AP - 111

FWGWMWP

2020

NEW MEXICO
ENVIRONMENT DEPARTMENT

Hazardous Waste Bureau

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CERTIFIED MAIL - RETURN RECEIPT REQUESTED

August 31, 2020

John Moore
Environmental Superintendent
Western Refining, Southwest Inc., Gallup Refinery
92 Giant Crossing Road
Gallup, New Mexico 87301

RE: DISAPPROVAL
FACILITY WIDE GROUND WATER MONITORING WORK PLAN – UPDATES FOR 2020
WESTERN REFINING SOUTHWEST INC., GALLUP REFINERY
EPA ID # NMD000333211
HWB-WRG-20-012

Dear Mr. Moore:

The New Mexico Environment Department (NMED) has reviewed the *Facility Wide Ground Water Monitoring Work Plan – Updates for 2020* (Work Plan), dated April 8, 2020, submitted on behalf of Marathon Petroleum Company dba Western Refining Southwest Inc., Gallup Refinery (the Permittee). NMED hereby issues this Disapproval with the attached comments.

The Permittee must submit a revised Work Plan that addresses all comments contained in the Attachment. Two hard copies and an electronic version of the revised Work Plan must be submitted to the NMED. The Permittee must also include a redline-strikeout version in electronic format showing where all revisions to the Work Plan have been made. The revised Work Plan must be accompanied with a response letter that details where all revisions have been made, cross-referencing NMED's numbered comments. The Revised Work Plan must be submitted to NMED no later than **December 31, 2020**.

If you have questions regarding this Disapproval, please contact Michiya Suzuki of my staff at 505-476-6046.

Sincerely,

Dave Cobrain
Program Manager
Hazardous Waste Bureau

cc: M. Suzuki, NMED HWB
C. Chavez, OCD
L. King, EPA Region 6 (6LCRRC)
B. Moore, WRG

File: Reading File and WRG 2020 File
HWB-WRG-20-012

Attachment

Comment 1

In Section 2.1, *Historical and Current Site Use,* page 5, the Permittee states, "[a]s a result of these processing steps, the refinery produces a wide range of petroleum products including propane, butane, unleaded gasoline, diesel, and residual fuel." The ammonium thiosulfate and sulfur recovery units also produce fertilizer product and solid elemental sulfur. The refinery produces commercial products other than petroleum products. Clarify the statement for accuracy in the revised Work Plan.

Comment 2

In Section 2.1, *Historical and Current Site Use,* page 7, and Section 2.3, *Type and Characteristics of the Waste and Contaminants and any Known and Possible Sources,* page 10, the Permittee states, "[n]o waste water is discharged from the refinery to surface waters of the state," and "[d]isposal of waste water into open fields is not practiced at the Gallup Refinery." The *Hydrocarbon Seep Interim Measures 2019 1st Quarter Status Report,* dated April 30, 2019, states, "[t]his [reverse osmosis reject water] line transmits approximately 45 gallons per minutes (gpm) of reject from the Boiler House area (near potable water well PW-3) to evaporation pond number 9 (Pond-9)." The evaporation ponds contain surface water and reverse osmosis reject water is waste water; therefore, the statement is not accurate. Clarify the statements for accuracy in the revised Work Plan. If the discharge to Pond-9 already ceased, provide information regarding the current status for how reverse osmosis reject water is handled at the facility in a response letter. Additionally, the title of Section 2.3 (Type and Characteristics of the Waste and Contaminants and any Known and Possible Sources) lacks clarity. Revise the title of Section 2.3 for clarity in the revised Work Plan.

Comment 3

In Section 2.2, *Potential Receptors*, page 8, the Permittee states, "[c]urrently, PW-2 is sampled every three years, PW-4 is sampled semi-annually and PW-3 is sampled on an annual basis." According to Appendix B, *Table 1 Gallup Refinery – Ground Water Monitoring Schedule,* the sampling frequencies for wells PW-3 and PW-4 are indicated as quarterly. Resolve the discrepancy in the revised Work Plan.

Comment 4

Section 2.4.1, *Separate Phase Hydrocarbons*, page 12, must provide an introductory statement for subsequent discussions (e.g., Section 2.4.1.1 through 2.4.1.5). Provide brief introductory statement under Section 2.4.1 that discusses detections of separate phase hydrocarbons (SPH). Additionally, the subsequent sections discuss detections of SPH in the Main Tank Farm, Hydrocarbon Seep, Aeration Basin, French Drain Release, and Truck Loading Rack areas. However, the Permittee did not include a discussion regarding the detection of SPH in the NAPIS Unit area. SPH has been detected in well NAPIS-1 since 2017. Discuss the detection of SPH in the NAPIS Unit area in the revised Work Plan.

Comment 5
In Section 2.4.1.1, *Main Tank Farm*, page 12, the Permittee states, "[i]t is noted that observed SPH measurements may not accurately reflect site conditions." The statement seems to conflict with the purpose of groundwater monitoring. Provide a clarification for why observed SPH measurements may not accurately reflect site conditions in the revised Work Plan.

Comment 6
In Section 2.4.2, *Methyl Tert Butyl Ether*, page 14, the Permittee states, "New Mexico Environmental Department – Hazardous Waste Bureau (NMEDHWB) requested two Work Plans to further investigate the known MTBE plume at the Facility and investigate a suspected plume north of the tank farm (SWMU 6)." Multiple MTBE plumes are present at various locations within and beyond the facility. NMED previously directed the Permittee to investigate the extent of MTBE plumes other than the one north of the tank farm. For example, the *[Revised] Work Plan 2015 Annual Groundwater Report Comments,* dated October 2019, states, "[t]o evaluate the potential migration of MTBE within the Sonsela aquifer, an additional well will be located approximately halfway between OW-12 and OW-13," and "[t]o delineate the down-gradient extent of the [MTBE] plume detected at OW-1, a new Sonsela well will be installed approximately five hundred feet down-gradient to the west of OW-1." Include the description of all planned and ongoing MTBE plume investigations directed by NMED in the revised Work Plan.

Comment 7
In Section 2.4.4, *Aeration Basin*, page 17, the Permittee states, "[b]oth GWM-2 and GWM-3 have been included in the Aeration Basin Corrective Action Work Plan which began investigative soil and water sampling near the aeration basin in the third quarter of 2012 to support selection of a remedy for SWMU NO. 1 and determine the source of water detected in GWM-2 and GWM-3. Figure 4 shows the location of all of the active monitoring wells on the facility." Figure 4 does not present the location of SWMU 1 and the purpose of referencing Figure 4 in the statement is not clear. Although Figure 4 presents the location of wells GWM-2 and GWM-3, the former and latter sentences do not appear to connect one another. Provide a clarification in the response letter and revise the statement, as appropriate.

Comment 8
In Section 2.4.4, *Aeration Basin*, page 17, the Permittee states, "[t]he aeration lagoons and pond 1 (EP-1), are no longer in service." The Permittee did not include the description of more recent activities associated with SWMU 1. The Permittee submitted the *Solid Waste Management Unit 1 Investigation Report*, dated March 31, 2020, which evaluated the extent of excavation associated with SWMU 1, and the submittal is currently under NMED review. In the revised Work Plan, include a discussion of the more recent activities associated with SWMU 1.

Comment 9
In Section 3.0, *Site Conditions*, page 19, the Permittee states, "[t]he surrounding land is

comprised primarily of public and private lands used for cattle and sheep grazing.[2]" The footnote states, "[2] See, for example, the web site of McKinley County at http://www.co.mckinley.nm.us/ " The referenced website is not relevant to the statement. Remove the footnote from the revised Work Plan.

Comment 10

In Section 3.2, *Drainages*, page 20, the Permittee states, "[a]t the new waste water treatment plant, there are three storm drains located on the south, southwest and west side of the waste water treatment plant which is connected to an underground storm culvert that exits on the northwest section of STP-1 into a conveyance ditch along the northern edge of pond 2 into a holding pond equipped with manual flow valves, located north of evaporation pond 3. The discharge from this holding pond then flows north-northwest towards the Outfall 001 area." Section 2.4.1.4, *French Drain Release,* page 13, discusses the discovery of SPH at the stormwater drainage ditch south of STP-1 referred as "French Drain". It is not clear whether the "French Drain" where SPH was discovered is connected to the Outfall 001 area through the stormwater drainage ditch. If SPH in the "French Drain" follows the ditch to the Outfall 001, the entire ditch can be contaminated with SPH. Provide a figure that depicts the location of the "French Drain" and the flow paths to the Outfall 001, as appropriate. Discuss whether an investigation of soil contamination associated with SPH for the ditch from the "French Drain" to the Outfall 001 is warranted in the response letter.

Comment 11

In Section 3.5.1, *Soil Types and Associations*, page 21, the Permittee states, "[m]ost of the soils found at the surface in the locations where wells are located consist of the Gish-Mentmore complex.[3]" A footnote is provided to reference the source of the statement on the same page. Since there are several such references, it is more appropriate to create a reference section in the Work Plan and list all citations. Revise the Work Plan accordingly.

Comment 12

In Section 4.0, *Investigation Methods*, page 23, the Permittee states, "Appendix A provides a thorough discussion on actual sampling methods that will be used." Actual field sampling methods must be discussed within the text of the Work Plan (see Permit Section IV.L. 2.h). Revise the Work Plan accordingly.

Comment 13

In Section 4.1, *Ground Water Sampling Methodology*, page 23, the Permittee states, "Appendices C-2 and C-2.1 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. Appendix C-3 includes well information for artesian wells also known as Process or Production wells (PW)." Appendices C-2, C-2.1, and C-3 are not included in the Work Plan. Include these appendices in the revised Work Plan.

Comment 14

In Section 4.1.2, *Well Purging,* page 24, the Permittee states, "[w]ell purging and sampling will be performed using 1.5-inch x 3 foot and/or 3-inch x 3-foot disposable polyethylene bailers for ground water sampling and/or appropriately decontaminated portable sampling pumps." The Permittee must provide a table that presents a list of wells with a type of sampling device used to collect groundwater samples in future periodic groundwater monitoring reports. No revision is necessary.

Comment 15

Section 4.2.1, *Sample Handling,* page 25, and Appendix A, *Gallup Refinery Field Sampling Collection and Handling Standard Procedures, Order of Collection*, page 3, lists volatile organic compounds (VOC) first among other analytes. The Permittee has been collecting nitrite samples for laboratory analysis in recent sampling events despite its short holding time. Refer to Comment 12 of *NMED's Approval with Modifications Investigation Report Sanitary Lagoon,* dated April 24, 2020, and Comment 11 of NMED's *Approval with Modifications Annual Ground Water Monitoring Report Gallup Refinery – 2018*, dated January 22, 2020 for references. If laboratory nitrite analysis is feasible for future sampling events, nitrite samples must be collected first in the order to accommodate its short holding time. If field nitrite analysis is conducted using a colorimeter as proposed in the *Response to Disapproval Facility Wide Ground Water Monitoring Work Plan - Updates for 2019*, dated September 11, 2019, include a section that discusses procedures for the field nitrite analysis in the revised Work Plan. Revise the Work Plan accordingly.

Comment 16

In Section 4.4.6.1, *Blanks*, page 30, the Permittee states, "[i]f contaminants are detected in field or laboratory blanks, the sample data will be qualified, as appropriate." The data quality must be discussed and the implications must be identified if such data are qualified rather than rejected. Revise the Work Plan accordingly.

Comment 17

Section 6.0, *Monitoring Program Revisions*, page 35, does not reference NMED's comments that directed revisions to the monitoring program. For example, Comment 12 of NMED's *Approval with Modifications Annual Ground Water Monitoring Report Gallup Refinery – 2018,* dated January 22, 2020, states, "[i]f the causes are not known and the chromium level did not decline in 2019, include hexavalent chromium analysis for the groundwater samples collected from well NAPIS-2 in the two subsequent sampling events in 2020." Hexavalent chromium analysis for the groundwater samples collected from well NAPIS-2 is not proposed in Appendix B – Table 2, *Gallup Refinery – Requested/Approved Changes to the Ground Water Monitoring Schedule* or in Section 6.0. Section 6.0 must reference Comment 12 of the January 22, 2020 *Approval with Modifications* and include a discussion for why hexavalent chromium analysis was not proposed at this time. Reference all relevant NMED's comments that directed revisions to the monitoring program and provide a discussion in the revised Work Plan.

Comment 18

Figure 5, *Sonsela Water Elevation Map – 2020,* presents the potentiometric surface for the Sonsela aquifer. Wells MW-1, MW-2, MW-4, MW-5, BW-1C, BW-2C, BW-3C, BW-5C, OW-01, OW-10, OW-11, OW-12, and OW-1 were presented; however, the groundwater elevation data for these wells were not included in the figure. Include the elevation data in the revised figure. In addition, the date on the figure is indicated as March 27, 2020. However, it is not clear whether the date represents actual gauging date or preparation date for the figure. Indicate the date when the gauging data was collected in the revised figure.

Comment 19

In Appendix A, *Gallup Refinery Field Sampling Collection and Handling Standard Procedures, Field Data Collection, Elevation and Purging,* page 1, the Permittee states, "Gallup does not have any recovery well pumps that need to be shut off and removed prior to water elevation measurements." Groundwater recovery pumps were installed in wells RW-1, RW-2, RW-5, RW-6, OW-14, OW-58, OW-30, and OW-55 in August 2019. Comment 13 of the January 22, 2020 *Approval with Modifications* states, "[s]ince the groundwater level was depressed due to the fluid recovery operation, the Permittee must halt the pumping operation at least 48 hours prior to conducting depth measurements in these wells. Include the provision in the future groundwater monitoring events." These pumps must be shut off prior to water elevation measurements as required by Comment 13 of the letter. Revise the Work Plan accordingly.

Comment 20

In Appendix A, *Gallup Refinery Field Sampling Collection and Handling Standard Procedures Field Data Collection, Elevation and Purging,* page 1, the Permittee states, "[t]he 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 every ten feet." The pump hose is marked every ten feet to set the intake at the midpoint of screened intervals. A ten-foot increment on the hose may not allow accurate enough placement to position the pump intake at the midpoint of screened intervals. The increment must be small enough (e.g., one-foot) to allow more accurate placement. Revise the Work Plan accordingly.

Comment 21

In Appendix A, *Gallup Refinery Field Sampling Collection and Handling Standard Procedures, Field Data Collection, Elevation and Purging,* page 1, the Permittee states, "[f]ield water quality parameters measured during purging (pH, electrical conductivity, temperature, and dissolved oxygen), must stabilize to within 10% for a minimum of three consecutive measurements before collection of ground water samples from each well." Clarify whether purging is considered complete when one or all of these criteria is met in the revised Work Plan.

In addition, Section 4.1.2, *Well Purging,* page 24, includes oxidation-reduction potential (ORP) as one of stabilization criteria in addition to the water quality parameters listed in Appendix A. ORP readings must be included as one of stabilization criteria. The pH, electrical conductivity,

temperature, dissolved oxygen, ORP data must be collected from all groundwater monitoring wells. Resolve the discrepancy in the revise Work Plan accordingly.

Comment 22
In Appendix A, *Gallup Refinery Field Sampling Collection and Handling Standard Procedures, Field Data Collection, Elevation and Purging,* page 2, the Permittee states, "[t]he water level in the well, total depth of well and thickness of floating product (if any) will be measured using an oil/water interface meter. If product is present, a ground water sample is not obtained." Provide information regarding specific product thickness that allows or prevents groundwater sample collection in the revised Work Plan.

