 6 Surface Water and Sediment Sampling
- Section 7 Surface and Subsurface Soil Sampling
- Section 8 Other Sampling Matrices

3.8 DECONTAMINATION

- To reduce/minimize investigation-derived waste (IDW) a spray-bottle method of decontamination may be used where adequate. Zepp® brand spray bottles are recommended.
- Decontamination should use a phosphate-based detergent, such as Alconox® or Liquinox® Note that Simple Green® has not been confirmed to be PFAS free, and is therefore not approved for PFAS sampling decontamination at this time.
- PFAS-free water (lab supplied is preferable) should be used for a final rinse. If a large volume of decontamination water is needed, a local water source may be used, but the water source should be tested and verified as being PFAS-free. Best practice is to use lab-supplied PFAS-free water for a final rinse.
- Equipment blanks should be collected from non-dedicated equipment that contacts the sampled media to validate decontamination procedures.
- Decontaminated equipment may be stored in fresh Ziploc bags, in decontaminated equipment cases, on HDPE sheeting, or similar, until immediately prior to sampling, to minimize risk of contamination.
- Additional decontamination considerations for sampling of different media types are provided in Sections 4 through 7.

3.9 INVESTIGATION DERIVED WASTE

IDW may include purge water, soils, disposable tubing from groundwater sampling, purge water from spigot/sample port sampling, spent PPE, or other solid waste generated during the collection of PFAS samples. Although PFAS compounds are new analytes for many facilities where sampling is conducted, the chemistry of purged groundwater will be similar to that of water generated during regular sampling events. Therefore, depending on local, state, or site-specific requirements, all IDW water may be handled following normal site-sampling procedures. Other solid waste will be discarded in an appropriate on-site container, following standard site procedures for solid waste. Potential PFAS-impacted IDW will need to be profiled and managed in accordance with local/state or client requirements.

3.10 FIELD DOCUMENTATION

The information documented during the field activities should include, at a minimum:

- Photo-documentation (if allowable – photo documentation can be helpful for documenting unconventional site conditions for potential PFAS impacts)
- Descriptions of sample matrices
- Descriptions of sampling locations
- Sample collection dates and times
- Sample container sizes, amounts, types, and preservatives
- Sampling methodology
- Deviations from this SOP or site-specific work plans

An example field documentation form used for PFAS sampling is provided in Attachment C.

3.11 SITE DATA MANAGEMENT

Due to the prolific nature of PFAS, its status as an emerging contaminant, and the high degree of uncertainty surrounding environmental liability associated with PFAS, many PFAS sites are the subject of potential or ongoing litigation. As such, additional care should be used when managing site data. This may include various best practices that should be discussed with the client prior to initiating sampling activities, including:

- Determining what documentation to collect for sample procedures to verify that samples are representative of site conditions.
- Determining if existing judicial orders are present which may direct sample activities, notifications, or document retention and production requirements.
- Being thorough, yet careful to only record data observations (as opposed to including qualitative speculation, judgement, or opinion) when producing field notes, sample logs, sample figures, and other documentation.
- Determining whom may receive/respond to inquiries from members of the public.
- Discussing with field staff and project managers what information can and cannot be disclosed about site activities.

- Evaluating potential conflicts of interest and making staffing and project selection determinations accordingly.

4.0 DRINKING WATER AND SUPPLY WELL SAMPLING

This section provides PFAS sampling considerations for drinking water and supply well matrices. This section is not intended to teach water sampling fundamentals, but rather to provide instruction on differences in procedures and considerations specific to PFAS sampling. Procedures discussed in this section are additional considerations to the general PFAS sampling guidelines provided in Section 3. Due to the potential sensitivity to low-level detections in drinking water samples, drinking water and supply well sampling should be undertaken with the utmost consideration of cross contamination risk, materials used, and planning of sampling procedure.

4.1 EQUIPMENT/MATERIALS

In addition to the general and decontamination supplies listed in Sections 3.3 and 3.8, respectively, additional sample materials and supplies may include:

- Purge water collection buckets (optional), in the event that purge water needs to be contained, or a sample tap is located in a vault or other undrained location.
- A garden hose (optional) may be used to direct purge water from an exterior spigot, if needed to direct drainage to a suitable location; however, the hose must be removed prior to sampling such that a sample is collected directly from the spigot.

4.2 SAMPLING PROCEDURES

Sample collection for PFAS should generally follow these procedures. During most steps, samplers should don new (unused) nitrile gloves, even if it is not expressly identified below. New gloves should always be donned before handling sample containers, at any time.

- Using appropriate pen or ultra-fine Sharpie, fill out sample labels with all information except sample time and apply labels to sample containers. Pre-labeled sample containers may be stored in labeled 1-gallon Ziploc bags prior to sampling.
- Prepare a clean workspace for the sample staging area, using a decontaminated surface, clean PE sheeting, or untreated paper towels.
- Prepare the sampling area, removing moveable/unnecessary materials from the sampling area, including unnecessary hoses, aerators, filters, or other attachments/extensions of the tap (as noted, a hose may be in place during purging from an exterior spigot, only if needed to direct purge water, but must be removed prior to sampling).
- Don new nitrile gloves, changing as needed. Identify the sample port and open to allow purging and stabilization of the water flow for at least 3 minutes (purge time may vary based on project objectives) at a moderate to high flow.

- After purging is complete, reduce the discharge rate to a slow stream (generally less than 1 liter per minute) to minimize potential sample aeration.
- Don new nitrile gloves and collect the sample, filling each sample container to the shoulder.
- After closing sample containers, remove excess water from sample container surface with a fresh, untreated paper towel (excess water can facilitate cross-contamination) and place sample containers inside a new Ziploc bag. Double bag samples if they come from an area with known elevated PFAS levels.
- Place the samples in a cooler with ice, separate from any cooler with empty sample bottles.
- After sample handling is complete, close the sample spigot.

4.3 DECONTAMINATION AND IDW MANAGEMENT

The need for decontamination of reusable sampling equipment is not anticipated for water sampling from spigots. If reusable equipment such as a portable table for sample staging is used, which cannot be covered with PE sheeting, decontaminate using Alconox or similar and PFAS-free water.

Use a plastic contractor's bag (or similar) to contain solid IDW, including PE sheeting, nitrile gloves, Ziploc baggies, and other sampling materials, to minimize risks of cross contamination.

4.4 OTHER NOTES

- If a hose is used to direct water during purging, it must be removed prior to sampling.
- If Teflon® tape is visible at the sample port locations where water exists the port, document on the field forms. Although PFAS are associated with Teflon® tape production, experience to date suggests that it isn't a significant source of PFAS contamination in samples collected; nevertheless, its presence should be noted.

Domestic water may flow through a pressure tank or treatment system (e.g., water softener) before being discharged from a tap. For domestic wells, depending on sampling objectives, it may be necessary to collect water samples pre-treatment, post-treatment, or both. Pre-treatment sampling may be best if sampling is being conducted to evaluate local source-water impacts, but post-treatment may be best if sampling is conducted to evaluate drinking water exposure.

5.0 GROUNDWATER SAMPLING

This section provides PFAS sampling considerations specific to groundwater matrices. This section assumes general understanding of basic groundwater sampling procedures, and is not intended to teach groundwater sampling fundamentals, but rather to provide instruction on differences in procedures and considerations specific to PFAS sampling. Groundwater sampling typically requires purging of groundwater from wells using standard ("high-volume") or low-flow methods; alternatively, no-purge methods such as HydraSleeves are available. Where appropriate, Trihydro's preferred groundwater sampling method for PFAS is no-purge sampling using HydraSleeves, to limit risk of cross-contamination and minimize risk of bias in sampling results due to artificially mobilizing PFAS in groundwater during purging. If no-purge sampling is not feasible, or is not accepted by regulatory agencies, low-flow sampling is recommended. Standard, high-volume purging methods should be avoided if possible, but may be required due to deep groundwater or other location-specific needs. Regardless of sampling method, sampling materials should be screened for PFAS compatibility. Additional considerations for sampling materials associated with these methods are provided in this section. The procedures discussed in this section are additional considerations to the general PFAS sampling guidelines provided in Section 3.

5.1 EQUIPMENT/MATERIALS

In addition to the general and decontamination supplies listed in Sections 3.3 and 3.8, respectively, additional sample materials and supplies required for PFAS sampling via no-purge sampling, low-flow sampling, bailer sampling, and submersible pump sampling are described below.

No-purge sampling (preferred). No-purge sampling may be conducted using HydraSleeve or other passive samplers constructed of HDPE or similar PFAS-compatible material. Passive diffusion samplers are also available for PFAS sampling. When ordering HydraSleeves (or similar no-purge sampling devices), communicate with the vendor that they are to be used for PFAS sampling, and materials must be PFAS compatible. PFAS-compatible rope (e.g., cotton or nylon) must be used for HydraSleeve deployment; it is recommended (but not required) to procure the PFAS-compatible rope from the HydraSleeve vendor. Deployment of no-purge sampling equipment can generally follow manufacturer's instructions but should also follow the general PFAS sampling approach described herein.

The HydraSleeve samplers consist of collapsible HDPE plastic sleeves that are deployed in a well at a fixed depth within the screened interval (typically near the bottom of the screened interval). A check valve at the top of the sleeve prevents groundwater from entering the sleeve during deployment. After deployment, the samplers are left in place for a prescribed amount of time (typically a week) to allow groundwater within the well to equilibrate with the formation. For sample collection and recovery, the HydraSleeve sampler is pulled upward, which opens the check valve and allows water to fill the sleeve. The HydraSleeve sampler is then recovered to the surface, and a sample collected from the sleeve. The sleeves are available in 1-liter, 2-inch well diameter size ('Super/SkinnySleeve 1-Liter', part number PFCHDSS-1L) and 2-liter, 2-inch well diameter size ('Super/SkinnySleeve 2-Liter', part number PFCHDSS-2L). For groundwater sampling in 4-inch wells, the HydraSleeve sampler may be deployed with a 4- to 2-inch reducer and spring clip, which is available from the vendor. Non-disposable components (dedicated materials) associated with the HydraSleeves (i.e., reducer, spring clip, and weight) should be dedicated to each well.

Low-flow sampling. Low-flow sampling involves well-purging at a limited flow rate (e.g., <500 mL/min) until parameters stabilize (EPA 1996). A peristaltic pump is recommended for PFAs sampling, if water depth can accommodate a peristaltic pump, to reduce/eliminate the need for equipment decontamination between sampling locations. If needed (e.g., for water too deep for a peristaltic pump), bladder pumps or electric submersible pumps may be used. Dedicated pumps are preferred, otherwise PFAS-compatible decontamination procedures must be completed between locations. For a bladder pump, the pump body should be constructed of stainless steel (or other PFAS compatible material), and the bladder and O-rings must be constructed of polyethylene or similar PFAS-compatible materials, and be replaced between sample locations. If an electric submersible pump is selected, evaluate that the pump is free of PTFE and other fluoropolymer fittings. Additional considerations for low-flow PFAS sampling are as follows:

- For a rental pump used for PFAS sampling, verify with the vendor that the pump is designed and constructed to be PFAS compatible.
- Downhole tubing should be either disposable or dedicated to a single location, and constructed of HDPE or a similar PFAS-compatible material; tubing constructed of Teflon, PTFE, or similar fluoropolymers cannot be used.
- Standard silicone tubing may be used for a peristaltic pump, but the tubing should be replaced between sample locations.
- A flow-through cell with a multi-parameter meter may be used to track parameters stabilization during low-flow purging. The flow-through cell does not need to be completely constructed of PFAS-compatible materials, but the meter/flow-through-cell must be removed from the flow path before sample containers are filled.

Bailer sampling. Samples can also be collected via bailer, though it is generally not preferred due to sample agitation and potential mixing with the air-water interface. Bailer materials are available that are compatible with PFAS sampling, such as HDPE. PFAS-compatible rope (e.g., cotton or nylon) must be used for bailer sampling. When used for PFAS sampling, bailers should be gently lowered across the water surface to minimize turbidity, and should be lowered sufficiently below the water surface such that the sample represents formation water rather than interfacial water.

Submersible pump sampling. High-flow purging with a submersible pump is generally not recommended for PFAS sampling, due to potential for PFAS contamination by pump components, cross-contamination between wells, and the possibility of mobilizing PFAS in a non-representative manner (e.g., via air bubbles) during high-volume purging. However, submersible pumps may be the only practical sampling device for deep wells. When practicable, use dedicated pump systems to eliminate cross contamination. The purge-water flow rate should be kept low, to eliminate or minimize entrained air bubbles in the water stream while purging and sampling.

Additional groundwater sampling considerations.

- Sampling materials should never be placed directly on the ground. Use a clean surface or PE sheeting for work space.
- If turbidity is noted, do not field-filter samples as filtration may affect PFAS concentrations. The laboratory should be informed of highly turbid samples; under certain circumstances, the laboratory may use centrifugation to prepare the sample for analysis.
- Purge water may generally be collected in standard 5-gallon buckets.
- Fluid level or interface probes may be used to monitor water levels before/during sampling. PFAS-compatible decontamination procedures must be followed between locations. Unless necessary, measurement of in-well total depth is not recommended during PFAS sampling to minimize cross-contamination risks.
- PFAS-compatible rope/twine (typically cotton or nylon) may be used for securing HydraSleeves, submersible pumps, or bailers.
- Equipment that contacts water within the well (e.g., pumping equipment and water meters) should not contain or be coated with Teflon®, unless the Teflon® is internal to the equipment and does not contact the external environment. Often, equipment suppliers will label products as "PFAS Testing Approved" or "PFAS-free." It is highly recommended that equipment and supplies be identified as PFAS-free. If unsure whether a product is suitable for collecting a PFAS sample, contact the supplier and/or collect an equipment blank.

5.2 SAMPLING PROCEDURES

Sample collection for PFAS should generally follow these procedures. During most steps, samplers should don new nitrile gloves, even if it is not expressly identified below. New gloves should always be donned before handling sample containers, at any time.

- Decontaminate reusable equipment that will contact groundwater prior to use. Gauge depth to water and determine targeted pump-intake or screened interval for sampling.
- Using appropriate pen or ultra-fine Sharpie, fill out sample labels with all information except sample time (which can be added after the sample is collected and the lid replaced) and apply labels to sample containers. Pre-labeled sample containers may be stored in labeled 1-gallon Ziploc bags prior to sampling.
- Prepare a clean workspace for the sample staging area, using a decontaminated surface, clean PE sheeting, or untreated paper towels.
- Prepare the sample collection area, removing any moveable/unnecessary materials from the sampling area. Deploy PE sheeting as needed for staging of sampling materials, providing workspace to keep materials off the ground.

- Lower the pump, intake tubing, bailer, or passive sampler to the desired sample interval. Importantly, the sample interval should be several feet below the groundwater-air interface to ensure the collection of a representative groundwater sample and avoid sampling of PFAS accumulated at the interface.
- If low-flow purging is performed, connect the water quality meter to the flow path and initiate purging. Collect purge-water in a dedicated container (e.g., plastic 5-gallon bucket) and make sure that water does not splash or come into contact with the sample staging area and sample bottles. Record parameters at regular intervals, in accordance with standard practice for low-flow purging. After groundwater parameters have stabilized, disconnect the water quality meter before sampling.
- Collect the sample - don new nitrile gloves and fill the sample containers without touching other equipment or surfaces, including the sample tubing.
- It is preferable to have two personnel for sampling, one person to handle the sample device (e.g., HydraSleeve) and pour, and the other person to manage the sample containers, without needing to set down the sampling device and containers and risk potential cross-contamination.
- After sample containers are filled and closed, use clean, untreated paper towels to remove excess water from the exterior of the sample containers (excess water poses a cross-contamination risk during sample handling). Immediately place sealed sample containers in Ziploc bags, and place the bags in a sample cooler. Always have at least two dedicated coolers, one for clean sample bottles, and one for collected samples, to further minimize risk of cross-contamination during sample collection and handling.