Comment 23
Appendix A, *Gallup Refinery Field Sampling Collection and Handling Standard Procedures, Sampling Equipment at Gallup Refinery,* pages 2 and 3, lists sampling equipment to be maintained in the facility. However, the list does not include an instrument for ORP, TDS and salinity measurements, nitrite field testing kit, or coarse (100 µm) filters for turbid waters as required by previous NMED correspondence. Explain if the equipment will be maintained at the facility or provided by contractors in the revised Work Plan.

Comment 24
In Appendix A, *Gallup Refinery Field Sampling Collection and Handling Standard Procedures, Filtration,* page 3, the Permittee states, "[t]he 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." Refer to Comment 9 of NMED's January 22, 2020 *Approval with Modifications* for the direction how to handle groundwater samples with high level of total suspended solids. Use the sequential filtration process (e.g., 100 to 45 µm filter) for dissolved metals sampling, where applicable. Include the provision in the revised Work Plan.

Comment 25
In Appendix A, *Gallup Refinery Field Sampling Collection and Handling Standard Procedures, Filtration,* page 4, the Permittee states, "[s]ampling personnel carry a cell phone when gathering ground water and other water 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 Hall Environmental Analytical Laboratory to verify that sampling is correctly performed." It is not clear under what circumstances personnel would call a laboratory to receive instructions during sampling events. Provide examples for the situation where personnel must call a laboratory amid sampling in the revised Work Plan.

Comment 26
Appendix A, *Gallup Refinery Field Sampling Collection and Handling Standard Procedures,*

General Well Sampling Procedures, page 5, describes sampling procedures in a manner which appears to be directions for field personnel. Note that the Work Plan is submitted for NMED's formal review. Revise the Work Plan to describe the sampling procedures in a manner that does not constitute instructions.

Comment 27

Appendix B includes Table 1, *Gallup Refinery – Ground Water Monitoring Schedule,* and Table 2, *Gallup Refinery – Requested/Approved Changes to the Ground Water Monitoring Schedule.* These tables do not include page numbers. Include page numbers in the revised tables.

Comment 28

Appendix B, Table 2, *Gallup Refinery – Requested/Approved Changes to the Ground Water Monitoring Schedule,* and Appendix E, *Field Methods for Nitrite Analysis* are included in the Work Plan; however, these appendices are not referenced within the text of the Work Plan. These appendices must be referenced in relevant sections and a discussion must be provided within the text of the Work Plan. Revise the Work Plan accordingly.

Comment 29

In Appendix C-1, *2019 Fluid Level Measurements,* page 8 of 8, the stratigraphic unit for the screened interval of well SMW-2 is not legible. Present a legible description in the revised Work Plan.

Comment 30

Appendix C-1, *2019 Fluid Level Measurements*, indicates that some wells were not gauged in 2019 due to the presence of elevated hydrogen sulfide gas in the ambient air. Comment 3 of NMED's *Approval with Modifications Annual Ground Water Monitoring Report Gallup Refinery – 2018,* dated January 22, 2020, states, "[t]he Permittee must conduct the required sampling and change the scheduled sampling dates as necessary, if the H_2S concentrations are too high to allow personnel to conduct the sampling event on the scheduled sampling timeframe." The Permittee must collect required data from these wells in future gauging and sampling events. Reference the NMED's direction and include the provision in the revised Work Plan.

Marathon Petroleum Company LP

April 8, 2020

Mr. Kevin Pierard, Chief
New Mexico Environmental Department
2905 Rodeo Park Drive East, Bldg. 1
Santa Fe, New Mexico 87505

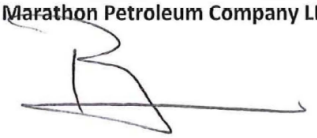
RE: Facility Wide Ground Water Monitoring Work Plan – Updates for 2020
Marathon Petroleum Company LP, Gallup Refinery
(dba Western Refining Southwest, Inc.)
EPA ID #NMD000333211

Dear Mr. Pierard:

Marathon Petroleum Company LP is submitting the referenced Work Plan. Enclosed please find two copies of the Work Plan along with two copies of a CD containing electronic copies of the Work Plan and cover letter.

If you require any additional information, please do not hesitate to contact me at 505-726-9745 or BMoore1@marathonpetroleum.com.

Sincerely,
Marathon Petroleum Company LP



Brian K. Moore
Senior HES Professional

Enclosure

cc Carl Chavez - Oil Conservation Division

Marathon Petroleum Company LP

Facility Wide Ground Water Monitoring Work Plan – Updates for 2020

Gallup Refinery
92 Giant Crossing Road
Gallup, NM 87301
(505) 722-3833

Submitted: April 8, 2020

Marathon Petroleum Company LP

CERTIFICATION

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

Robert S. Hanks

Robert S. Hanks
Refinery General Manager

04/08/2020
Date

Executive Summary

Western Refining Southwest, Inc. conducts quarterly, semi-annual and annual ground water monitoring at its Gallup Refinery on a site wide basis. The Ground Water Monitoring Work Plan (Plan) documents any additions or revisions in ground water monitoring and also details the sampling procedures used.

This Plan divides the facility into six monitoring groups. Group A consists of the boundary wells situated along the northwest corner of the refinery property and monitoring wells around the land treatment area (LTU). Group B consists of a cluster of wells at the aeration basin and at the sanitary treatment pond 1 (STP-1) near the Waste Water Treatment Unit. Group C consists of the observation wells on the northeast section of the refinery including four product recovery wells. One new well (OW-58A) was installed in this area in 2019. Group D includes the process/production wells and the four observation wells located on the south-southwest section of the property. Group E includes 49 permanent monitoring wells installed to delineate the extent of a hydrocarbon plume associated with a seep discovered in 2013 directly west of the crude tanks (T-101, 102) and more recently any other potential releases within this area; included in this group is a pre-existing well located directly west of the truck loading terminal. Five new wells (MKTF-46, MKTF-47, MKTF-48, MKTF-49, and MKTF-50) were installed in this area in 2019. Group F includes the sampling requirements for the evaporation ponds and effluent from the sanitary treatment pond (STP-1).

The Gallup Refinery will periodically review facility-wide monitoring data and assess the monitoring program presented in this Plan. Revisions to the Plan, as necessary, will then be presented annually for agency review and approval. These revisions may include, but not be limited to a reduction or change in monitoring locations, monitoring frequency, and/or target chemicals to be analyzed.

The Gallup Refinery follows the most current approved sampling/monitoring schedule from NMED: *Approval with Modifications Revised Facility-Wide Ground Water Monitoring Work Plan, Gallup Refinery – Updates for 2019,* HWB WRG 19-012, dated November 15, 2019.

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

Refinery General Manager

- Robert S. Hanks

Remediation Project Manager

- Brian K. Moore

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List of Acronyms

AL	Aeration Lagoon
API	American Petroleum Institute
BMP	Best Management Practices
BS	Blank Spike
BSD	Blank Spike Duplicate
BTEX	Benzene, Toluene, Ethylbenzene, Xylene
CFR	Code of Federal Regulations
DQO	Data Quality Objective
DRO	Diesel Range Organics
DTB	Depth to Bottom
DTW	Depth to Water
EP	Evaporation Pond
EPA	Environmental Protection Agency
FT.	Foot
FWGWMP	Facility Wide Ground Water Monitoring Plan
GPM	Gallons per minute
GRO	Gasoline Range Organics
HNO3	Nitric Acid
HWB	Hazardous Waste Bureau
IDW	Investigation Derived Waste
LDU	Leak Detection Unit
LTU	Land Treatment Unit
ML	Milliliter
MCL	Maximum Contaminant Level
MS	Matrix Spike
MSD	Matrix Spike Duplicate
MTBE	Methyl Tert Butyl Ether
NAICS	North American Industry Classification System

List of Acronyms – Continued

NAPIS	New American Petroleum Institute Separator
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NOI	Notice of Intent
OAPIS	Old American Petroleum Institute Separator
OW	Observation Well
OCD	Oil Conservation Division
ORP	Oxidation-Reduction Potential
PPE	Personal Protective Equipment
PPM	Parts per million
PSTB	Petroleum Storage Tank Bureau
PVC	Polyvinyl Chloride
PW	Process Well
QA	Quality Assurance
QC	Quality Control
RW	Recovery Well
RCRA	Resource Conservation and Recovery Act
SIC	Standard Industrial Classification
SOP	Standard Operating Procedure
SPH	Separate Phase Hydrocarbon
STP	Sanitary Treatment Pond
SVOC	Semi-volatile Organic Compound
SWMU	Solid Waste Management Unit
SWPP	Storm Water Pollution Prevention Program
TOC	Total Organic Content
VOC	Volatile Organic Compound
WQCC	Water Quality Control Commission
WWTP	Waste water treatment plant

1.0 Introduction

This Facility-Wide Ground Water Monitoring Work Plan (Plan) has been prepared for the implementation of a ground water monitoring program at the Gallup Refinery owned by Marathon Petroleum Company and operated by Western Refining Southwest, Inc. ("Gallup Refinery" or "Facility").

1.1 Scope of Activities

This Plan has been prepared to collect data that will be used to characterize the nature and extent of potential impacts to ground water at the Gallup Refinery. The monitoring plan is designed to assist the facility in evaluating any levels of contaminants that exceed compliance standards. This Plan divides the facility into six groups for periodic monitoring:

GROUP A	GROUP B	GROUP C	GROUP D	GROUP E	GROUP F
BW-1A, 1B, 1C	GWM-1, 2, 3	OW-13, 14, 29, OW-30	PW-2, 3, 4	MKTF-01 thru MKTF-50	EP-2, 3, 4, 5, 6, 7, 8, 9
BW-2A, 2B, 2C	NAPIS 1, 2, 3, KA-3, OW-62	OW-50, 52, 53, OW-54, 55, 56, OW-57, 58, OW-58A, 61, OW-63, 64, 65	OW-1, 10		EP-11, 12A, 12B
BW-3A, 3B, 3C BW-4A, 4B BW-5A, 5B, 5C	OAPIS-1 OW-59, 60	RW-1, 2, 5, 6	OW-11, 12		STP-1 to EP-2, Boiler Water Inlet to EP-9
MW-1, 2, 4, 5	LDU (3)				
SMW-2, 4	STP1-NW, SW				

Group A consists of the boundary wells situated along the northwest corner of the refinery property and the monitoring wells around the LTU. Group B consists of a cluster of monitoring wells and leak detection units for the NAPIS at the aeration basin and at the sanitary treatment pond. Group C includes the observation wells located on the northeast section of the plant and includes recovery wells from which small quantities of free product has been continually removed. Group D includes the process/production wells and four observation wells located on the south, southwest section of the refinery property. Group E includes a total of 49 monitoring wells installed to delineate a hydrocarbon plume associated with a seep discovered west of the crude tank (Tank 101); included in this group is a pre-existing well located directly west of the truck loading terminal. Group F includes sampling requirements for the evaporation ponds and for the effluent from the sanitary treatment pond. Designated wells and sample points identified are monitored on a quarterly, semi-annual and annual basis following the procedures presented in this Plan.

The Gallup Refinery periodically reviews facility-wide monitoring data and evaluates the monitoring program presented in this Plan. Annual revisions to the Plan will be presented for agency review and approval. These revisions may include, but not be limited to, a reduction or change in monitoring locations, monitoring frequency, and/or target chemicals to be analyzed.

1.2 Facility Ownership and Operation

This Plan pertains to the Gallup Refinery located at Exit 39 on Interstate I-40. This refinery is located at Jamestown, New Mexico, approximately 17 miles east of Gallup. Figure 1 shows the regional location of the Gallup Refinery.

The owner is:

	Marathon Petroleum Company 539 South Main Street Findlay, OH 45840	(Parent Corporation)
Operator:	Western Refining Southwest Inc. Gallup Refinery 92 Giant Crossing Road Gallup, New Mexico 87301	(Postal Address)

Western Refining Southwest Inc. (physical address)
Gallup Refinery
I-40, Exit 39 (17 Miles East of Gallup, NM)
Jamestown, New Mexico 87347

The following regulatory identification and permit governs the Gallup Refinery:

- SIC code 2911 (petroleum refining) and NAICS code 32411 apply to the Gallup Refinery;
- U.S. EPA ID Number NMD000333211;
- New Mexico OCD Abatement Plan Number AP-111; and
- 2015 NPDES MSGP, ID #NMR053168.

The facility status is corrective action/compliance. Quarterly, semi-annual and annual ground water sampling is conducted at the facility to evaluate present contamination.

The refinery is situated on an 810-acre irregular shaped tract of land that is largely located within the lower 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. Figure 2 is a topographic map showing the general layout of the refinery in comparison to the local topography.

2.0 Background Information

2.1 Historical and Current Site Use

Built in the 1950's, the Gallup Refinery is located within a rural and sparsely populated section of McKinley County in Jamestown, New Mexico, 17 miles east of Gallup, New Mexico. The setting is a high desert plain on the western slope of the Continental Divide. The nearest population centers are the Pilot Flying J Travel Center (Travel Center) refueling plaza, the Interstate 40 highway corridor, and a small cluster of residential homes located on the south side of Interstate 40 approximately 2 miles southwest of the refinery (Jamestown). The surrounding land is comprised primarily of public lands and is used for cattle and sheep grazing.

The refinery primarily receives crude oil via two 6-inch diameter pipelines; two pipelines from the Four Corners Area enter the refinery property from the north. In addition, the refinery also receives natural gasoline feed stock via a 4-inch diameter pipeline that comes in from the west along the Interstate 40 corridor from the Western Refining Southwest, Inc. - Wingate Plant (formerly Conoco gas plant). Crude oil and other products also arrive at the site via railroad cars. These feed stocks are then stored in tanks until refined into products.

The Gallup Refinery is a crude oil refining and petroleum products manufacturing facility. The Standard Industrial Classification (SIC) code is 2911 and the North American Industry Classification System Code (NAICS) is 32411. There are no organic chemicals, plastics, or synthetic fibers manufactured that contribute to our process flow of waste water. The Gallup Refinery does not manufacture lubricating oils.

The refinery incorporates various processing units that convert crude oil and natural gasoline into finished products. These units are briefly described as follows.

- Crude Distillation Unit - separates crude oil into various fractions; including gas, naphtha, light oil, heavy oil, and residuum.

- Fluidized Catalytic Cracking Unit (FCCU) - dissociates long-chain hydrocarbon molecules into smaller molecules, and essentially converts heavier oils into naphtha and lighter oils.
- Alkylation Unit - combines specific types of hydrocarbon molecules into a high octane gasoline blending component.
- Reforming Unit - breaks up and reforms low octane naphtha molecules to form high octane naphtha.
- Hydro-Treating Unit - removes undesirable sulfur and nitrogen compounds from intermediate feed stocks, and also saturates these feed stocks with hydrogen to make diesel fuel.
- Treater Unit - removes impurities from various intermediate and blending feed stocks to produce finished products that comply with sales specifications.
- Ammonium Thiosulfate Unit - accepts high H_2S and ammonia containing gas streams from the Amine and the Sour Water Stripper units, and converts these into a useful fertilizer product, ammonium thiosulfate.
- Sulfur Recovery Unit - converts and recovers various sulfur compounds from the gases and liquids produced in other processing units to create a solid elemental sulfur byproduct.
- Waste Water Treatment Plant - processes and treats refinery waste and storm water before releasing to treatment ponds.