5.3 EQUIPMENT DECONTAMINATION

Ideally, sampling should use disposable or dedicated equipment that does not require decontamination. Rental equipment should be treated as potentially contaminated, and be decontaminated before initial use. If a bladder pump is utilized, the bladder should be changed between sample locations and the pump body thoroughly decontaminated. Reusable equipment, including a pump or water-level meter, should be decontaminated using a Alconox, Liquinox, or Citrinox wash and a final, triple-rinse using laboratory-supplied water that is certified PFAS-free. Note that Simple Green® has not been confirmed to be PFAS free, and is therefore not approved for PFAS sampling decontamination at this time.

5.4 OTHER NOTES

If existing sample tubing is present in the well, unless the tubing composition is known, it should be assumed to be PFAS-containing (e.g., Teflon). In this case, it is highly recommended that the tubing be removed from the well, and at least one well volume of water purged from the well prior to sampling. Greater fluid volumes can be removed from the well if deemed necessary, however removal of at least one well volume is required before sampling.

Samples should not be collected from wells with measurable light non-aqueous phase liquids (LNAPL), due to the tendency of PFAS to accumulate at oil/water interfaces (e.g., Brusseau 2018). Similarly, PFAS will also preferentially tend to accumulate at air-water interfaces. To ensure representative sample collection, do not collect groundwater samples directly from the groundwater-air interface, where practicable.

6.0 SURFACE WATER AND SEDIMENT SAMPLING

This section provides PFAS sampling considerations specific to surface water and sediment matrices. This section assumes general understanding of basic surface water and sediment sampling procedures, and is not intended to teach surface water and sediment sampling fundamentals, but rather to provide instruction on differences in procedures and considerations specific to PFAS sampling. The procedures discussed in this section are additional considerations to the general PFAS sampling guidelines provided in Section 3.

6.1 EQUIPMENT/MATERIALS

In addition to the general and decontamination supplies listed in Sections 3.3 and 3.8, respectively, additional sample materials and supplies may include:

- Waders that have not been treated with waterproof coating (Table 1)
- Transfer containers, such as beakers or dippers, and extension rods
- Stainless-steel sample spoons, sample augers, or sample core barrels
- Disposable sample spoons constructed of PFAS-compatible material
- Single-use PVC or acetate sediment sampler liners (as needed)
- HDPE core-liner caps (preferred) or LDPE liner caps (if HDPE are not available) as needed
- Self-retracting utility knife with hook blades (decontaminated)
- Hacksaw with uncoated blade (decontaminated)
- Wrist- or elbow-length nitrile or PVC gloves for sediment sampling beneath shallow surface water

6.2 SURFACE WATER SAMPLING PROCEDURES

Where surface water and sediment samples are to be co-located, surface water samples should be collected first, to minimize potential for suspended sediment in the water sample. Surface-water samples should be collected below the surface and avoid water from the surface film, to avoid sample bias due to PFAS accumulation at air-water interfaces. During most steps, samplers should don new nitrile gloves, even if it is not expressly identified below. New nitrile gloves should always be donned before handling sample containers, at any time. Sample collection for PFAS should generally be conducted in accordance with the following procedures:

1. Before use, decontaminate reusable equipment that will contact surface water or sediment.
2. Using appropriate pen or ultra-fine Sharpie, fill out sample labels with all information except sample time (which can be added after the sample is collected and the lid replaced) and apply labels to sample containers. Pre-labeled sample containers may be stored in labeled 1-gallon Ziploc bags prior to sampling.
3. Prepare a clean workspace for the sample staging area, using a decontaminated surface, clean PE sheeting, or untreated paper towels.
4. Select a location where a sample can be collected from a depth of at least 10 centimeters (cm) (4 inches) from the sediment bed, at least 10 cm below the surface-water level, and as close to the center of the channel as practicable.
5. Where surface water can be collected by hand, samplers should approach the sample location from downstream.
6. Keeping the lid in place, submerge the sample container to the target sample depth.
7. Orient the sample container upstream; remove the cap to fill the container. The container should be filled to the shoulder, some headspace is preferred, if practical while filling underwater.
8. Replace the cap while the container is still submerged and close tightly before bringing the container above the water's surface.
9. Remove excess water from the outside of the sample container with a clean, untreated paper towel, add sample time to label, and immediately place inside a clean Ziploc bag, and place in the sample cooler.

Use of a transfer container is not recommended for PFAS sampling, but under certain circumstances may be required. A transfer container may be needed where sample locations are not directly accessible, such that extension rods or dippers are needed, or if sample containers require preservation and cannot be submerged. Transfer containers may be used under such circumstances, but must be clean and constructed of PFAS-compatible materials.

6.3 SEDIMENT SAMPLING PROCEDURES

Surface water sampling should be completed before sediment sampling. Spoons or scoops may be used to sample shallow sediments, however these methods may not be ideal due to agitation of the sample, mixing and washing during collection, and the inability to accurately determine sediment interval. For deeper/depth-discrete sampling, the preferred sediment sample collection method is to use a sediment sample auger (or similar). General sample collection procedures are as follows:

1. Before use, decontaminate reusable equipment that will contact surface water or sediment.
2. Using appropriate pen or ultra-fine Sharpie, fill out sample labels with all information except sample time (which can be added after the sample is collected and the lid replaced) and apply labels to sample containers. Pre-labeled sample containers may be stored in labeled 1-gallon Ziploc bags prior to sampling.
3. Prepare a clean workspace for the sample staging area, using a decontaminated surface, clean PE sheeting, or untreated paper towels.
4. If sediment sampling beneath shallow surface water using a spoon/scoop, don wrist-length nitrile or PVC gloves to avoid contact between skin and surface water, reducing risk potential for cross-contamination.
5. Approach the desired sediment sampling location from downstream if using waders. Sample should be collected from the midpoint of the channel, where practicable.
6. Drive the sediment sampler into the sediment. It is best to 'overshoot' the target sample depth, so that organics and debris overlying the sediment can be discarded, allowing collection of a representative sample.
7. Remove the sediment sampler, and place the sediment on an PE-lined sample table. Be sure to note the top and bottom of the sediment interval.
   - If using a sediment sampler with an acetate liner:
     - The liner can be opened using the self-retracting knife, to identify the desired sample interval. Change gloves after handling the knife. Discard organic material and debris on the surface, and transfer target sample intervals to HDPE sample containers. The samples can be transferred using a decontaminated stainless-steel scoop or disposable scoop. Use a fresh scoop and change nitrile gloves if collecting samples from more than one interval.
     - Alternatively, the liner can be cut into segments, capped with a liner cap, and placed into Ziploc bags for shipping to the analytical laboratory. Remove excess silt and debris from the exterior of the liners before cutting. Place each liner section in its own separate bag.
   - If using a sediment sampler without a liner:
     - Place the sampler on a clean, PE-lined table. Identify the desired sample interval. Do not allow organic material and debris on the surface to be entrained in the sample. Transfer target sample intervals to HDPE sample containers. The samples can be transferred using a decontaminated stainless-steel scoop or disposable scoop. Use a new scoop and change nitrile gloves if collecting samples from more than one interval. Fill the sample container and replace the cap.
8. Clean the outside of the sample container with a untreated paper towel, add the time sampled, and place into a Ziploc bag and then directly into the sample cooler.

6.4 EQUIPMENT DECONTAMINATION

Ideally, sampling should use disposable or dedicated equipment that does not require decontamination. Rental equipment should be treated as potentially contaminated, and be decontaminated before first use. Reusable equipment, including a sediment sample spoon or hand-auger, should be decontaminated using a Alconox, Liquinox, or Citrinox wash and a triple-rinse using laboratory-supplied water that is certified PFAS-free. Note that Simple Green® has not been confirmed to be PFAS free, and is therefore not approved for PFAS sampling decontamination at this time.

7.0 SURFACE AND SUBSURFACE SOIL SAMPLING

This section provides sampling considerations specific to surface and subsurface matrices. This section assumes general understanding of basic soil sampling procedures, and is not intended to teach soil sampling fundamentals, but rather to provide instruction on differences in procedures and considerations specific to PFAS sampling. Surface soil sampling may be conducted using hand tools or drill equipment. Generally, standard soil sampling and/or drilling equipment is compatible with PFAS sampling, with certain considerations noted in this section. When subcontracting a driller for soil sampling, it is important to communicate PFAS requirements early in the process, so they are able to prepare and plan accordingly. Procedures discussed in this section are additional considerations to the general PFAS sampling guidelines provided in Section 3.

7.1 EQUIPMENT/MATERIALS

In addition to the general and decontamination supplies listed in Sections 3.3 and 3.8, respectively, additional sample materials and supplies may include:

1. Disposable polyvinyl chloride (PVC), high density polyethylene (HDPE), or acetate liners
2. HDPE liner caps (preferred) or LDPE liner caps (if HDPE are not available) as needed
3. Self-retracting utility knife with uncoated hook blades or uncoated razor blades
4. Hacksaw with uncoated blade
5. Stainless-steel hand auger, trowel, or shovel
6. Polyethylene or polyvinyl brush to remove particles during decontamination

Equipment that contacts soil should not contain or be coated with Teflon® (or other PFAS incompatible material) unless the Teflon® is internal to the equipment and does not contact the external environment. If uncertain, contact the supplier and/or an equipment blank may be collected.

7.2 SAMPLING PROCEDURES

Surface and subsurface soil samples may be collected to delineate surficial and vertical extent of impacts where PFAS are potentially or known to be released to land/soil. Overall, sampling procedures used for PFAS are similar to those used for conventional soil sampling, with certain material limitations and precautions against cross-contamination as noted herein. Surface and shallow soil samples can be collected using a decontaminated stainless-steel hand auger, trowel, or shovel; a disposable plastic scoop may also be used. If sampling from a hand auger, the sample material may be removed from the auger into a decontaminated stainless-steel bowl. Soil samples collected using a trowel or shovel may be transferred directly into the sample container using a disposable scoop, decontaminated spoon, or a new nitrile glove. Care should be taken to ensure the samples avoid contact with uncontrolled surfaces such as the ground, contaminated equipment, cooler-top, or tailgate.

Several methods are available for PFAS-related subsurface soil sampling, including hand-auger, direct-push, hollow-stem auger/split-spoon sampler, or continuous core collection via sonic drill rig or other drill method. Direct push and split spoon samplers, which generate cores in acetate, HDPE, or PVC liners, are preferred due to the minimization of sample contact with drilling equipment, as well as minimization of agitation. For accurate assessment of subsurface PFAS impacts, collection of cores with minimal disturbance is preferred. Drilling methods that produce loose cuttings such as those obtained by auger and rotary drilling processes should be avoided if possible. Additional considerations for drilling are provided in the following section.

After collection, soil core liners may be cut open using a decontaminated stainless-steel cutting device, such as a retractable-blade utility knife. Soil core samples may be transferred to a decontaminated stainless-steel bowl for consolidation and subsampling, or samples may be collected directly from the core liners and transferred to laboratory-provided HDPE or polypropylene sample bottles. Soil samples should be transferred from the core liners using disposable scoops, decontaminated spoons, or new nitrile gloves. If other analytical suites are to be collected (e.g., metals, volatile organic compounds), collect the PFAS samples first and secure the PFAS samples in coolers before collecting other analytical suites to prevent container cross-contamination. Do not touch other sample containers, which may have PTFE-containing septa or lids, prior to collecting the PFAS sample. Place PFAS samples in separate bags or separate coolers from other analytical samples for shipping. When collecting samples, the sample container cap should never be placed directly on the ground during sampling; sample container caps/lids should be held, or only placed on surfaces that are known to be PFAS-free. Once collected, soil sample containers should be stored in their own Ziploc bags within the sample cooler, and placed on double-bagged ice to begin the cooling process in accordance with the procedures in Section 3.7. Soil samples stored in bags should be double bagged.

Alternatively, soil core samples may remain in the PVC, HDPE, or acetate liners for shipping to the analytical laboratory. Full soil cores inside the sample liners should be cut crosswise using a decontaminated, untreated hook blade knife or hacksaw, into the target sample intervals. The core-liner segments can be capped on both ends using HDPE liner caps. LDPE liner caps may be used if HDPE caps are unavailable; however, PFAS compounds may adsorb to LDPE liner caps. Bulk soil on the exterior of each core-liner segments should be removed using clean, untreated paper towels and each core segment should be placed in a Ziploc bag (core segments should be double-bagged if elevated PFAS concentrations are suspected). The capped/bagged core segments can then be placed in a sample cooler on double-bagged ice.

7.3 DRILLING PROCEDURES

Subsurface soil sampling necessarily involves the use of non-dedicated equipment such as drill rods, core barrels, split spoons, augers, trowels, shovels, and other drilling related equipment. These equipment can be a potential source of cross contamination both from boring to boring as well as between vertical intervals within a single boring. Lubricants used during drilling should not be labeled as containing PTFE or other fluoropolymer. Thorough decontamination of the exterior and interior surfaces of drill rods, core barrels, and other drill rig tooling should be conducted between every boring location. Due to the size and quantity of this equipment, it may not be practical to use laboratory supplied PFAS-free water for decontamination purposes. Therefore, a source of clean decontamination water may be identified and confirmed as PFAS-free by laboratory analysis prior to the field event.

Beyond drilling equipment, there are additional cross-contamination risks inherent to the drilling process. Drillers handle drilling equipment manually when advancing the drilling tooling. Work gloves, boots, and clothing worn by the drillers can pose a cross-contamination risk. Clothing requirements discussed in Section 3 should be communicated to drill crews in advance of the field event. Drill crews should avoid wearing waterproof, water resistant, or stain proof clothing. Nitrile gloves should be worn outside work gloves and changed often when handling drill tooling. Work boot overshoes, PVC coveralls, and other mitigation measures may be considered to limit cross-contamination risks. However, personnel safety is paramount and should not be sacrificed for cross-contamination mitigation. Cross-contamination risks can also be mitigated using procedural measures such as ensuring that drillers do not touch the internal surfaces of drilling equipment (e.g., inside of core barrels) or other surfaces which might come in direct contact with the soil sample. For this reason, it is recommended that PFAS considerations be communicated with the drilling contractor and also included in a kickoff meeting, held with the drill crew in advance of the event where detailed procedures and cross-contamination mitigation best practices are discussed. Selection of a drilling contractor with PFAS-specific experience is also recommended.

7.4 EQUIPMENT DECONTAMINATION

Where possible, sampling should use disposable or dedicated equipment that does not require decontamination. Decontamination of soil-drilling and soil-sampling equipment (cores, grab samples) can be conducted via pressure-washing or using Alconox, Liquinox, and Citranox solutions (see Table 1). Equipment should be scrubbed with a plastic brush and rinsed thoroughly in tap water to wash away debris or material on exposed surfaces. Replace decontamination solution if sediment has accumulated or between locations where high PFAS concentrations may be expected. As a final decontamination step, triple rinse equipment in laboratory-supplied PFAS-free water. Use a spray bottle for the PFAS-free water rinse, to avoid contaminating decon rinse water. PVC or acetate liners should be discarded and not decontaminated between sampling sites.

8.0 OTHER SAMPLING MATRICES

PFAS sampling may be required in other matrices, such as sludge/biosolids, air, non-aqueous phase liquids (NAPLs), asphalt, concrete, and plant or animal tissues. This SOP does not include protocols for these matrices. The general PFAS sampling guidelines should be followed, and a laboratory consulted for specific guidelines on sample requirements. Consult a member of Trihydro's PFAS sampling team for assistance.

9.0 PFAS LABORATORY REQUIREMENTS

This section includes procedures and considerations for initial laboratory communications, PFAS analytical methods, container preservation requirements, and sample quality control/quality analysis (QA/QC) requirements.