As a result of these processing steps, the refinery produces a wide range of petroleum products including propane, butane, unleaded gasoline, diesel, and residual fuel. In addition to the afore-mentioned processing units, various other equipment and systems support the operation of the refinery and are briefly described as follows.

Storage tanks are used throughout the refinery to hold and store crude oil, natural gasoline, intermediate feed stocks, finished products, chemicals, and water, which are all located above ground. Capacity of these tanks range in size from 80,000 barrels to less than 1,000 barrels.

Pumps, valves, and piping systems are used throughout the refinery to transfer various liquids among storage tanks and processing units. A railroad spur track and a railcar loading rack are used to transfer feed stocks and products from refinery storage tanks into and out of railcars. Several tank truck loading racks are used at the refinery to load out finished products and also receive crude oil, other feed stocks, additives, and chemicals.

Gasoline and diesel are delivered to the Travel Center via tanker truck. An underground diesel pipeline exits between the refinery and the Travel Center. In 2013 the underground diesel line

from Gallup Refinery to the Travel Center was replaced and put back in service on February 3, 2014, but was subsequently removed from service. The replaced line runs above ground from the marketing area of the refinery for approximately 150 feet and continues underground to the Travel Center.

A firefighting training facility is used to conduct employee firefighting training. Waste water from the facility, when training is conducted, is pumped into a tank which is then pumped out by a vacuum truck. The vacuum truck pumps the oily water into a process sewer upstream of the New API Separator (NAPIS).

The process waste water system is a network of curbing, paving, catch basins, and underground piping used to collect waste water from various processing areas within the refinery. The waste water effluent then flows into the equalization tanks and the NAPIS where the oil is separated from water based on the principle that, given a quiet surface, oil will float to the water surface where it can be skimmed off. The skimmed slop is passed to a collection chamber where it is pumped back into the refinery process. The clarified water is routed to a waste water treatment plant (WWTP) where benzene is removed via granular activated carbon (GAC) canisters that are placed at the effluent of the dissolved gas flotation (DGF) unit. WWTP operations alternate the configuration of these GAC canisters from a single setup to an in-series setup (i.e. primary and secondary canister). To help monitor the breakthrough of these GAC canisters, several waste water samples are taken at the effluent of the last GAC canister. Results from benzene analysis of the waste water samples are monitored to manage the breakthrough from the GAC canisters. When benzene values exceed 0.4 ppm, one or more of the following actions are taken: GAC canister configuration is modified to an in-series set-up; GAC canister is replaced with fresh carbon; GAC canister effluent is recirculated back through the WWTP. The treated water flows from the GAC canisters into pond STP-1. STP-1 consists of two bays, north and south and each bay is equipped with five aerators per bay. Effluent from STP-1 then flows into Evaporation Pond 2 and gravitated to the rest of the ponds.

During episodes of unit upsets or major storm events, the waste water is held in one of the three equalization tanks, T-35, T-27 and T-28 which are used to handle large process and storm water

flows allowing the flow to the NAPIS to be controlled. These tanks are also used to store waste water if problems are encountered with the downstream equipment, i.e., NAPIS and the WWTP.

The storm water system is a network of valves, gates, berms, embankments, culverts, trenches, ditches, natural arroyos, and retention ponds that collect, convey, control, and release storm water that falls within or passes through refinery property. Storm water that falls within the processing areas is considered equivalent to process waste water and is sent to tanks T-35, T-27 and T-28 when needed before it reaches the NAPIS, WWTP, STP-1 and into Evaporation Pond 2 where flow is gravitated to the rest of the ponds. Storm water discharge from the refinery is very infrequent due to the arid desert-like nature of the surrounding geographical areas.

At the evaporation ponds, waste water is converted into vapor via solar and mechanical wind-effect evaporation via two 80 gallons per minute electrically driven evaporation pond spraying snow machines located between ponds 4 and 5. Two additional 66 GPM (gallons per minute) evaporation pond sprayers were installed in October 2014 between ponds 3 and 4 for a total of four evaporators. No waste water is discharged from the refinery to surface waters of the state. In September 2015, Gallup Refinery submitted a Notice of Intent requesting continued coverage under the 2015 NPDES Multi-Sector General Permit which was approved on October 8, 2015 (NMR053168). The refinery maintains a Storm Water Pollution Prevention Plan (SWPPP) that includes Best Management Practices (BMPs) for effective storm water pollution prevention (updated September 2015). The refinery has constructed several new berms in various areas and improved outfalls (installed barrier dams equipped with gate valves) to minimize the possibility of potentially impacted runoff leaving the refinery property and also to minimize the stormwater run-on from the I-40 interchange and the Travel Center onto refinery property.

2.2 Potential Receptors

Potential receptors at the facility also include those that may arise from future land uses. Currently, these include on-site workers, nearby residents, wildlife, and livestock.[1] The major route to exposure of humans would be from contaminants reaching a drinking water well. Other routes could be from showering, cooking, etc. with contaminated ground water, raising crops and vegetables with contaminated ground water, or getting exposed to or fishing in surface water that has commingled with shallow ground water. Exposure can also occur through contact with soils and/or plants that have become contaminated through contact with contaminated ground water. However, drinking water wells remain the primary route of possible exposure.

At this time, the nearest drinking water wells are located on-site at the southwest areas of the facility, at depths of approximately 1000 feet which are identified as process or production (PW) wells. These wells are designated as PW-2, PW-3, and PW-4 (See Figure 4 for location). These wells are operated by the facility to provide the refinery's process water and drinking water to nearby refinery-owned houses, to the refinery itself, and to the Travel Center. Currently, PW-2 is sampled every three years, PW-4 is sampled semi-annually and PW-3 is sampled on an annual basis. The chemical analyses of these and all of the other water samples collected under this Work Plan are discussed in the Annual Facility-Wide Groundwater Monitoring Reports. Annual sampling results from 2009 through 2019 have indicated concentrations above screening levels of sulfate in samples collected at PW-3, a single detection of iron in a sample collected at PW-4, a single detection of Tetrachloroethene in a sample collected from PW-2, a single detection of phenol in a sample collected at PW-3, and two detections of bis(2-ethylhexyl phthalate) at PW-4. The chemical analyses of these and all of the other water samples collected under this Work Plan are discussed in the Annual Facility-Wide Groundwater Monitoring Reports.

Other than the on-site wells, there is no known drinking water wells located within a 4-mile radius of the site. The nearest drinking water wells that could be used by off-site residents are located to

[1] Note: There is extensive and regular patrolling by security personnel of the facility which operates 24-hours – therefore, we can discount the possibility of an inadvertent or deliberate intruder becoming exposed to contamination in groundwater that has reached the surface in some form.

the northwest of the site at a distance slightly greater than 4-miles located within the Navajo community of Iyanbito (shown on the USGS Topographical Map - Gallup Quadrangle (Revised 1980)). These wells are northwest of the South Fork of the Puerco River which, flows towards the southwest from immediately north of the facility. The Cibola National Forest lies in the south-east direction and there are no wells or residents in this protected area.

Artesian conditions at some locations of the site lead to the possibility of ground water emerging onto the surface and thus being able to affect wildlife. No surface water on the site is used for human consumption or primary contact, such as immersion, or secondary contact, such as recreation. The man-made ponds on the site are routinely monitored and are a part of this Plan. Therefore, if they are in contact with shallow ground water that has exhibited elevated levels of contaminants, the Plan will detect any commingling of ground water and surface waters.

Fluctuating ground water elevations can smear contaminants into subsurface soil and rocks, and there is a possibility that plant roots could reach such contaminated soils and bio-concentrate contaminants creating another route of exposure to potential receptors, such as birds and animals that eat the plants. No food crops are currently grown on the site.

2.3 Type and characteristics of the waste and contaminants and any known and possible sources

The types of waste likely include – volatile and semi-volatile organic compounds, primarily hydrocarbons, but could include various other industrial chemicals such as solvents, acids, spent caustic solutions, and heavy metals present in spent chemicals and waste water. These wastes could be in the form of waste water, spent chemicals destined for off-site shipping and disposal packed in drums, sludge, and dry solids.

Most of the wastes and contaminants that could possibly reach ground water have the characteristic that they would biodegrade and naturally attenuate. However, any heavy metals present in dirt and sludge could possibly leach into ground water and would not biodegrade. There is a possibility also that certain long-lived chemicals would not biodegrade, or, if they did, it would

be at a very slow rate. Possible sources include leaks from buried pipes, tanks, surface spills, and historical dumping of wastes in remote areas of the site.

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 bermed areas to contain spills. The NAPIS has double walls and a leak detection system installed.

Similarly, surface impoundments can serve as a source of possible ground water contamination. In the past, waste water from the railroad loading rack flowed to a settling and separation lagoon north of the rack and flow exited at the north end where water leaving the lagoon was distributed across a flat open site known as the fan-out area. The free flow of liquids led to subsurface soil contamination. This area is identified as SWMU No. 8 and has been cleaned up for a corrective action complete with controls status. Disposal of waste water into open fields is not practiced at the Gallup Refinery.

There are fourteen Solid Waste Management Units (SWMU) identified at the Gallup Refinery, and one closed land treatment area. On December 31, 2013, the RCRA Post-Closure Care Permit ("Permit") became effective under §20.4.1.901A(10) NMAC and identified an additional 20 Areas of Concern (AOCs) requiring corrective action as listed below.

RCRA (Resource Conservation and Recovery Act) Regulated Units

- Land Treatment Unit (LTU)

SWMUs (Solid Waste Management Units)

- 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 – API Separator

AOCs (Areas of Concern)

- AOC 15 – New API Separator
- AOC 16 – New API Separator 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

Existing ground water monitoring wells effectively surround all of the above listed SWMUs and AOCs. The Permit was subsequently modified in September 2017, with SWMU 8 and AOCs 19 and 25 granted Corrective Action Complete status. AOC 32 was combined with SWMU 14 and AOC 33 was combined with SWMU 12. AOCs 20, 21, 22, and 23 are combined to make new AOC 35. The schedule in 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 and this resulted in 11 AOCs (AOC 16, 17, 18, 24, 26, 27, 28, 29, 30, 31, and 34) being removed from the Permit and transferred to the Consent Order for further evaluation.

2.4 Summary of contaminant releases that could contribute to possible ground water contamination.

Spills and leaks are known to have occurred on the site in various locations. Although most hydrocarbons are immediately picked up for recovery and contaminated soil is removed, some of the liquids present in a spill may enter the subsurface. With precipitation, there is the possibility that some of the contaminants could leach and reach ground water.

2.4.1 Separate Phase Hydrocarbons

2.4.1.1 Main Tank Farm

Separate phase hydrocarbons (SPH) floating on shallow ground water was found in the mid-1990s at the northeast end of the facility in the main tank farm. A series of recovery wells were installed and SPH has been recovered since the initial discovery. Recovery through hand-bailing was conducted on a quarterly basis and in 2019 recovery pumps were installed. In March 2019, MPC proposed an interim recovery system using pumps in RW-1, RW-2, RW-5, RW-6, OW-14, OW-58, OW-30, and OW-55. The interim system was proposed to recover SPH and dissolved-phase impacts within and down-gradient of the main tank farm. The *Interim Groundwater Recovery System Work Plan* was approved with modifications on August 6, 2019. It is noted that observed SPH measurements may not accurately reflect site conditions. Recovery wells in the main tank farm and the down-gradient area are listed as follows:

RECOVERY WELLS			
RW-1	RW-2	RW-5	RW-6
OW-14	OW-58	OW-30	OW-55

2.4.1.2 Hydrocarbon Seep

In June of 2013 during a routine inspection, a hydrocarbon seep was discovered in an isolated area approximately 100 yards west of Tank 101/102. A series of excavations were completed in the area of the seep including installation of six temporary sumps for bi-weekly hydrocarbon recovery. Through 2019 a total of 1,727,574 gallons of liquid (hydrocarbon and ground water) have been recovered from these sumps. To date a total of 49 permanent monitoring wells have been installed

with an addition of one pre-existing well, which has been labeled as MKTF-45, and is located in the vicinity of the site investigation. SPH has been measured in Marketing Tank Farm (MKTF) wells located west and northwest of the truck loading rack and marketing tank farm, extending northwest to the location of the hydrocarbon seep. The Gallup Refinery continues to further characterize potential source areas, recovery of liquids from the temporary sumps, and continued sampling of the monitoring wells for characterization and delineation purposes. All 50 wells are included in the Ground Water Monitoring Schedule (see Appendix B), which includes the addition of five new wells (MKTF-46 through MKTF-50) in 2019. The well logs are provided in Appendix D.

Additional soil staining was observed north, northwest of the sumps and these sites were excavated of approximately 38.26 tons of soil, which was sent to the Painted Desert Landfill for disposal.

Temporary retention ditches were installed to recover liquids from this area. From April 1, 2016 through December 31, 2019, approximately 645,981 gallons of liquid (hydrocarbon and ground water) have been recovered from this area via vacuum truck.

RECOVERY WELLS
MKTF-01 THRU MKTF-50

2.4.1.3 Aeration Basin

A measurable level of SPH was identified in GWM-1 during the third quarter sampling event in 2015 through October 2019.

2.4.1.4 French Drain Release

On February 6, 2018 a mixture of hydrocarbon and water was discovered flowing out of a 4-inch diameter PVC pipe that discharges into a stormwater drainage ditch south of STP-1. Sample analysis indicated the hydrocarbon was naphtha. The flow from the pipe was estimated to be 1.7 gallons per minute. The drainage ditch feeds into a small collection pond that is equipped with a drain valve. The valve was closed and no hydrocarbon was discharged from the pond. A catch

basin was installed at the discharge point of the PVC pipe. Site personnel utilized a vacuum truck to transfer the discharge back into the Gallup Refinery.

A subsurface investigation was conducted during March 2018. Five monitor wells (OW-61 thru OW-65) were installed in effort to delineate the hydrocarbon plume that was discharging from the PVC pipe. During the 2019 quarterly gauging, SPH was detected in three of the monitor wells (OW-61, OW-62 and OW-65) during each event and only during the first event in OW-64. All of these wells are screened within the Chinle/Alluvium Interface and measured water levels are consistent with other nearby wells also screened within the Chinle/Alluvium Interface.

2.4.1.5 Truck Loading Rack Underground Pipeline Gasoline Release

A release of gasoline was observed at the land surface on October 27, 2019 on the west side of the Truck Loading Rack. The source of the release was determined to be an underground transfer line on the north side of the Truck Loading Rack. Associated with this release, SPH was detected in MKTF-17, MKTF-19, and MKTF-36.

2.4.2 Methyl Tert Butyl Ether

Methyl Tert Butyl Ether (MTBE) has not been used at the refinery since April 2006. Several monitoring wells were installed at various depths to monitor SPH and MTBE contaminant plumes from historical contamination. Historical analytical data for the observation wells (OW-14, 29 and 30) indicate the contaminant, MTBE has slowly been increasing over the years in these wells. Based on this information, New Mexico Environmental Department – Hazardous Waste Bureau (NMED-HWB) requested two Work Plans to further investigate the known MTBE plume at the Facility and investigate a suspected plume north of the tank farm (SWMU 6). Pursuant to NMED's February 23, 2016 Approval with Modifications of the *Investigation Work Plan OW-29 & OW-30 and North Drainage Ditch Areas*, wells OW-53, OW-54, OW-55, and OW-56 were installed. These observation wells (OW) are located downstream on the northeast section of the plant and are designated as follows.