9.1 LABORATORY COMMUNICATION

Communication is recommended with the selected analytical laboratory before sampling, or during pre-project communications with candidate analytical laboratories, to confirm the following:

1. Does the laboratory have the necessary accreditation?
2. Can the laboratory meet the required reporting limits <u>for all PFAS analytes</u>?
3. Do the laboratory-specific methods (e.g., 537-MOD) use isotope dilution for quantification?
4. Can the laboratory accommodate project-specific needs, such as high concentrations or unusual matrices?
5. Can the laboratory provide certified PFAS-free water for decontamination and QA/QC samples?
6. Can the laboratory meet the required turnaround time? What is the current backlog for PFAS samples?

9.2 ANALYTICAL METHODS

As of July 2022, the EPA has published the following PFAS analytical methods:

1. Method 533: drinking water, 24 analytes
2. Method 537.1: drinking water, 18 analytes
3. Method 8327: non-drinking water aqueous samples, 24 analytes
4. DRAFT Method 1633: wastewater, surface water, groundwater, soil, biosolids, sediment, landfill leachate, and fish tissue; 40 analytes
5. DRAFT Method 1621: aqueous matrices, adsorbable organic fluorine (AOF) (i.e., total organic fluorine)

For non-drinking-water matrices, most laboratories have established independent methods for PFAS analysis, typically involving isotope dilution to account for matrix interference and including both branched and linear isomers. Although often referred to as ‘modified 537’ or ‘537-MOD’ these laboratory-independent methods are in fact unrelated to EPA 537.1. To ensure consistent and repeatable analysis for non-drinking water samples, the laboratory should have proper accreditation and have capability to perform analysis that is consistent with U.S. Department of Defense (DoD) Quality System Manual (QSM) Version 5.1 or later (5.3 is the most recent version), Table B-15. QSM 5.3 Table B-15 is not an analytical method, per se, but provides a standardized set of laboratory quality control procedures. Compliance with QSM Table B-15 protocol has generally been required for regulatory-ordered PFAS samples, although this requirement may change as the EPA finalizes more methods. Trihydro’s PFAS team recommends that samples be analyzed in compliance with QSM Table B-15 protocol to ensure data quality, even if not specifically required. PFAS analytes associated with each of these methods are provided on Table 2.

1. **EPA 537.1**: Determination of Selected Per-and Polyfluorinated Alkyl Substances in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry. November 2018. Drinking water method for 18 analytes, does not use isotope dilution*.

2. **EPA 533**: Determination of Per- and Polyfluoroalkyl Substances in Drinking Water by Isotope Dilution Anion Exchange Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry. November 2019. Drinking water method for 25 analytes, uses isotope dilution*.

3. **EPA 8327**: Per- and Polyfluoroalkyl Substances by Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS). July 2021. Aqueous, non-drinking water matrices (groundwater, surface water, waste water), considered as a screening-level method, does not use isotope dilution*.

4. **DRAFT EPA 1633**: Analysis of Per- and Polyfluoroalkyl Substances (PFAS) in Aqueous, Solid, Biosolids, and Tissue Samples by LC-MS/MS. August 2021. DRAFT method for ground water, surface water, waste water, soil and sediment matrices, using isotope dilution*. This method has not been finalized as of March 2022. Despite “draft” status, the method is being used and required by some states in monitoring permits. Unless required for a specific sampling event, this method is not recommended at this time by Trihydro’s PFAS team.

5. **DRAFT Method 1621**: Screening Method for the Determination of Adsorbable Organic Fluorine (AOF) in Aqueous Matrices by Combustion Ion Chromatography (CIC). Provides a single result (“AOF”) representing total PFAS concentration.

6. **DoD QSM 5.3 Table B-15**: DoD Quality Systems Manual Version 5.3. May 2019. Table B-15: Per- and Polyfluoroalkyl Substances (PFAS) Using Liquid Chromatography Tandem Mass Spectrometry (LC/MS/MS) With Isotope Dilution or Internal Standard. As of March 2022, this is recommended as a standardized method for groundwater, surface water, waste water, soils, and sediment samples. Can be referenced in work plans as “the samples will be analyzed at a certified laboratory using methods compliant with DoD QSM Table B-15” (uses isotope dilution*).

> **Note regarding isotope dilution*: the descriptions above indicate which methods use isotope dilution to quantify analytes. Isotope dilution is an internal standard, and methods that do not use isotope dilution use external standards. Isotope dilution increases detection accuracy, which can be very important to quantify and control matrix interference, which can be very important for complex environmental matrices.

The specific analyte list is an important consideration for PFAS site investigation. PFOA, PFOS, perfluorobutane sulfonate (PFBS), and GenX are the only PFAS compounds with USEPA Health Advisory Levels (as of July 2022), but hundreds to thousands of additional PFAS compounds are also present in the environment. Typical laboratory methods quantify a relatively small fraction of these compounds. The specific analyte list for each project should be determined based on method requirements, sampling objectives, and client needs. PFAS analytes associated with the above methods are shown on Table 2. Unless a USEPA method is referenced for a compound list, a list of target PFAS analytes should be attached to the chain of custody (COC) form. State-issued sampling orders may require other PFAS or non-PFAS analytes.

9.3 USE OF PRESERVATIVE

For drinking water samples, each 250 mL sample bottle may be required to contain a preservative. EPA method 537.1 a small amount (1.25 g) of Trizma® and method 533 requires 1 g/L ammonium acetate, both of which are included to remove free chlorine from chlorinated drinking water (USEPA 2015). Before sampling drinking water for PFAS analysis, confirm the need for the Trizma® or ammonium acetate with the selected analytical laboratory. For groundwater samples or other water matrices, inclusion of Trizma® is not required but is considered harmless (in terms of potential effects on measured PFAS concentrations) and may be included.

The Trizma® and ammonium acetate buffers are required for samples analyzed via EPA Method 537.1 and EPA Method 533, respectively. The buffer is required regardless of whether the water being sampled is chlorinated.

9.4 FIELD QUALITY ASSURANCE AND QUALITY CONTROL SAMPLES

Field quality-assurance / quality-control (QA/QC) samples are imperative for PFAS analysis. Five different types of QA/QC samples may be collected during the sampling event as described below. Each type of QA/QC sample listed below is provided a "Required" or "Optional" label. QA/QC sampling needs may be determined in a Quality Assurance Project Plan (QAPP).

<u>Field Blanks (Required)</u>: Field blanks (or field reagent blanks) are collected to verify that the sampling environment and site-required PPE worn during the sampling event do not contaminate samples. At a minimum, one field blank should be collected for each site, with each sampling event that involves collecting an aqueous sample. Field blanks are analyzed for the same list of PFAS constituents as

analyzed for associated field samples. The field blank is collected by pouring PFAS-free reagent water received from the laboratory into an empty, clean sample container at the sampling site. Generally, two laboratory-provided sample containers are filled for each field-blank sample.

Equipment Blanks (Required): Equipment blanks will be prepared and submitted for laboratory analysis to verify that equipment decontamination procedures are effective, and to verify that sampling equipment is PFAS-free and not causing contamination. Equipment blanks are analyzed for the same PFAS constituents as required for the field samples. Minimally, equipment blanks should be collected for sampling equipment that may contact the sample matrix, such as HDPE core liners, bailers, pump tubing, using PFAS-free water provided by the laboratory. Equipment blanks should be collected at a rate of at least 1 per event per piece of equipment used for sampling. Equipment blanks are not required for tapwater sampling, where sample containers are filled directly from source water.

Blind Duplicates (Recommended): Blind Duplicate samples can be collected to evaluate reproducibility of analytical techniques and the homogeneity of sample matrices. Duplicate samples are submitted for the same PFAS analyses that are required for the field samples. Duplicate samples will be collected at a frequency of 10%, or one for every 10 samples for aqueous sampling matrices. If less than 10 samples are collected during a particular sampling event, one blind duplicate sample will be collected. The duplicate sample will be “blind” to the laboratory, therefore will have a coded identity on its label and on the COC. The actual sampling location and identification will be recorded on the sampling log.

Trip Blanks (Optional): Trip blanks are laboratory-prepared bottles containing PFAS-free water that travel from the laboratory to the site, and then transported back to the laboratory with the samples in the sample coolers. A set of trip blanks can accompany each cooler that contains PFAS samples. Trip blanks should be supplied by the laboratory and will accompany the sample containers throughout the sampling event. Trip blanks will only be analyzed by the laboratory for PFAS if instructed to do so by the PM; these samples should otherwise be held once received by the laboratory. Trip blanks are generally not required for PFAS samples but may be helpful to identify sources of contamination, should they occur.

Matrix Spikes/Matrix Spike Duplicates (MS/MSD) (Optional): MS/MSDs can be prepared and analyzed by the laboratory for each matrix sampled. MS/MSDs are samples in which known quantities of specific PFAS compounds are added before extraction and analyses. The recoveries for spiked compounds can be used to assess how well the method for analysis recovers target compounds. MS/MSD samples are submitted for the same PFAS analyses that are required for the field samples.

10.0 REFERENCES

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TABLES

TABLE 1. PFAS SAMPLING ITEMS[1]
SOP FOR CHARACTERIZATION OF PFAS AT BULK FUEL STORAGE TERMINALS AND REFINERIES

Prohibited Items/Materials	Acceptable Items/Materials
Sampling Equipment[1]	
Polytetrafluoroethylene (PTFE), including Teflon® and Hostaflon®-containing materials (tubing, bailers, tape, and plumbing paste)	High-density polyethylene (HDPE) materials including polypropylene[2]
Polyvinylidene fluoride (PVDF), including Kynar®-containing materials (tubing, coatings on aluminum and steel, lithium-ion batteries)	Stainless steel
Polychlorotrifluoroethylene (PCTFE), including Neoflon®-containing materials (valves, seals, gaskets, food packaging)	Nylon or cotton
Ethylene-tetrafluoro-ethylene (ETFE), including Tefzel® (wire/cable insulation, pipe liners)	Polyvinyl chloride (PVC)
Fluorinated ethylene propylene (FEP), including Teflon® FEP and Hostaflon® FEP-containing materials (wire/cable insulation, pipe liners)	Acetate liners
Low-density polyethylene (LDPE)	Silicone tubing
Aluminum foil	Natural rubber
Sample Labeling and Field Documentation	
Waterproof field books	Loose paper (non-waterproof)
Plastic clipboards, binders, spiral hard cover notebooks	Aluminum field clipboards or with Masonite®; Rite-in-the-Rain is acceptable in staging area if gloves are changed after note taking.
Post-It Notes	Ballpoint pens
Regular/thick size markers (Sharpie®)	Fine and Ultra-Fine point Sharpie® markers are acceptable to label empty sample bottles while in staging area provided the lid is on the sample bottle and gloves are changed following sample bottle labeling.
Re-usable chemical (blue) ice packs	Water-based ice in polyethylene bags (double bagged)
Clothing and Personal Protective Equipment (PPE) used by Field Personnel[3]	
Clothing laundered using fabric softener	Synthetic or cotton clothing that has been well-laundered clothing, defined as clothing that has been washed 6 or more times after purchase
New cotton clothing or synthetic water-resistant/ waterproof clothing or dirt/stain-resistant treated clothing, clothing containing GORE-TEX™, Scotchgard™, and RUCO®	Waterproof clothing made with polyurethane, PVC, wax-coated fabrics, rubber, or neoprene
Boots containing GORE-TEX™	Boots made with polyurethane and/or PVC
Latex gloves	Powderless nitrile gloves
Clothes chemically treated for insect resistance and ultraviolet protection	
Coated Tyvek®	

TABLE 1. PFAS SAMPLING ITEMS[1]
SOP FOR CHARACTERIZATION OF PFAS AT BULK FUEL STORAGE TERMINALS AND REFINERIES

Prohibited Items/Materials	Acceptable Items/Materials
Personal Care Products, Sun/Biological Protection	
No cosmetics, moisturizers, fragrances, hand cream, or other related products as part of personal cleaning showering routine on the day of sampling, and 24 hours prior to sampling.	**Sunscreens** - Alba Organics Natural Sunscreen, Yes To Cucumbers, Aubrey Organics, Jason Natural Sun Block, Kiss my face, Baby sunscreens that are “free” or “natural” -- **Insect Repellents** - Jason Natural Quit Bugging Me, Repel Lemon Eucalyptus Insect repellant, Herbal Armor, California Baby Natural Bug Spray, BabyGanics -- **Sunscreen and insect repellent** - Avon Skin So Soft Bug Guard Plus – SPF 30 Lotion
Sample Containers	
LDPE or glass containers	HDPE or polypropylene
Teflon®-lined caps	Unlined polypropylene caps
Rain Events	
Waterproof or water-resistant rain gear	Gazebo tent that is only touched or moved before and following sampling activities
Equipment Decontamination	
Decon 90® , Simple Green®	Alconox®, Liquinox®, or Citranox®
	Laboratory supplied PFAS-free water
	Commercially available deionized water if verified to be PFAS-free
Water from an on-site well	Potable water from municipal drinking-water supply if known to be PFAS-free
Food Considerations	
All food and drink, with exceptions noted herein. Note that fast-food and prepackaged food containers may contain PFAS.	Bottled water and hydration drinks (i.e., Gatorade® and Powerade®) to be brought and consumed only in the staging area

Notes:
1. PFAS sampling-item restrictions apply to the entire sample collection and processing area, including vehicles used by sampling personnel
2. The United States Environmental Protection Agency (USEPA) and American Society for Testing and Materials (ASTM) method for the analysis of PFAS in solid and liquids specify polypropylene or HDPE with polypropylene lids. Check with the laboratory regarding their polypropylene or HPDE preference.
3. Sampling personnel includes all personnel who:
   - Are directly involved in the collection, handling, and/or processing of samples before the samples leave the site.
   - Handle any part of equipment that directly contacts surface water or stormwater.
   - Are within 2 to 3 meters (i.e., 6 to 9 feet) of the borehole during soil sampling.

Personnel are not included as sampling personnel if they remain at least 2 to 3 meters away from sample-collection areas before and during sampling.

TABLE 2. PFAS REFERENCE TABLE - CHEMICAL NAMES, ACRONYMS, AND ANALYTICAL METHODS
PFAS SAMPLING STANDARD OPERATING PROCEDURES
TRIHYDRO CORPORATION

This table presents a select subset of the 3,000+ compounds classified as PFAS.