OBSERVATION WELLS					
OW-13	OW-14	OW-29	OW-30	OW-50	OW-52
OW-53	OW-54	OW-55	OW-56		

2.4.3 NAPIS Unit

A unit at the southwest end of the facility that is used to recover and recycle oil back into the process has also – through leakage and spills – caused some MTBE and hydrocarbon contamination in shallow ground water. This unit is known as the NAPIS and was put into service in October 2004. 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. The NAPIS unit is also equipped with three leak detection units on the east and west bays and also at the oil sump section on the east bay and are designated as follows:

NAPIS WELLS				LEAK DETECTION UNITS		
NAPIS-1	NAPIS-2	NAPIS-3	KA-3	EAST LDU	WEST LDU	OIL SUMP LDU

2.4.4 Aeration Basin

The Aeration Basin, which is designated as SWMU No. 1 in the facility's RCRA Post-Closure Care Permit includes three cells, known as AL-1, AL-2 (lagoons) and holding pond 1 which is currently referred to as EP-1, although it is not an evaporation pond and is not part of the area covered by SWMU No. 2 – Evaporation Ponds. All three of these cells are no longer in service since the startup of the Waste Water Treatment Plant in 2012. All refinery waste water flow was diverted to the WWTP bypassing the lagoons and pond 1. The Gallup Refinery has experienced intermittent discharges of oil and oily water into the lagoons and spills to ground surface while it was in operation. Most of these occurrences were the result of unit upsets and or large storm events affecting the old API Separator.

Two ground water monitoring wells (GWM-1 and GWM-2) were installed immediately down gradient of the aeration lagoons in 2004 and 2005 in order to detect potential leakage from the aeration basin. GWM-3 was installed in 2005 on the northwest corner of pond 1 (EP-1).

Analysis of ground water samples collected at GWM-1 and GWM-2 have indicated several organic constituents at concentrations above the screening levels in ground water, which would indicate a potential for historical releases from the lagoons. In the third quarter of 2015, quarterly inspection of GWM-1 indicated the presence SPH during gauging activities. NMED was notified of this finding and the Gallup Refinery was instructed to collect a hydrocarbon sample for fingerprint analysis (DRO/GRO and MRO). Gallup was also instructed to purge and gauge the well on a weekly basis to check the recharge rate. The initial measurement was made without the use of an oil/interface probe and the thickness of the hydrocarbon layer in the well was not immediately known. Measured SPH thickness ranged from 0.35 to 0.45 feet in September, October and November 2015. On December 10, 2015, the Gallup Refinery sent a response to NMED–HWB concurring that the source of the hydrocarbons observed in GWM-1 is from the adjacent aeration lagoon.
Depth to water ranged from 20.83 feet to 22.07 feet during the quarterly monitoring in 2019. The measured thickness of SPH in 2019 ranged from 0.13 feet to 0.48 feet during the quarterly monitoring events.

GWM-2 and 3 upon installation in 2005 were found to be dry. Water was first detected in GWM-2 in the first quarter of 2008 and in GWM-3 in the third quarter of 2010. 24-hour notification of the finding was given to NMED and OCD respectively. Analyses of ground water samples collected from GWM-2 and GWM-3 have detected the presence of several constituents at concentration levels above applicable water quality standards such as fluoride, chloride, nitrates, and sulfates. MTBE is the only VOC to have been detected in GWM-2 or GWM-3, but at concentrations well below the screening level.

Quarterly inspections in 2011 and 2012 continued to indicate an increase in measurable water levels in GWM-2 and GWM-3, which was consistent with the increased levels in the lagoons and pond 1. In the second half of 2012 through early 2013 the levels in the lagoons and pond 1 began

to decrease with cessation of gravitational flow between lagoons to pond 1 due in part to the start-up of the WWTP. Continued quarterly inspections indicated no water present in GWM-2 and GWM-3 in 2013 through 2019.

Both GWM-2 and GWM-3 have been included in the Aeration Basin Corrective Action Work Plan which began investigative soil and water sampling near the aeration basin in the third quarter of 2012 to support selection of a remedy for SWMU NO. 1 and determine the source of water detected in GWM-2 and GWM-3. Figure 4 shows the location of all of the active monitoring wells on the facility.

In February of 2012, the Gallup Refinery submitted a "Revised Investigation Work Plan Solid Waste Management Unit (SWMU) No. 1 Aeration Basin" to include sampling of soils and ground water surrounding the Aeration Basin to determine if there has been a release to the environment and to delineate any such release. In addition, information was collected to help determine the source of ground water that had been observed in monitoring wells GWM-2 and GWM-3. The work plan also included SWMU No. 14 Old API Separator soil and ground water sampling. A new well OAPIS-1 (SWMU 14-2) was installed on the northwest corner where the benzene strippers were located on July 17, 2012 by Enviro-Drill Inc. OAPIS-1 (SWMU 14-2) was added to the 2014 Monitoring Schedule.

In February of 2013, the influent to the aeration lagoons was routed to the new Waste Water Treatment Plant (WWTP) and rerouting of the Travel Center sanitary effluent was completed in June of 2013. The aeration lagoons and pond 1 (EP-1), are no longer in service.

WELLS AT THE AERATION BASIN			
GWM-1	GWM-2	GWM-3	OAPIS-1

2.4.5 North Drainage Ditch

On April 22, 2015, the Gallup Refinery notified NMED-HWB of the discovery of hydrocarbons in a drainage ditch in the northern portion of the refinery property. Surface water samples were

collected from the standing water in the drainage ditch and concentrations of benzene, toluene, ethylbenzene, and xylenes (BTEX) were detected as well as methyl tert-butyl ether (MTBE), gasoline range organics (GRO) and diesel range organics (DRO). An investigation work plan was submitted to NMED for review on August 13, 2015 and was subsequently implemented in May 2016 with installation of well OW-56.

2.4.6 OW-14 Source Area

In correspondence dated May 11, 2015, NMED requested submittal of a work plan to investigate the source of contaminants present in groundwater monitoring well OW-14. Subsequently, wells OW-57 and OW-58 were installed in 2016 pursuant to NMED's May 12, 2016 Approval with Modifications of the *Revised OW-14 Source Area Investigation Work Plan*. Well OW-58A was installed in 2019 adjacent to OW-58 in order to screen a higher interval than was screened in OW-58. A copy of the well log is included in Appendix D.

3.0 Site Conditions

The Gallup Refinery is located within a rural and sparsely populated section of McKinley County. It is situated in the high desert plain on the western flank of the Continental Divide approximately 17 miles east of Gallup. The surrounding land is comprised primarily of public and private lands used for cattle and sheep grazing.[2]

3.1 Current site topography and location of natural and manmade structures

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) and the lowest point is located at the northwest corner boundary (elevation approximately 6,860 feet). The refinery processing facility is located on a flat man-made terrace at an elevation of approximately 6,950 feet.

3.2 Drainages

Surface water in this region consists of the man-made evaporation ponds and aeration basins located within the refinery, a livestock watering pond (Jon Myer's Pond) located east of the refinery, two small unnamed spring fed ponds located south of the refinery, and the South Fork of the Puerco River and its tributary arroyos. The various ponds and basins typically contain water consistently throughout the year. The South Fork of the Puerco River and its tributaries are intermittent and generally contain water only during, and immediately after, the occurrence of precipitation.

There are several stormwater conveyance ditches located throughout the refinery which are directed to discharge into contained basins where it is collected and recycled for use as process water; collected and allowed to evaporate; diverted around regulated industrial activity or into two designated outfalls located on the east and west section of the property, identified as Outfall 001 and Outfall 002 (Figure 7). Outfall 001 is located directly south of evaporation pond 8 on the western edge of the refinery's property boundary and equipped with four separate small diameter

[2] See, for example, the web site of McKinley County at http://www.co.mckinley.nm.us/

overflow pipelines, each with a manual flow valve for independent control. Outfall 002 is located north of the rail road loading rack on the eastern section of the facility. This outfall consists of a concrete barrier with a valve to control discharges from a deep ditch that collects/ponds the runoff from the rail rack loading area.

Directly west of the crude tank area, there is also a concrete barrier with a valve to control discharges from a culvert that carries stormwater flow from the truck loading rack area. 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 evaporation ponds 3, 4, 5 and 6 and outward towards the Outfall 001 area. At the new waste water treatment plant, there are three storm drains located on the south, southwest and west side of the waste water treatment plant which is connected to an underground storm culvert that exits on the northwest section of STP-1 into a conveyance ditch along the northern edge of pond 2 into a holding pond equipped with manual flow valves, located north of evaporation pond 3. The discharge from this holding pond then flows north-northwest towards the Outfall 001 area.

3.3 Vegetation types

Surface vegetation consists of native xerophytic vegetation including grasses, shrubs, small junipers, and some prickly pear cacti. Average rainfall at the refinery is less than seven inches per year, although it can vary to slightly higher levels elsewhere in the county depending on elevation.

On alluvial fans on valley sides and drainage ways, the existing vegetation is usually alkali sacaton, western wheatgrass, Indian rice grass, blue grama, bottlebrush squirreltail, broom snakeweed, fourwing saltbush, threeawn, winterfat, mat muhly and spike muhly. On fan remnants on valley sides we usually find blue grama, western wheatgrass, Indian ricegrass, big sagebrush, galleta, bottlebrush squirreltail, fourwing saltbrush, needle and thread, one seed juniper, sand dropseed, spineless horsebrush, rabbitbrush, and two-needle pinyon. Cattails have been observed in isolated areas and are generally associated with wetlands.

3.4 Erosion features

The impacts of historic overgrazing are visible at the north-side of the facility, in the form of arroyos that formed when surface run-off cut through the ground and washed away soils that were not able to hold water with their ground cover lost to overgrazing. Now that the facility is fenced and no livestock grazing occurs on the site, vegetation has recovered in these areas. With the facility helping to bring back vegetation in its undeveloped areas the formation and deepening of erosion features on its land has decreased.

3.5 Subsurface conditions

3.5.1 Soil types and associations

Most of the soils found at the surface in the locations where wells are located consist of the Gish-Mentmore complex.[3] These soils occur in alluvial fans on valley sides and fan remnants on valley sides. The parent material for these soils is slope and fan alluvium derived from sandstone and shale. These are well drained soils with moderately slow (0.2 in/hr) to slow permeability (0.06 in/hr). In this association, the Gish and similar soils make up about 45 percent, the Mentmore and similar soils 35 percent, and minor components 20 percent. These minor components are - Berryhill and similar soils 10 percent and Anodize and similar soils 10 percent. The typical profile for these soils is – 0 to 2 inches fine sandy loam, 2 to 72 inches of various kinds of clay loam.

Drill logs for various wells have been provided electronically to the NMED-HWB. From these well logs we can infer that the soils in the subsurface are generally composed of clays starting at the immediate subsurface, interbedded with narrow sand and silt layers. At about 100 to 150 feet, layers of mudstone, sandstone (from the Chinle Group, Petrified Forest Formation) and siltstone start to appear. Figure 3 shows a generalized relationship of soils in and around the Gallup Refinery.

[3] Soil Survey of McKinley County Area, New Mexico, McKinley County and Parts of Cibola and San Juan Counties, Natural Resources Conservation Service (NRCS), US Department of Agriculture, available at - http://soildatamart.nrcs.usda.gov/Manuscripts/NM692/0/McKinley.Area%20NM.pdf

3.5.2 Stratigraphy

The 810-acre refinery property site is located on a layered geologic formation. Surface soils generally consist of fluvial and alluvial deposits; primarily clay and silt with minor inter-bedded sand layers. Below this surface layer is the Chinle Group, which consists of low permeability clay stones and siltstones. As such, the Chinle Group (Petrified Forest Formation) effectively serves as an aquiclude. Inter-bedded within the Chinle Group is the Sonsela Sandstone bed, which represents the uppermost potential aquifer in the region.

The Sonsela Sandstone bed lies within and parallels the dip of the Chinle Group. As such, its high point is located southeast of the refinery and it slopes downward to the northwest as it passes under the refinery. Due to the 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 property.

3.5.3 Presence and flow direction of ground water

Ground water flow within the Petrified Forest Formation is extremely slow and typically averages less than 10^{-10} centimeters per second (less than 0.01 feet per year). Ground water flow within the surface soil layer above the Petrified Forest Formation is highly variable due to the presence of complex and irregular stratigraphy; including sand stringers, cobble beds, and dense clay layers. As such, hydraulic conductivity may range from less than 10^{-2} centimeters per second in the gravelly sands immediately overlying the Petrified Forest Formation down to 10^{-8} centimeters per second in the clay soil layers located near the surface.

Shallow ground water located under refinery property generally flows along the upper contact of the Petrified Forest Formation. The prevailing flow direction is from the southeast and toward the northwest.

4.0 Investigation Methods

The purpose of this section is to describe the types of activities that will be conducted and the methods that will be used as part of this Plan. Appendix A provides a thorough discussion on actual sampling methods that will be used.

4.1 Ground Water Sampling Methodology

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

Appendix C-1 is a summary of the fluid level data collected in 2018 for the non-MKTF wells. Appendix C-1.1 is a summary of the fluid level data collected in 2018 for the MKTF wells. Appendices C-2 and C-2.1 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. Appendix C-3 includes well information for artesian wells also known as Process or Production wells (PW). Information provided for the artesian wells was gathered from well boring logs. These wells are encased and therefore measurement for depth to bottom was not field verified. Table C-2.1 is revised to include new monitor wells installed in 2018.

4.1.1 Well Gauging

At the beginning of each quarterly, semi-annual, or annual sampling event, all monitoring and recovery wells listed in Appendix B, Ground Water Monitoring Schedule, will be gauged to record the depth to SPH, if present, the DTW and the DTB 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. Each monitoring 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 also have a permanent marked reference point on the well casing from which ground water levels and well depths are measured. Figure 5 depicts the potentiometric surface

for the Sonsela aquifer and Figure 6 shows the potentiometric surface for the Alluvium/Chinle Group Interface zone.

Gauging measurements will be recorded on a field gauging form. Data obtained from the gauging will be reported in the annual ground water monitoring report. The data will be used to develop groundwater contour maps and SPH thickness isopleths which will also be included in the annual report.

4.1.2 Well Purging

Each monitoring well will be purged by removing ground water prior to sampling in order 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 measurements must stabilize for a minimum of three consecutive readings before purging will be discontinued. Field water quality measurements will include pH, electrical conductivity, temperature, dissolved oxygen (DO) mg/l, and oxidation-reduction potential (ORP). Field water quality measurement stability will be determined when field parameter readings stabilize to within ten percent between readings for three consecutive measurements. Once the readings are within ten percent, purging will stop and the well is ready for sample collection. The volume of ground water 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 x 3 foot and/or 3-inch x 3-foot disposable polyethylene bailers for ground water sampling and/or appropriately decontaminated portable sampling pumps.

4.2 Ground water Sample Collection

Ground water samples will be obtained from each well within 24 hours of the completion of well purging. Sample collection methods will be documented in the field monitoring reports. The samples will be transferred to the appropriate, clean, laboratory-prepared containers provided by the analytical laboratory. Sample handling and chain-of-custody (COC) procedures are described

in more detail in Appendix A as well as decontamination procedures for reusable water sampling equipment.

All purged ground water and decontamination water from monitoring wells will be drained into the refinery waste water treatment system upstream of the NAPIS. The procedures for disposing materials are described in Appendix A.

Ground water samples are collected and analyzed for both total and dissolved metals. Ground water samples obtained for dissolved metals analysis will be filtered through disposable filters with a 0.45 micrometers mesh size.

4.2.1 Sample Handling

All sample containers are supplied by the contracted analytical laboratory and shipped to the Gallup Refinery in sealed coolers. Chemical preservation is also provided by the laboratory through pre-preserved bottle ware. Collection of containerized ground water samples are in the order of most volatile to least volatile, such as: VOCs, SVOCs, metals, phenols, cyanide, sulfate, chloride, nitrate and nitrite. 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 COC procedures as detailed in Appendix A will be followed for all samples collected. All samples will be submitted to the laboratory as soon as possible to allow the laboratory to conduct the analyses within the specified method holding times. Details of the general sample handling procedures are provided in Appendix A.

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 EPA or industry-wide accepted method. The drainage hole at the bottom of the cooler will be sealed and secured in case of sample container leakage.
- 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.

4.3 Analytical Methods

Ground water and surface water samples collected during the monitoring events will be analyzed using the specified analytical methods and for the constituents listed in Appendix B.

4.4 Quality Assurance Procedures

Contract analytical laboratories will maintain internal quality assurance programs in accordance with EPA 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 Quality Assurance/Quality Control (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 EPA's laboratory certification requirements. The specific procedures to be completed are identified in the following sections.

4.4.1 Equipment Calibration Procedures and Frequency

The laboratory's equipment calibration procedures, calibration frequency, and calibration standards will be in accordance with the EPA test methodology requirements and documented in the laboratory's quality assurance (QA) and Standard Operating Procedures (SOP) 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.

4.4.2 Field QA/QC Samples

Field duplicates, field blanks, equipment rinsate blanks, reagent blanks and trip blanks may be obtained for quality assurance during sampling activities. The samples will be handled as described in Section 4.4.3.

Field duplicates will consist of two samples either split from the same sample device or collected sequentially. Field duplicate ground water 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 must always be obtained.

Field blanks shall be obtained at a frequency of no less that 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.

Equipment blanks shall be obtained for chemical analysis at the rate of five percent but no fewer than one rinsate blank per sampling day. Equipment rinsate blanks shall be collected at a rate of one per sampling day if disposable sampling apparatus is used. Rinsate samples shall be generated by rinsing deionized water through unused or 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 ten 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.

4.4.3 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 EPA 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 EPA test methods and a frequency of one in ten for non-EPA test methods. Laboratory batch QA/QC samples will be project specific.

4.4.4 Laboratory Deliverables

The analytical data package will be prepared in accordance with EPA-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 matrix spikes (MS/MSDs);
- Variability for duplicate analyses;
- Completeness; and,
- 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 EPA 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; and,
- 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).

4.4.5 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 EPA guidance documents: Guidance Document for the Assessment of RCRA Environmental Data Quality, National Functional Guidelines for Organic Data Review, and 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 Gallup Refinery Project Manager of data quality exceptions within one business day of identifying the data quality exception in order to allow for sample re-analysis, if possible. The Gallup Refinery Project Manager will contact NMED within one business day of

receipt of laboratory notification of data quality exceptions in order to discuss the implementations and determine whether the data will still be considered acceptable, or if sample re-analysis or re-sampling is necessary.

4.4.6 Blanks, Field Duplicates, Reporting Limits and Holding Times

4.4.6.1 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 contaminants are detected in field or laboratory blanks, the sample data will be qualified, as appropriate.

4.4.6.2 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.

4.4.6.3 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 ground water 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.

4.4.6.4 Holding Times

Per EPA 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.

4.4.7 Representativeness and Comparability

4.4.7.1 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.

4.4.7.2 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.

4.4.8 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 ground water 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 matrix spikes;
- Laboratory matrix spike duplicates;
- Laboratory blank spikes;
- Laboratory blank spike duplicates; and
- 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.

5.0 Monitoring and Sampling Program

The primary objective of ground water monitoring is to provide data which will be used to assess ground water quality at and near the facility. Ground water elevation data will also be collected to evaluate ground water flow conditions. The ground water monitoring program for the facility will consist of sample collection and analysis from a series of monitoring wells, recovery wells, outfalls, and evaporation pond locations.

The monitoring network is divided into six investigation areas (Groups A, B, C, D, E, and F). The sampling frequency, analyses and target analytes will vary for each investigation area and the combined data from these investigation areas will be used to assess ground water quality beneath and immediately down-gradient of the facility and evaluate local ground water flow conditions.

Samples will not be collected from monitoring wells that have measurable SPH. 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.

The following sections outline the monitoring program for each investigation area.

5.1 Group A Through Group F Sampling Locations

5.1.1 Sampling Locations

The location of the monitoring, recovery wells and leak detection units are shown in Figure 4. The following wells will be sampled (as described in Appendix B):

GROUP A	GROUP B	GROUP C	GROUP D	GROUP E
BW-1A, 1B, 1C	GWM-1, 2, 3	OW-13, 14, 29, 30	PW-2, 3, 4	MKTF-01 thru 50
BW-2A, 2B, 2C	NAPIS 1, 2, 3, KA-3	OW-50, 52, 53, 54	OW-1, 10	
	OW-62	OW-55, 56, 57, 58		

		OW-58A, 61, 63, OW-64, 65	
BW-3A, 3B, 3C BW-4A, 4B BW-5A, 5B, 5C	OAPIS-1 OW-59, 60	RW-1, 2, 5, 6	OW-11, 12
MW-1, 2, 4, 5	LDU (3)		
SMW-2, 4	STP1-NW, SW		

5.2 Evaporation Ponds, Outfalls

5.2.1 Sampling Locations

The Group F outfalls and ponds will be sampled (as described in Appendix B, Table 1). (Note: these outfalls are from one section of the waste water treatment system to another – they do not discharge to any location outside the facility).

GROUP F OUTFALLS
STP-1 to EP-2
Boiler Water Inlet to EP-9

GROUP F EVAPORATION PONDS		
Pond 1 – No longer in service	EP-5	EP-9
EP-2	EP-6	EP-11
EP-3	EP-7	EP-12A
EP-4	EP-8	EP-12B

6.0 Monitoring Program Revisions

Upon review of the analytical results from the monitoring events under this Plan, historic facility-wide monitoring data, available soil boring data, and other related information the Gallup Refinery will assess the monitoring program presented in this Plan. Revisions to the Plan, as necessary, will then be presented for agency review and approval on an annual basis. These revisions may include, but not be limited to, a reduction or change in monitoring locations, monitoring frequency, and/or target analytes listed in Appendix B, Table 1.

6.1 Requests for Modifications to Sampling Plan

New monitoring wells MKTF-46 through MKTF-50 have been added to the Sampling Plan. The proposed analytical suite for these five new wells includes the following:

- Volatile Organic Compounds;
- Semi-Volatile Organic Compounds;
- WQCC Metals – Total and Dissolved;
- GRO/DRO Extended;
- Major Cations/Anions; and
- 1,4-Dioxane by method 8270/8270 SIMMS for two consecutive events.

In addition, groundwater samples collected from MKTF-46 will be analyzed by method 8011 for 1,2-dibromoethane due to the detection of chlorinated solvents in samples collected from this well.

New monitoring well OW-58A has been added to the Sampling Plan. The proposed analytical suite includes the following:

- Volatile Organic Compounds (method 8260 & method 8011 for 1,2-dibromoethane);
- WQCC Metals – Total and Dissolved;
- GRO/DRO Extended; and
- Nitrite and nitrate.

Marathon Petroleum Company LP

FIGURES

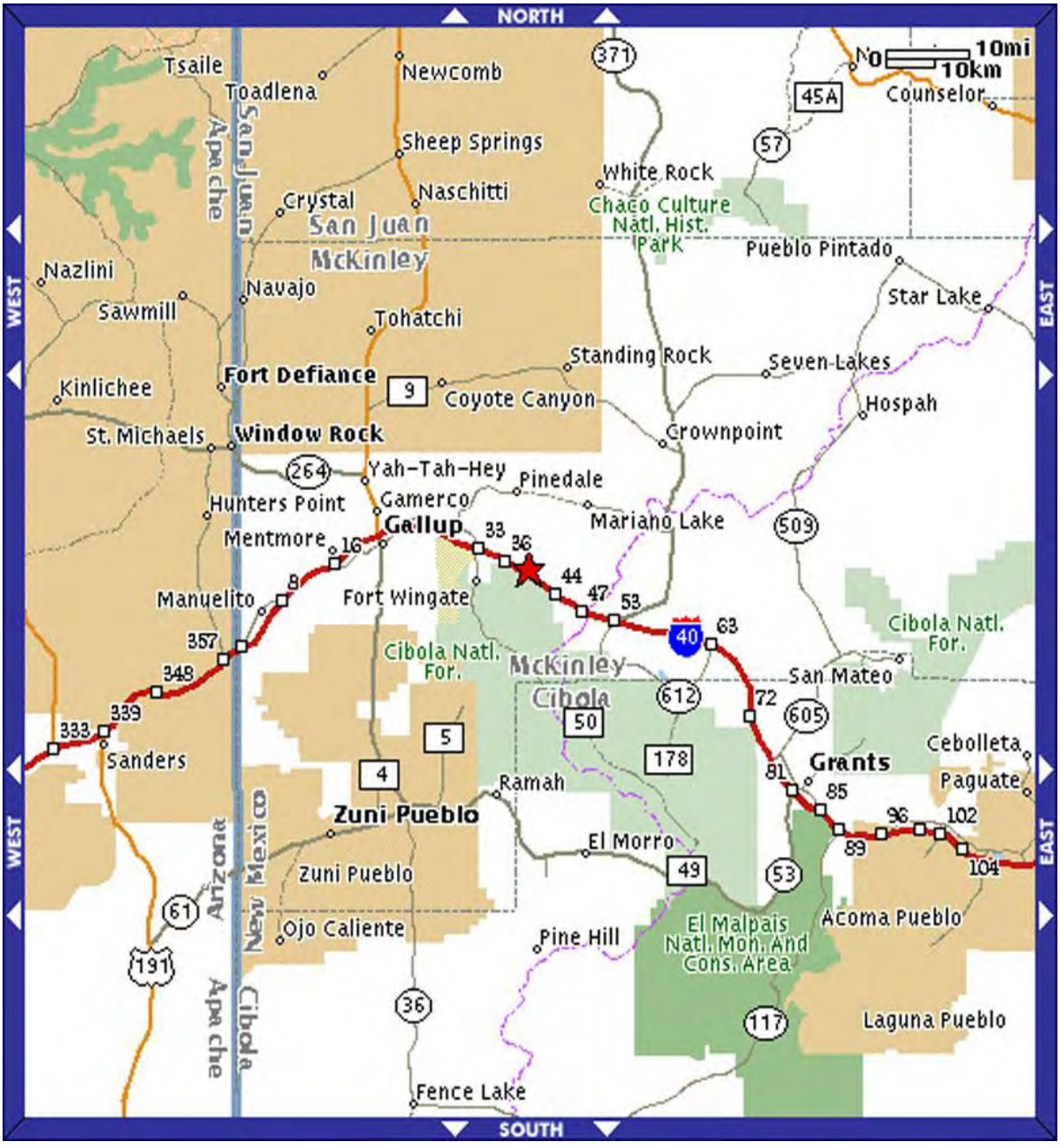


Figure 1: Regional map showing the location of the Gallup Refinery (red star along Interstate-40, 20 miles east of the City of Gallup).

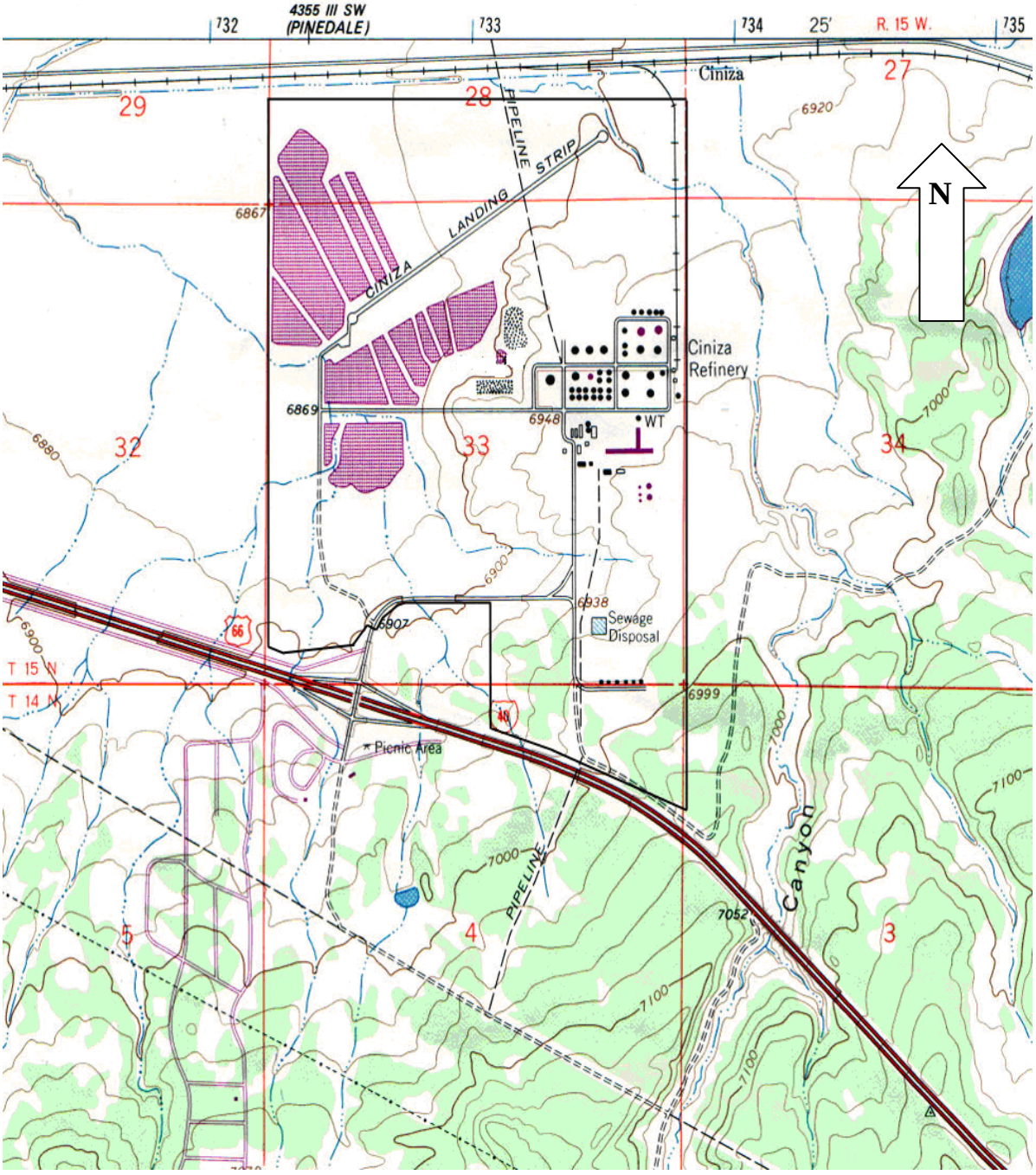


Figure 2: Topographic Map of the Gallup Refinery Site - USGS Topographical Map - Gallup Quadrangle (Revised 1980)