Classification	Family	Class	Group	PFAS Compound	Acronym	Chemical Abstract Service (CAS) #	Mol. Wt.	Chemical Formula fluorinated tail (red) head (blue)	EPA 537.1	EPA 533	EPA 8327	DoD QSM 5.1	EPA 1633 (draft)
									Analytical methods				
Per and Poly Fluoroalkyl Substances (PFAS)	Perfluorinated Compounds	Perfluoroalkyl Acid (PFAA)	1	Perfluorobutanoic acid *	PFBA	375-22-4	214.0	C_3F_7COOH		X	X	X	X
				Perfluoropentanoic acid *	PFPeA	2706-90-3	264.1	C_4F_9COOH		X	X	X	X
				Perfluorohexanoic acid *	PFHxA	307-24-4	314.1	$C_5F_{11}COOH$	X	X	X	X	X
				Perfluoroheptanoic acid *	PFHpA	375-85-9	364.1	$C_6F_{13}COOH$	X	X	X	X	X
				Perfluorooctanoic acid **	PFOA	335-67-1	414.1	$C_7F_{15}COOH$	X	X	X	X	X
				Perfluorononanoic acid **	PFNA	375-95-1	464.1	$C_8F_{17}COOH$	X	X	X	X	X
				Perfluorodecanoic acid **	PFDA	335-76-2	514.1	$C_9F_{19}COOH$	X	X	X	X	X
				Perfluoroundecanoic acid **	PFUnA	2058-94-8	564.1	$C_{10}F_{21}COOH$	X	X	X	X	X
				Perfluorododecanoic acid **	PFDoA	307-55-1	614.1	$C_{11}F_{23}COOH$	X	X	X	X	X
				Perfluorotridecanoic acid **	PFTriA	72629-94-8	664.1	$C_{12}F_{25}COOH$	X		X	X	X
				Perfluorotetradecanoic acid **	PFTeA	376-06-7	714.1	$C_{13}F_{27}COOH$	X		X	X	X
			2	Perfluorobutane sulfonic acid *	PFBS	375-73-5	300.1	$C_4F_9SO_3H$	X	X	X	X	X
				Perfluoropentane sulfonic acid *	PFPeS	2706-91-4	350.1	$C_5F_{11}SO_3H$		X	X	X	X
				Perfluorohexane sulfonic acid **	PFHxS	355-46-4	400.1	$C_6F_{13}SO_3H$	X	X	X	X	X
				Perfluoroheptane sulfonic acid **	PFHpS	375-92-8	450.1	$C_7F_{15}SO_3H$		X	X	X	X
				Perfluorooctane sulfonic acid **	PFOS	1763-23-1	500.1	$C_8F_{17}SO_3H$	X	X	X	X	X
				Perfluorononane sulfonic acid **	PFNS	68259-12-1	550.1	$C_9F_{19}SO_3H$			X	X	X
				Perfluorodecane sulfonic acid **	PFDS	335-77-3	600.1	$C_{10}F_{21}SO_3H$			X	X	X
				Perfluorododecane sulfonic acid **	PFDoS	79780-39-5	600.1	$C_{11}F_{23}SO_3H$					X
		FASA		Perfluorooctane sulfonamide	PFOSA	754-91-6	499.1	$C_8F_{17}SO_2NH_2$			X	X	X
				N-methyl perfluorooctane sulfonamide	N-MeFOSA	31506-32-8	513.2	$C_8F_{17}SO_2N(CH_3)H$					X
				N-ethyl perfluorooctane sulfonamide	N-EtFOSA	4151-50-2	527.2	$C_8F_{17}SO_2N(C_2H_5)H$					X
	Replacement Compounds	Fluoroalkyl Ethers		Hexafluoropropylene oxide dimer acid (GenX)	HFPO-DA	13252-13-6	330.2	$C_3F_7O(CF_2)_2COOH$	X	X			X
				4,8-dioxa-3H-perfluorononanoic acid	ADONA	919005-14-4	378.1	$CF_3O(CF_2)_3OC_2HF_3COOH$	X	X			X
				Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6	296.0	$CF_3O(CF_2)_2OCF_2COOH$		X			X
				Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	113507-82-7	316.1	$C_2F_5O(CF_2)_2SO_3H$		X			X
				Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1	230.0	$CF_3O(CF_2)_2COOH$		X			X
				Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5	280.0	$CF_3O(CF_2)_3COOH$		X			X
				11-Chloroeicosafluoro-3-oxaundecade-1-sulfonic acid	11Cl-PF3OUdS	763051-92-9	632.6	$Cl(CF_2)_8O(CF_2)_2SO_3H$	X	X			X
				9-Chlorohexadecafluoro-3-oxanone-1-sulfonic acid	9Cl-PF3ONS	756426-58-1	532.6	$Cl(CF_2)_6O(CF_2)_2SO_3H$	X	X			X
	Polyfluorinated / Precursors	Fluorotelomers	3	4:2 Fluorotelomer sulfonic acid	4:2 FTSA	757124-72-4	328.2	$C_4F_9(CH_2)_2SO_3H$		X	X	X	X
				6:2 Fluorotelomer sulfonic acid	6:2 FTSA	27619-97-2	428.2	$C_6F_{13}(CH_2)_2SO_3H$		X	X	X	X
				8:2 Fluorotelomer sulfonic acid	8:2 FTSA	39108-34-4	528.2	$C_8F_{17}(CH_2)_2SO_3H$		X	X	X	X
			4	6:2 Fluorotelomer alcohol	6:2 FTOH	647-42-7	364.1	$C_6F_{13}(CH_2)_2OH$					
				8:2 Fluorotelomer alcohol	8:2 FTOH	678-39-7	464.1	$C_8F_{17}(CH_2)_2OH$					
		Perfluoroalkane Sulfonamido	5	N-ethyl perfluorooctanesulfonamido acetic acid	N-EtFOSAA	2991-50-6	585.2	$C_8F_{17}SO_2N(C_2H_5)CH_2CO_2H$	X		X	X	X
				N-methyl perfluorooctanesulfonamido acetic acid	N-MeFOSAA	2355-31-9	571.2	$C_8F_{17}SO_2N(CH_3)CH_2CO_2H$	X		X	X	X
			6	N-ethyl perfluorooctane sulfonamido ethanol	EtFOSE	1691-99-2	571.3	$C_8F_{17}SO_2N(C_2H_5)(CH_2)_2OH$					X
				N-methyl perfluorooctane sulfonamido ethanol	MeFOSE	24448-09-7	557.2	$C_8F_{17}SO_2N(CH_3)(CH_2)_2OH$					X
		Fluorotelomer Carboxylic Acids		3-Perfluoropropyl propanoic acid	3:3 FTCA	356-02-5	242.1	$C_3F_7C_2H_4COOH$					X
				2H,2H,3H,3H-Perfluorooctanoic acid	5:3 FTCA	914637-49-3	342.1	$C_5F_{11}C_2H_4COOH$					X
				3-Perfluoroheptyl propanoic acid	7:3 FTCA	812-70-4	442.1	$C_7F_{15}C_2H_4COOH$					X

Notes:
* denotes short chain perfluoroalkyl acid
** denotes long chain perfluoroalkyl acid

PFAS Class Acronyms
PFAA: Perfluoroalkyl acid
FASA: Perfluoroalkane sulfonamide

PFAS Group Names and Acronyms
1. PFCA: Perfluoroalkyl carboxylic acid
2. PFSA: Perfluoroalkane sulfonic acid
3. FTSA: Fluorotelomer sulfonic acid
4. FTOH: Fluorotelomer alcohols
5. FASAA: Perfluoroalkyl sulfonamido acetic acids
6. FASE: Perfluoroalkane sufonamido ethanols

References:
ITRC guidance document, Chapter 2. https://pfas-1.itrcweb.org/2-pfas-chemistry-and-naming-conventions-history-and-use-of-pfas-and-sources-of-pfas-releases-to-the-environment-overview/
EPA working list of PFAS compounds: https://www.epa.gov/chemical-research/ord-subset-pfas-research

ATTACHMENT A

OFFICE TRAINING CHECKLIST

ATTACHMENT A. OFFICE TRAINING CHECKLIST
PFAS SAMPLING STANDARD OPERATING PROCEDURES
TRAINING PROGRAM
TRIHYDRO CORPORATION

(development/review in progress)

1. PFAS Overview – basic information to understand rationale for PFAS sampling approaches and to address basis questions
   a. Chemistry
   b. PFAS uses/environmental sources
   c. Regulatory status
2. Unique elements of PFAS sampling
   a. Hundreds/thousands of compounds
   b. Presence in common materials
   c. Highly scrutinized results
3. Standard Operating Procedures Overview
   a. Table of Contents overview/key elements
   b. Material compatibility table
   c. General PFAS sampling steps
4. Project Sampling Discussion
   a. Types of sampling
   b. Additional training needs
   c. Project specific preparation needs/focus on relevant SOP sections

ATTACHMENT B

FIELD TRAINING CHECKLIST

ATTACHMENT B. FIELD TRAINING CHECKLIST
PFAS SAMPLING STANDARD OPERATING PROCEDURES
TRAINING PROGRAM
TRIHYDRO CORPORATION

(development/review in progress)

1. Allowable materials
   a. Clothing/PPE
   b. Gloves
   c. Paper Towels
   d. Buckets
   e. Sampling Materials
   f. Pens/Sharpies
   g. Field Notes
2. Prohibited Materials
   a. Area Inspection
   b. Clothing/PPE
   c. Food wrappers
3. Site Preparation and Area Management
   a. Staging Area
   b. Sampling Area
   c. Personnel
   d. Coolers
   e. Housekeeping
4. Hands
   a. Awareness
   b. Changing gloves
5. Sampling considerations
   a. Groundwater pumps, tubing, supplies
   b. Soil Sampling: drilling and hand-auger
6. Sample Container Management
   a. Pre-collection
   b. During collection
   c. Post-collection
7. Decontamination
   a. Plastic brush
   b. Spray bottles