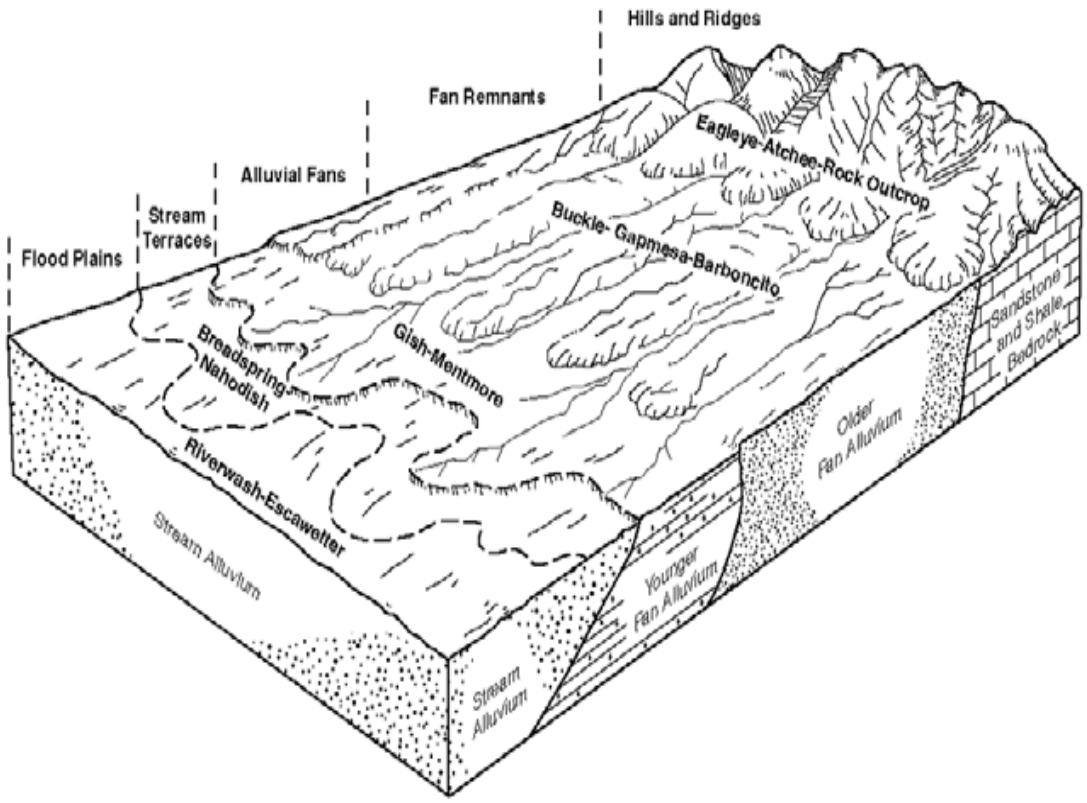
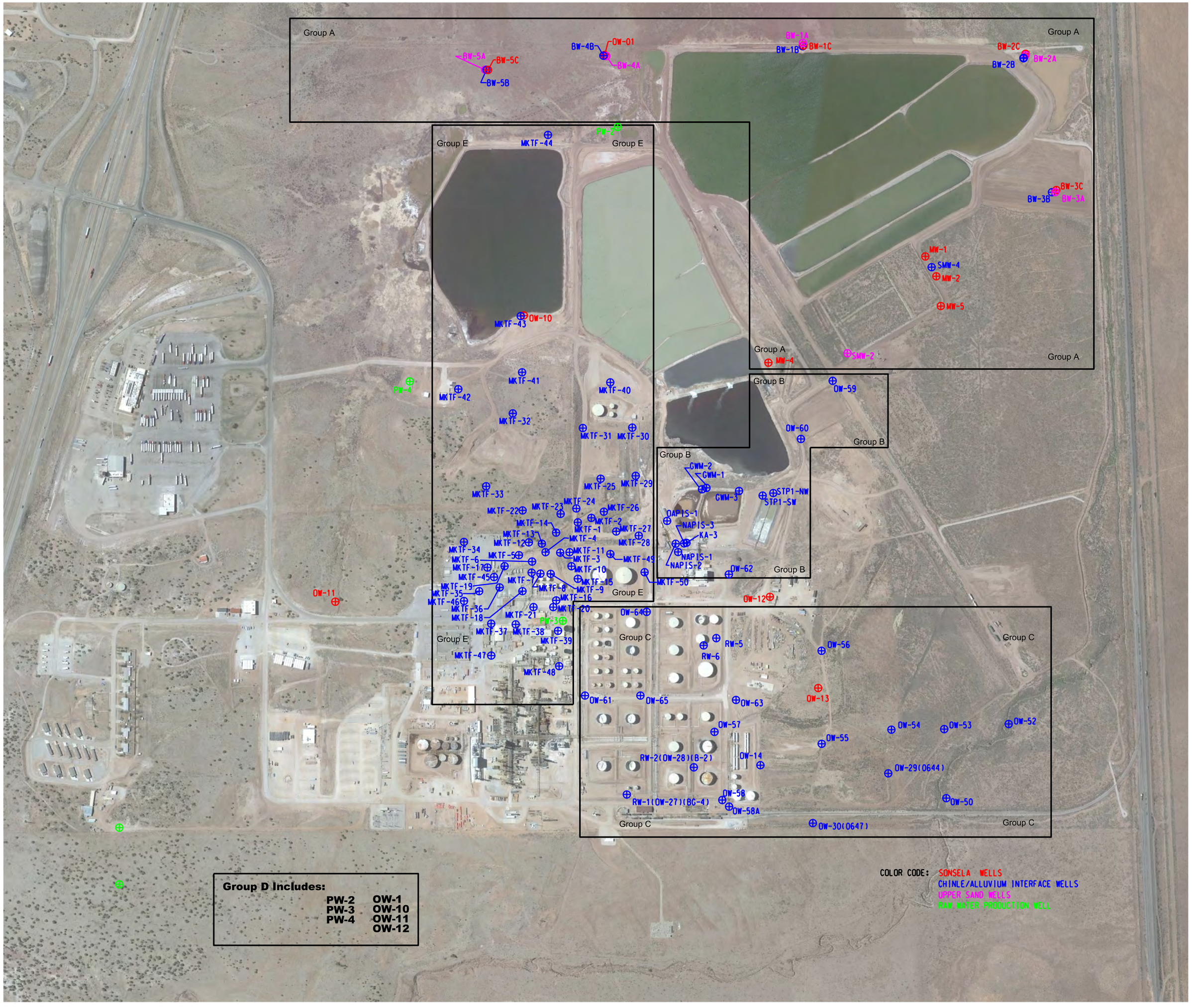


Figure 3: Generalized relationship of soils in the Gallup Refinery area: from NRCS/USDA Soil Survey of McKinley County.



This Line is 1" on Original

intertek psi
4601 Ripley
El Paso, Texas 79922
915-584-1317

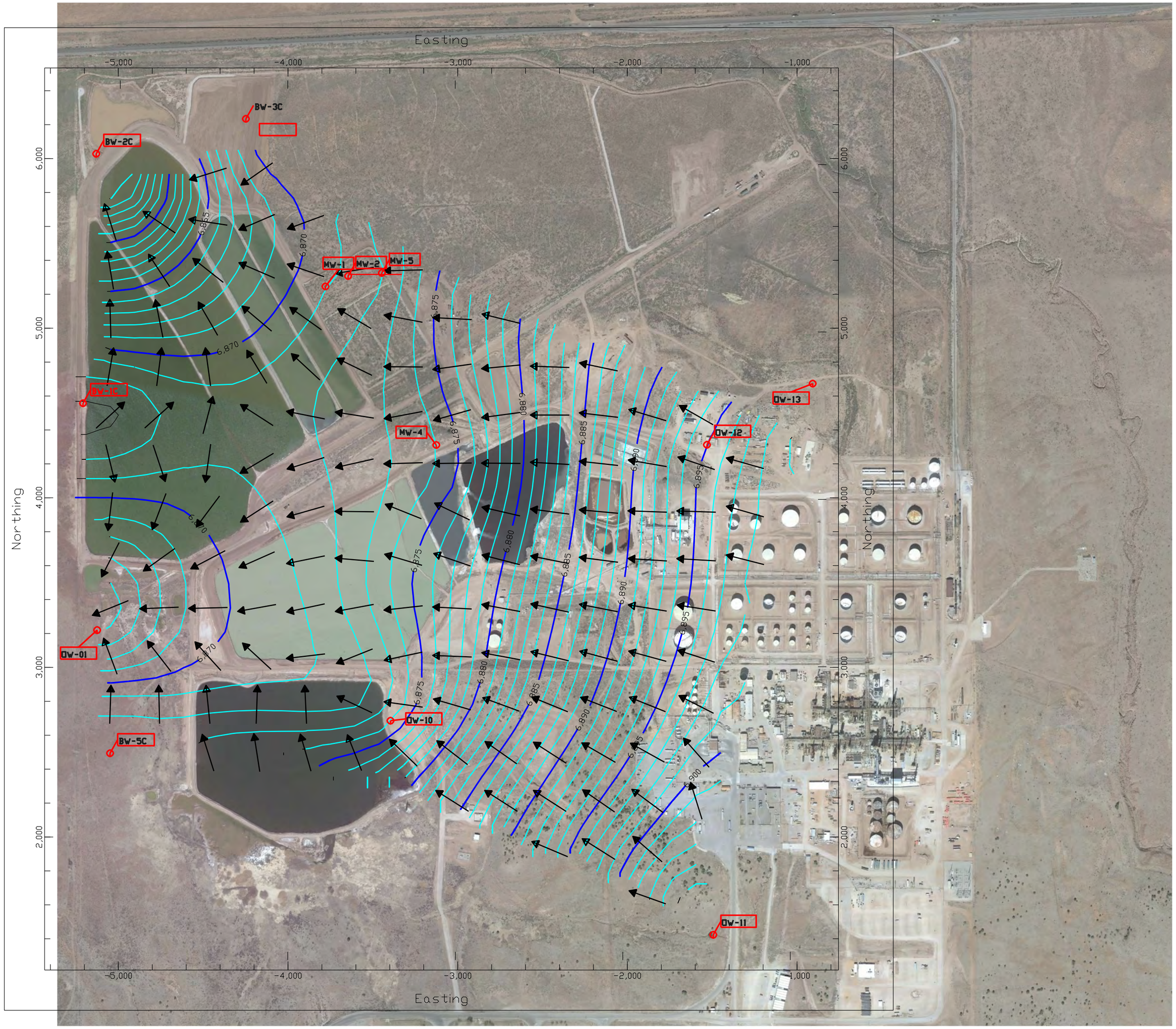
1"=500'

Project #: 06251970

FIGURE 4
FACILITIES AND WELL GROUPS - 2020
MARATHON - GALLUP REFINERY

Marathon - Gallup Refinery
92 Giant Crossing Road
Gallup, New Mexico 87301

April 1, 2020



FLOW DIRECTION:

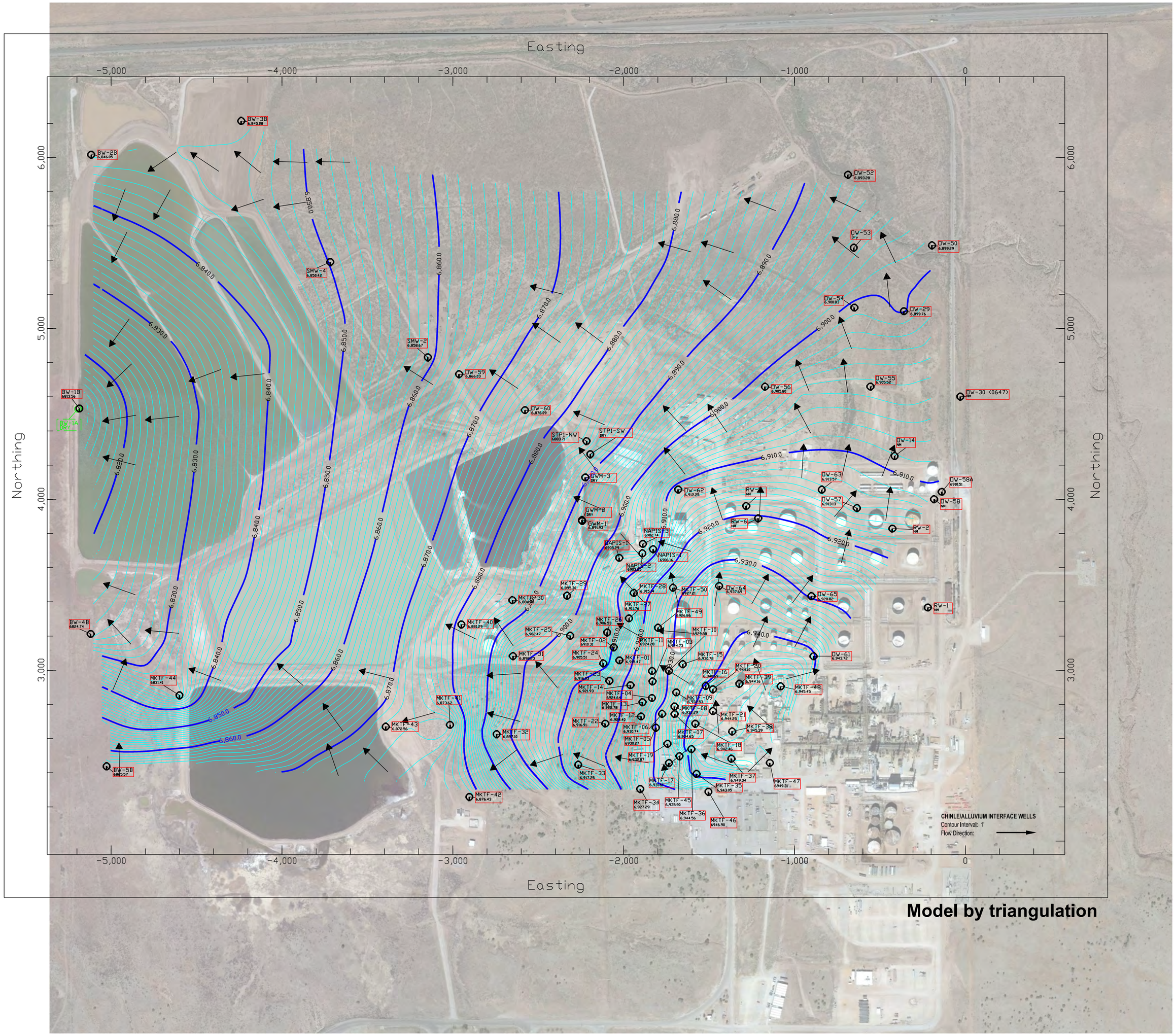
intertek psi
4601 Ripley
El Paso, Texas 79922
915-584-1317

1"=500'

Project #: 06251970

Figure 5
Sonsela Water Elevation Map - 2020
MARATHON - GALLUP REFINERY

Marathon - Gallup Refinery
92 Giant Crossing Road
Gallup, New Mexico 87301
Date: March 27, 2020



intertek psi

4601 Ripley
El Paso, Texas 79922
915-584-1317

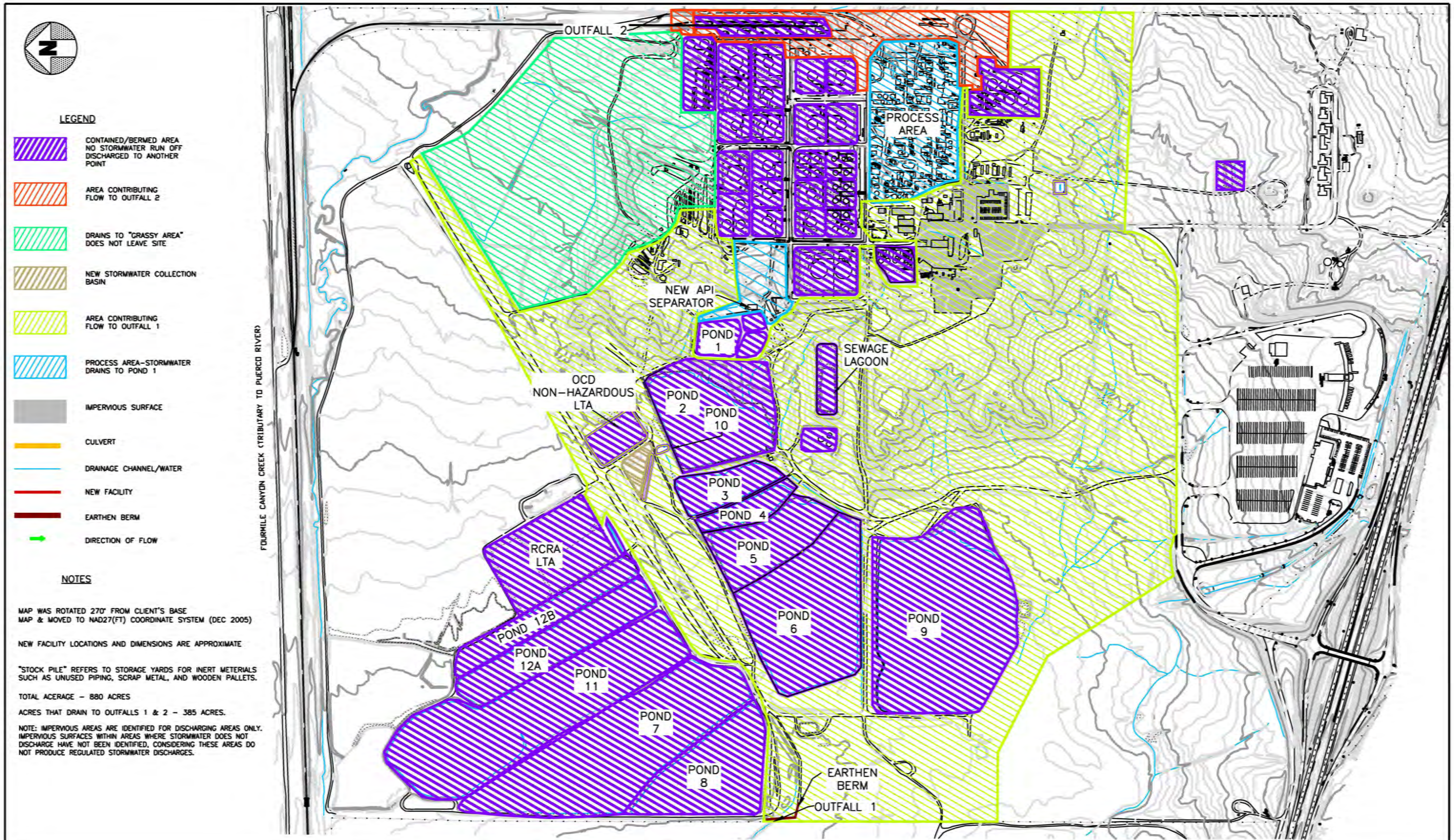
1"=500'

Project #: 06251970

FIGURE 6
2020 ALLUVIUM / CHINLE GROUP INTERFACE WATER ELEVATION MAP
MARATHON - GALLUP REFINERY

Marathon - Gallup Refinery
92 Giant Crossing Road
Gallup, New Mexico 87301

Date: April 1, 2020



SCALE
300' 0 300' 600'
CONTOUR INTERVAL 2 FT.

Rev	Description	BY	Date
3	REVISED FOR 2008 MSGP		12/19/08
1	FINAL ISSUE		1/9/06
A	DRAFT ISSUE TO CLIENT		12/16/05

REVISIONS

Scale: 1"=600'
Designed by: LAL/JM
Drawn by: DB
Checked by: AMEC
Approved by:

Issued for: Western Refining

Issued by: amec
1405 West Auto Drive, Tempe, Arizona 85284
(480) 940-2320 (480) 785-0970 fax

Title: STORMWATER CATCH BASINS GALLUP REFINERY

FIGURE 7

2 REVISION

Project: SWPPP GALLUP REFINERY
Project no.: 0811505023
FIGURE 8
Location: GALLUP, NEW MEXICO
Date: 12/19/08
2 SHEET 2 OF 12

APPENDIX A

Appendix A
Gallup Refinery Field Sampling Collection and Handling Standard Procedures

Field Data Collection: Elevation and Purging

All facility monitoring wells and recovery wells are gauged as required throughout the year. Gallup does not have any recovery well pumps that need to be shut off and removed prior to water elevation measurements.

Each monitoring well is field verified with the well number on the well casing or adjacent to the well to ensure that samples are collected from the correct well location. Wells also have a permanent marked reference point on the well casing from which ground water 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 every ten feet. In wells with dedicated pumps, the pumps have been installed at the midpoint of the screened interval.

All water/product levels are measured to an accuracy of the nearest 0.01 foot 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.

Generally, at least three well volumes (or a minimum of two if the well has low recharge) are purged from each well prior to sampling. Field water quality parameters measured during purging (pH, electrical conductivity, temperature, and dissolved oxygen), must stabilize to within 10% for a minimum of three consecutive measurements before collection of ground water samples from each well.

Before sample collection can begin, the water collected from each monitoring well must be fresh aquifer water. Well evacuation replaces stagnant well water with fresh aquifer water. The water level in the well, total depth of well and thickness of floating product (if any) will be measured using an oil/water interface meter. If product is present, a ground water sample is not obtained.

If a well is pumped or bailed dry before two or three well volumes can be evacuated, it requires only that sufficient time elapse for an adequate volume of water to accumulate for the sampling event. The first sample will be tested for pH, temperature, specific conductivity and dissolved oxygen (mg/L). The well will be retested for pH, temperature, specific conductivity and dissolved oxygen (mg/L) after sampling as a measure of purging efficiency and as a check on the stability of the water samples over time. All well evacuation information will be recorded in a log book.

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. The remaining wells are hand-bailed if the presence of water is detected. If SPH is detected in any of these wells, no samples are collected.

Purged well water from wells is collected in 55-gallon drums, buckets, or totes and drained to the process sewer upstream of the NAPIS. The water is treated in the refinery's waste water treatment system.

Sampling Equipment at Gallup Refinery

The following sampling equipment is maintained at the Gallup 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.

- IQ Scientific Instruments, pH/Temperature/Conductivity/ Dissolved Oxygen meter, Model IQ1806LP.
- Grundfos 2-inch 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, an instrument similar to the inoperable instrument will be used.

Order of Collection

Samples will be collected in the order listed below:

Parameter	**Bottle Type**
VOC	40 ml VOA vials (HCl)
TPH	40 ml VOA vials (HCl)
TPH	250 ml glass amber bottle
EDB and EDC	40 ml VOA vials ($Na_2S_2O_3$)
SVOC	1 liter glass amber bottle
Total Metals	250 ml plastic bottle (HNO_3)
Dissolved Metals	125 ml plastic bottle (HNO_3)
Major Cations/Anions	125 ml plastic bottle (HNO_3)
Major Cations/Anions	125 ml plastic bottle (H_2SO_4)
Major Cations/Anions	125 ml plastic bottle
BOD	1 liter plastic bottle
TDS	500 ml plastic bottle
COD	500 ml plastic bottle (H_2SO_4)
Cyanide	500 ml plastic bottle (NaOH)
Pesticides	1 liter glass amber bottle
E-Coli	100 ml plastic

*Pre-filtration bottle for dissolved metals which is subsequently filtered in the field and transferred to a pint plastic bottle with HNO_3 preservative.

Filtration

Ground water 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 two hours of sample collection. Pour the filtrate into a sample bottle containing HNO_3 preservative.

For samples destined for total metals analysis, do not filter the sample, and preserve with HNO_3 to pH <2 in the field.

Sampling personnel carry a cell phone when gathering ground water and other water 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 Hall Environmental Analytical Laboratory to verify that sampling is correctly performed.

Sample Handling Procedures

At a minimum, the following procedures will be used when collecting samples:

- Neoprene, nitrile, or other protective gloves will be worn when collecting samples. 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 container will be clearly marked. Sample container volumes and preservation methods will be in accordance with the most recent standard EPA and industry accepted practices for use by accredited analytical laboratories. Sufficient sample volume will be obtained for the laboratory to complete the method-specific QC analyses on a laboratory-batch basis.
- 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 Section 4.2.1 of this Plan, will be followed for all samples collected. All samples will be submitted to the laboratory to allow the laboratory to conduct the analyses within the method holding times.

General Well Sampling Procedures

For safety protection and sampling purity, rubber gloves or disposable nitrile gloves are worn and changed between each activity.

Prepare for sampling event by making out sample bottle labels and have bottles separated into plastic bags for each well to be sampled and placed in an ice chest ready to take into the field. Bring along a note book and sample log. Document weather conditions, sample date and time. Fill in label with location, date, time, analysis, preservative, and your name. Start sampling by adjusting converter speed for each well. Affix sample label and fill bottle according to lab instructions. For samples intended for VOC analysis, use bottles with septa lids, fill bottle to neck and add final amount of water with cap to form meniscus. Turn bottles upside down to examine for bubbles, if bubbles are detected in the vial, repeat collection procedure. If no bubbles show, secure lids and pack in bubble wrap and place in cooler until sampling is completed.

Decontaminate equipment that is not dedicated for use in a particular well. Refrigerate completed samples until shipping to lab. Be sure to check holding times and arrange for appropriate shipping method. Be sure that the field effort is adequately staffed and equipped. Check QA/QC requirements before departing—QA/QC samples require additional equipment and supplies.

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 notebooks. The sampler will avoid disturbing sediment and gently allow the sample container to fill making sure that undue disturbance does not allow volatile contaminants 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 duly noted in the field log books. The decision to use a separate bottle/bailer will be made, if at all, by the sampler and the reasons for doing so will be noted in the field log book.

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 a sufficient distance away so as to prevent sample contamination from emissions. Appropriate sample containers and gloves must be used for the type of analyses to be performed.

Decontamination Procedures

The objective of the decontamination procedures is to minimize the potential for cross-contamination. The majority of field equipment used for ground water sampling will be disposable and, therefore, not require decontamination. In order 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 (examples include 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 Section 4.2. Decontamination procedures and the cleaning agents used will be documented in the daily field log.

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 daily field logs.

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 daily field logs.

Collection and Management of Investigation Derived Waste

Investigation derived waste (IDW) 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

(including sampling gloves, tubing, etc.) will be disposed of with the Refinery's general municipal waste.

Documentation of Field Activities

Daily field activities, including observations and field procedures, will be recorded using indelible ink on field sampling forms. The original field forms will be maintained at the Gallup 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 ID/ 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

Sample Custody

All samples collected for analysis will be recorded in the field report or data sheets. 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 form will be signed as received by the laboratory, and the conditions of the samples will be recorded on the form. The original chain-of-custody form will remain with the laboratory. The Gallup Refinery will maintain copies of all chain-of-custody forms generated as part of sampling activities. Copies of the chain-of-custody records will be included with all draft and final laboratory reports submitted to NMED and OCD.

APPENDIX B

Appendix B - Table 1
Gallup Refinery - Ground Water Monitoring Schedule

Sampling Location ID	Sampling Frequency	Collect GW Elevation, DTW, DTP	Water Quality Parameters	Analytical Suite
NAPI Secondary Containment (3 units)	Q	NA	NA	BTEX+MTBE, GRO/DRO extended, WQCC Metals or check for fluids
NAPI Inlet	Q	NA	NA	BTEX+MTBE, GRO/DRO extended, WQCC Metals
RW-1	Q	X	NA	Measure DTW, DTP (Hydrocarbon recovery). Sample for BTEX, MTBE, GRO/DRO extended if no SPH is detected, nitrite, nitrate
RW-2	Q	X	NA	Same as RW-1 with 1,4-dioxane by 8270/8270 SIMS for two consecutive events
RW-5	Q	X	NA	Same as RW-1
RW-6	Q	X	NA	Same as RW-1
OW-1	Q	X	pH, EC, DO, ORP, Temp, TDS	Visual check for artesian flow conditions: Sample for Major Cations/Anions, WQCC Metals, VOCS (Methods 8260 & 8011 for 1,2-dibromethane), GRO/DRO extended, 1,4-dioxane by 8270/8270 SIMS for two consecutive events
OW-10	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as OW-1
OW-13	Q	X	pH, EC, DO, ORP, Temp, TDS	VOCS (Methods 8260 & 8011 for 1,2-dibromoethane), WQCC Metals, GRO/DRO extended, 1,4-dioxane by 8270/8270 SIMS for two consecutive events, nitrite, nitrate
OW-14	Q	X	pH, EC, DO, ORP, Temp, TDS	VOCS (Methods 8260 & 8011 for 1,2-dibromoethane), WQCC Metals, GRO/DRO extended, 1,4-dioxane by 8270/8270 SIMS for two consecutive events, nitrite, nitrate
OW-29	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as OW-14
OW-30	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as OW-14
OW-53	Q	X	pH, EC, DO, ORP, Temp, TDS	VOCS (Methods 8260 & 8011 for 1,2-dibromoethane), WQCC Metals, GRO/DRO extended, nitrite, nitrate
OW-54	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as OW-14
OW-55	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as OW-14
OW-56	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as OW-14
OW-57	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as OW-53
OW-58	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as OW-53
OW-58A	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as OW-53
OW-59	Q	X	pH, EC, DO, ORP, Temp, TDS	Major Cations/Anions, VOCS, SVOCS, GRO/DRO extended, WQCC Metals
OW-60	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as OW-59
OW-61	Q	X	pH, EC, DO, ORP, Temp, TDS	VOCS, SVOCS, WQCC Metals, GRO/DRO extended, Major Cations/Anions
OW-62	Q	X	pH, EC, DO, ORP, Temp, TDS	VOCS, SVOCS, WQCC Metals, GRO/DRO extended, Major Cations/Anions
OW-63	Q	X	pH, EC, DO, ORP, Temp, TDS	VOCS, SVOCS, WQCC Metals, GRO/DRO extended, Major Cations/Anions
OW-64	Q	X	pH, EC, DO, ORP, Temp, TDS	VOCS, SVOCS, WQCC Metals, GRO/DRO extended, Major Cations/Anions
OW-65	Q	X	pH, EC, DO, ORP, Temp, TDS	VOCS, SVOCS, WQCC Metals, GRO/DRO extended, Major Cations/Anions
GWM-1	Q	X	pH, EC, DO, ORP, Temp, TDS	Major Cations/Anions, VOCS (Methods 8260 & 8011 for 1,2-dibromoethane), GRO/DRO extended, WQCC Metals, 1,4-dioxane by 8270/8270 SIMS for two consecutive events
GWM-2	Q	X	NA	Check for Water - if water is detected report to OCD & NMED within 24 hours. Sample for GRO/DRO extended, Major Cations/Anions, VOCs
GWM-3	Q	X	NA	Check for Water - if water is detected report to OCD & NMED within 24 hours. Sample for VOCS, GRO/DRO extended, Major Cations/Anions

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Gallup Refinery - Ground Water Monitoring Schedule