ATTACHMENT C

EXAMPLE FIELD SAMPLING DOCUMENTATION FORM

ATTACHMENT C. EXAMPLE FIELD SAMPLING DOCUMENTATION FORM

Client / Project # :

Boring / Sample ID ______________ Sample Date/Time: ______________
Analysis: 537.1 / 537 MOD / Other ______________ QC samples: ______________
Sample Depth: ______________ Sample Recovery: ______________
Sample Description: ______________

Boring / Sample ID ______________ Sample Date/Time: ______________
Analysis: 537.1 / 537 MOD / Other ______________ QC samples: ______________
Sample Depth: ______________ Sample Recovery: ______________
Sample Description: ______________

Boring / Sample ID ______________ Sample Date/Time: ______________
Analysis: 537.1 / 537 MOD / Other ______________ QC samples: ______________
Sample Depth: ______________ Sample Recovery: ______________
Sample Description: ______________

Boring / Sample ID ______________ Sample Date/Time: ______________
Analysis: 537.1 / 537 MOD / Other ______________ QC samples: ______________
Sample Depth: ______________ Sample Recovery: ______________
Sample Description: ______________

Boring / Sample ID ______________ Sample Date/Time: ______________
Analysis: 537.1 / 537 MOD / Other ______________ QC samples: ______________
Sample Depth: ______________ Sample Recovery: ______________
Sample Description: ______________

Trihydro

Sampling Equipment: ______________
Field Personnel:

Appendix C – Skinner List

REGION 5 SKINNER LIST

A "Skinner List" of Appendix VIII Hazardous Constituents applicable to refinery wastes was developed by EPA's Office of Solid Waste. (Skinner refers to the name of the U.S. EPA official signing the guidance memorandum). Any Appendix VIII constituent believed applicable to refineries was included. In 1985, this list was shortened to a more practical list of constituents and published as "Constituents of Petroleum Refining Wastes" as part of EPA's guidance for "Petitions to Delist Hazardous Wastes". This 1985 list of Appendix VIII Hazardous Constituents applicable to refining processes became known as the "Skinner List", and has been used as the basis for many RCRA Facility Investigation measurements.

In 1993, EPA's Office of Solid Waste updated the Skinner List through additions to and deletions from the 1985 list as part of new EPA guidance for "Petitions to Delist Hazardous Wastes. The 1993 list is labeled "Constituents of Concern for Wastes from Petroleum Processes".

In 1997, Region 5's Waste Management Branch melded the 1985 and 1993 Skinner Lists to establish a broader list of refinery process waste constituents, which is identified as the "Region 5 Skinner List" (Attachment 1). The Region 5 Skinner List was developed on the basis of:

1. Combining the1985 and 1993 Skinner Lists.

2. Hazardous Constituents deleted in 1993 from the 1985 list were retained if they are identified in Superfund's CLP Target Compound List or Target Analyte List. Multiparameter test procedures such as Methods 8260, 8270, and 6010 are routinely calibrated for TCLs and TALs; therefore, there is no need to discard the data being captured for each sample's measurements.

3. The 1985 Skinner List constituents deleted in 1993 were also deleted from the Region 5 list (or deemed optional) if they are impossible or impractical analytical measurements (e.g-methyl chrysene, benzenethiol), if they are not part of Appendix IX or the CLP TCL/TALs.

4. A list of polynuclear aromatic hydrocarbon (PAH) constituents, with low concentration PRGs and common to the 1985 or 1993 lists, was established for low level HPLC/fluorescence measurements.

5. Special considerations for specific constituents are:

    a. The 1985 constituent *quinoline*, deleted in the 1993 list, was retained by Region 5 because of its relatively toxicity.

    b. Methyl tertiary butyl ether (MTBE) was added to the Region 5 list because of its wide usage as a gasoline additive. Environmental laboratories usually have this compound in their calibration standards for Method 8015 and 8260.

c. The 1985 list includes “methyl chrysene”. No distinction is made for its different structural isomers. GC/MS mass spectra for methyl chrysene can not be easily differentiated from closely eluting isomers of methyl dibenz(a, h)anthracene. This constituent was deleted from the optional Region 5 list because inappropriate analytical measurements would occur.

d. Benzenethiol, or thiophenol, can be found in refinery wastes of caustic pH values. Benzenethiol is unstable in water/soils of neutral or acid pH values. Benzenethiol rapidly degrades in organic solvents used to prepare instrument calibration standards. Benzenethiol is part of Appendix VIII and the 1985 Skinner List, but never made it to Appendix IX to 40 CFR 264, because of its instability in the environment or in analytical standards. It is listed as an optional Region 5 constituent.

e. Cobalt was deleted from the 1985 list. Silver and zinc were added to the 1993 Skinner List. All three are in the Region 5 Skinner List because their concentrations are captured by commonly used multiparameter ICP emission spectroscopy measurements (Method 6010).

ATTACHMENT 1

Region 5 Waste Management Branch "Skinner List"
Constituents of Concern for Wastes from Petroleum Processes

Inorganics

Antimony	Cadmium	Lead	Silver
Arsenic	Chromium	Mercury	Vanadium
Barium	Cobalt	Nickel	Zinc
Beryllium	Cyanide	Selenium	

Volatile Organics

Benzene	1,2-Dichloroethane	Ethylene dibromide (EDB)	1,1,1-Trichloroethane
Carbon disulfide	1,1-Dichloroethane	Methyl ethyl ketone (MEK)	Trichloroethene
Chlorobenzene	1,4-Dioxane	Styrene	Tetrachloroethylene
Chloroform	Ethylbenzene	Toluene	Xylenes (total)

Semivolatile Organics

Acenaphthene	o-Cresol	Diethyl phthalate	Naphthalene
Anthracene	m-Cresol	2,4 Dimethylphenol	4-Nitrophenol
Benzo(a)anthracene	p-Cresol	Dimethyl phthalate	Phenanthrene
Benzo(b)fluroranthene	Dibenz(a,h)anthracene	2,4 Dinitrophenol	Phenol
Benzo(k)fluoranthene	Di-n-butyl phthalate	Fluoranthene	Pyrene
Benzo(a)pyrene	1,2-Dichlorobenzene*	Fluorene	Pyridine
Bis(2-ethylhexyl) phthalate	1,3-Dichlorobenzene*	Indeno(1,2,3-cd)pyrene	Quinoline
Chrysene	1,4-Dichlorobenzene*	Methyl tertiary butyl ether (MTBE)	*- can be tested as a volatile

Low Concentration Polynuclear Aromatic Hydrocarbons (Optional)

Benzo(a)anthracene	Benzo(k)fluoranthene	Dibenz(a,h)anthracene	Indeno(1,2,3-cd)pyrene
Benzo(b)fluoranthene	Benzo(a)pyrene	Chrysene*	

* added to this group to assist the chromatographic resolution of chrysene from Dibenz(a,h)anthracene in sample extracts

Optional Semivolatile Organics

Indene	Benzenethiol**	Dibenz(a,h)acridine	1-Methylnaphthalene*

*Note that 2-Methylnaphthalene is part of Appendix IX and is a CLP TCL organic. 1-Methylnaphthalene is not on these lists.

**Benzenethiol can be detected in certain petroleum refinery wastes. Its measurement must compensate for its instability at neutral and acid pH values during sample preparation and its unstable instrument calibration standards

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State of New Mexico
Energy, Minerals and Natural Resources
Oil Conservation Division
1220 S. St Francis Dr.
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CONDITIONS

Action 319230

CONDITIONS

Operator:	
Western Refining Southwest LLC 539 South Main Street Findlay, OH 45840	OGRID: 267595
	Action Number: 319230
	Action Type: [UF-DP] Discharge Permit (DISCHARGE PERMIT)

CONDITIONS

Created By	Condition	Condition Date
joel.stone	Approved for OCD record retention purposes.	9/17/2024