Sampling Location ID	Sampling Frequency	Collect GW Elevation, DTW, DTP	Water Quality Parameters	Analytical Suite
NAPIS-1 [1]	Q	X	pH, EC, DO, ORP, Temp, TDS	Major Cations/Anions, BTEX+MTBE, SVOCS, GRO/DRO extended, WQCC Metals
NAPIS-2 [1]	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as NAPIS-1 with 1,4-dioxane by 8270/8270 SIMS for two consecutive events
NAPIS-3 [1]	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as NAPIS-1 with Method 8011 for 1,2-dibromoethane, and 1,4-dioxane by 8270/8270 SIMS for two consecutive events
KA- 3 [1]	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as NAPIS-1 with 1,4-dioxane by 8270/8270 SIMS for two consecutive events
OAPIS-1	Q	X	pH, EC, DO, ORP, Temp, TDS	VOCS (Methods 8260 & 8011 for 1,2-dibromoethane), SVOCS, GRO/DRO extended, WQCC Metals, Major Cations/Anions, Cyanide, and 1,4-dioxane by 8270/8270 SIMS for two consecutive events
STP1-NW	Q	X	NA	Major Cations/Anions, VOCS, SVOCS, GRO/DRO extended, WQCC Metals
STP1-SW	Q	X	NA	Major Cations/Anions, VOCS, SVOCS, GRO/DRO extended, WQCC Metals
STP-1 TO EP-2 (EP-2 Inlet)	Q	NA	NA	VOCS, GRO/DRO extended, BOD, COD, TDS, WQCC Metals, TSS
Boiler Water (Reverse Osmosis) inlet to EP-9	SA	NA	pH, EC, DO, ORP, Temp, TDS	Major Cations/Anions
Pond 1 [2]				NO LONGER IN SERVICE
Evaporation Pond 2 [2]	SA		pH, EC, DO, ORP, Temp, TDS	General Chemistry, VOCS, SVOCS, BOD, COD, E-Coli Bacteria, WQCC Metals
Evaporation Pond 3 [2]	SA		pH, EC, DO, ORP, Temp, TDS	Same as EP-2
Evaporation Pond 4 [2]	SA		pH, EC, DO, ORP, Temp, TDS	Same as EP-2
Evaporation Pond 5 [2]	SA		pH, EC, DO, ORP, Temp, TDS	Same as EP-2
Evaporation Pond 6 [2]	SA		pH, EC, DO, ORP, Temp, TDS	Same as EP-2
Evaporation Pond 7 [2]	SA		pH, EC, DO, ORP, Temp, TDS	Same as EP-2
Evaporation Pond 8 [2]	SA		pH, EC, DO, ORP, Temp, TDS	Same as EP-2
Evaporation Pond 9 [2]	SA		pH, EC, DO, ORP, Temp, TDS	Same as EP-2
Evaporation Pond 11 [2]	SA		pH, EC, DO, ORP, Temp, TDS	Same as EP-2
Evaporation Pond 12A [2]	SA		pH, EC, DO, ORP, Temp, TDS	Same as EP-2
Evaporation Pond 12B [2]	SA		pH, EC, DO, ORP, Temp, TDS	Same as EP-2
Any temporary Pond containing fluid	SA		pH, EC, DO, ORP, Temp, TDS	Same as EP-2
BW-1A	Annual (A)	X	pH, EC, DO, ORP, Temp, TDS	Major Cations/Anions, VOCS, WQCC METALS, GRO/DRO extended
BW-1B	A	X	pH, EC, DO, ORP, Temp, TDS	Same as BW-1A
BW-1C	A	X	pH, EC, DO, ORP, Temp, TDS	Same as BW-1A
BW-2A	A	X	pH, EC, DO, ORP, Temp, TDS	Same as BW-1A
BW-2B	A	X	pH, EC, DO, ORP, Temp, TDS	Same as BW-1A
BW-2C	A	X	pH, EC, DO, ORP, Temp, TDS	Same as BW-1A
BW-3A	A	X	pH, EC, DO, ORP, Temp, TDS	Same as BW-1A
BW-3B	A	X	pH, EC, DO, ORP, Temp, TDS	Same as BW-1A
BW-3C	A	X	pH, EC, DO, ORP, Temp, TDS	Same as BW-1A
BW-4A	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as BW-1A

Appendix B - Table 1
Gallup Refinery - Ground Water Monitoring Schedule

Sampling Location ID	Sampling Frequency	Collect GW Elevation, DTW, DTP	Water Quality Parameters	Analytical Suite
BW-4B	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as BW-1A
BW-5A	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as BW-1A
BW-5B	Q	X	pH, EC, DO, ORP, Temp, TDS	Major Cations/Anions, VOCS (Methods 8260 & 8011 for 1,2-dibromoethane), WQCC METALS, GRO/DRO extended, and 1,4-dioxane by 8270/8270 SIMS for two consecutive events
BW-5C	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as BW-5B
MW-1	Annual and every 10 years beginning in 2009 per RCRA Post Closure Permit	X	pH, EC, DO, ORP, Temp, TDS	Major Cations/Anions, VOCS, GRO/DRO extended, WQCC Metals, Cyanide, SVOCS, and 1,4-dioxane by 8270/8270 SIMS for two consecutive events
MW-2	Annual and every 10 years beginning in 2009 per RCRA Post Closure Permit	X	pH, EC, DO, ORP, Temp, TDS	Same as MW-1, excluding 1,4-dioxane
MW-4	Annual and every 10 years beginning in 2009 per RCRA Post Closure Permit	X	pH, EC, DO, ORP, Temp, TDS	Same as MW-2
MW-5	Annual and every 10 years beginning in 2009 per RCRA Post Closure Permit	X	pH, EC, DO, ORP, Temp, TDS	Same as MW-2
OW-11	A	X	pH, EC, DO, ORP, Temp, TDS	Major Cations/Anions, VOCS, WQCC Metals, GRO/DRO extended
OW-12	A	X	pH, EC, DO, ORP, Temp, TDS	VOCS, WQCC Metals, GRO/DRO extended, nitrite, nitrate
OW-50	Q	X	pH, EC, DO, ORP, Temp, TDS	VOCS (Methods 8260 & 8011 for 1,2-dibromoethane), GRO/DRO extended, WQCC Metals, General Chemistry, nitrite, nitrate
OW-52	Q	X	pH, EC, DO, ORP, Temp, TDS	VOCS (methods 8260 & 8011 for 1,2-dibromoethane) , GRO/DRO extended, WQCC Metals, General Chemistry, nitrite, nitrate
SMW-2	A	X	pH, EC, DO, ORP, Temp, TDS	Major Cations/Anions, VOCS, GRO/DRO extended, WQCC Metals, Cyanide, SVOCS
SMW-4	Annual and every 10 years beginning in 2009 per RCRA Post Closure Permit	X	pH, EC, DO, ORP, Temp, TDS	Major Cations/Anions, VOCS, SVOCS, GRO/DRO extended, WQCC Metals, Cyanide, 1,4-dioxane by 8270/8270 SIMS for two consecutive events
PW-3	Q	X	pH, EC, DO, ORP, Temp, TDS	VOCS, SVOCS, WQCC Metals, Cyanide, Nitrate, Nitrite
PW-2	Every 3 years. Starting in 2008	X	pH, EC, DO, ORP, Temp, TDS	VOCS, SVOCS, WQCC Metals, Cyanide, Nitrate, Nitrite, 1,4-dioxane by 8270/8270 SIMS for two consecutive events
PW-4	Q	X	pH, EC, DO, ORP, Temp, TDS	VOCS, SVOCS, WQCC Metals, Cyanide, Nitrate, Nitrite
MKTF-01	Q	X	pH, EC, DO, ORP, Temp, TDS	VOCS (Methods 8260 & 8011 for 1,2-dibromoethane), SVOCS, WQCC Metals, GRO/DRO extended, Major Cations/Anions, and 1,4-dioxane by 8270/8270 SIMS for two consecutive events
MKTF-02	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-01
MKTF-03	Q	X	pH, EC, DO, ORP, Temp, TDS	VOCS, SVOCS, WQCC Metals, GRO/DRO extended, Major Cations/Anions, and 1,4-dioxane by 8270/8270 SIMS for two consecutive events
MKTF-04	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-01
MKTF-05	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03
MKTF-06	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03
MKTF-07	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03
MKTF-08	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03

Appendix B - Table 1
Gallup Refinery - Ground Water Monitoring Schedule

Sampling Location ID	Sampling Frequency	Collect GW Elevation, DTW, DTP	Water Quality Parameters	Analytical Suite
MKTF-09	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03
MKTF-10	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03
MKTF-11	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03
MKTF-12	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03
MKTF-13	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03
MKTF-14	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03
MKTF-15	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03
MKTF-16	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03
MKTF-17	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03
MKTF-18	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-01
MKTF-19	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-01
MKTF-20	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03
MKTF-21	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03
MKTF-22	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03
MKTF-23	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-01
MKTF-24	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-01
MKTF-25	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-01
MKTF-26	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-01
MKTF-27	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-01
MKTF-28	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03
MKTF-29	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03
MKTF-30	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-01
MKTF-31	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-01
MKTF-32	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-01
MKTF-33	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-01
MKTF-34	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-01
MKTF-35	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-01
MKTF-36	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-01
MKTF-37	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-01
MKTF-38	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03
MKTF-39	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03
MKTF-40	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-01
MKTF-41	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-01
MKTF-42	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-01
MKTF-43	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03

Appendix B - Table 1
Gallup Refinery - Ground Water Monitoring Schedule

Sampling Location ID	Sampling Frequency	Collect GW Elevation, DTW, DTP	Water Quality Parameters	Analytical Suite
MKTF-44	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03
MKTF-45	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03
MKTF-46	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-01
MKTF-47	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03
MKTF-48	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03
MKTF-49	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03
MKTF-50	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03

DEFINITIONS:

DO- Dissolved Oxygen	DTW - Depth to Water	MW - Monitor Well	DRO - Diesel Range Organics	BTEX - Benzene, Toluene, Ethylbenzene, Xylenes, plus Methyl Tert-Butyl Ether (MTBE) - EPA Method 8021+MTBE
ORP - Oxygen Reduction Potential	DTP - Depth to Product	OW - Observation Well	MRO - Motor oil range organics	General Chemistry - pH, specific conductance, cations, Anions
Temp - Temperature	DTB - Depth to Bottom	RW - Recovery Well	GRO - Gasoline Range Organics	WQCC metals include the RCRA 8 metals, must be analyzed as totals and dissolved
EC - Electrical or Specific Conductivity	EP - Evaporation Pond	NA - Not Applicable	MKTF - Marketing Tank Farm Well	VOC - Volatile Organic Compounds - EPA Method 8260, must include MTBE
TDS - Total Dissolved Solids	BW - Boundary Well		PW - Raw Water Production Well	SVOC - Semi-Volatile Organic Compounds - EPA Method 8270, must include phenol

NOTES:

1. NAPIS-1, NAPIS-2, NAPIS-3, and KA-3: Detection of product during quarterly monitoring must comply with Section II.F.2 (24-hour reporting) of NMED Post-Closure Care Permit
2. Sample using the State of New Mexico approved analytical methods as required by 20.6.4.14 NMAC, as amended through February 16, 2006 (use methods 9221-E, until EPA approves 40 CFR 136 Methods (Colilert, Colilert-18, m-Coliblue24, membrane filter method)). Parameters are subject to change. Evaporation pond samples must be collected at the inlet where waste water flows into the evaporation ponds.
3. Where nitrite and/or major anions are specified Hach Field Test Kit NI-12 will be used for the field analysis of nitrite in addition to laboratory analysis for nitrate + nitrite.

Appendix B - Table 2
Gallup Refinery - Requested/Approved Changes to the Ground Water Monitoring Schedule

Sampling Location ID	Sampling Frequency (Q - Quarterly A - Annual SA - Semi-Annual)	Collect GW Elevation, DTW, DTP	Water Quality Parameters	Analytical Suite	2019 Requested Changes	Rationale for Requested Changes
NAPI Secondary Containment (3 units)	Q	NA	NA	BTEX+MTBE, GRO/DRO extended, WQCC Metals or check for fluids	None	
NAPI Inlet	Q	NA	NA	Same as above (SAA)	None	
RW-1	Q	X	NA	Measure DTW, DTP (Hydrocarbon recovery) Sample for BTEX + MTBE, GRO/DRO extended. Sample only if no SPH is detected.	None	
RW-2	Q	X	NA	Same as RW-1	None	
RW-5	Q	X	NA	Same as RW-1	None	
RW-6	Q	X	NA	Same as RW-1	None	
OW-1	Q	X	pH-, EC, DO, ORP, Temp, TDS	Visual check for artesian flow conditions: Sample for Major Cations/Anions, WQCC Metals, VOCS (Methods 8260 & 8011 for 1,2-dibromoethane), GRO/DRO extended	None	
OW-10	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as OW-1	None	
OW-13	Q	X	pH, EC, DO, ORP, Temp, TDS	VOCS (Methods 8260 & 8011 for 1,2-dibromoethane), WQCC Metals, GRO/DRO extended	None	
OW-14	Q	X	pH, EC, DO, ORP, Temp, TDS	VOCS (Methods 8260 & 8011 for 1,2-dibromoethane), WQCC Metals, GRO/DRO extended	None	
OW-29	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as OW-14	None	
OW-30	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as OW-14	None	
OW-53	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as OW-14	None	
OW-54	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as OW-14	None	
OW-55	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as OW-14	None	
OW-56	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as OW-14	None	
OW-57	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as OW-14	None	
OW-58	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as OW-14	None	
OW-58A	Q	x	pH, EC, DO, ORP, Temp, TDS	Same as OW-14	Add to Monitoring Schedule	New Well
OW-59	Q	X	pH, EC, DO, ORP, Temp, TDS	Major Cations/Anions, VOCS, SVOCS, GRO/DRO extended, WQCC Metals	None	
OW-60	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as OW-59	None	
OW-61	Q	X	pH, EC, DO, ORP, Temp, TDS	VOCS, SVOCS, WQCC Metals, GRO/DRO extended, Major Cations/Anions	None	

Appendix B - Table 2
Gallup Refinery - Requested/Approved Changes to the Ground Water Monitoring Schedule

Sampling Location ID	Sampling Frequency (Q - Quarterly A - Annual SA - Semi-Annual)	Collect GW Elevation, DTW, DTP	Water Quality Parameters	Analytical Suite	2019 Requested Changes	Rationale for Requested Changes
OW-62	Q	X	pH, EC, DO, ORP, Temp, TDS	VOCS, SVOCS, WQCC Metals, GRO/DRO extended, Major Cations/Anions	None	
OW-63	Q	X	pH, EC, DO, ORP, Temp, TDS	VOCS, SVOCS, WQCC Metals, GRO/DRO extended, Major Cations/Anions	None	
OW-64	Q	X	pH, EC, DO, ORP, Temp, TDS	VOCS, SVOCS, WQCC Metals, GRO/DRO extended, Major Cations/Anions	None	
OW-65	Q	X	pH, EC, DO, ORP, Temp, TDS	VOCS, SVOCS, WQCC Metals, GRO/DRO extended, Major Cations/Anions	None	
GWM-1	Q	X	pH, EC, DO, ORP, Temp, TDS	Major Cations/Anions, VOCS (methods 8260 and 8011 for 1,2-dibromoethane), GRO/DRO extended, WQCC Metals	None	
GWM-2	Q	X	NA	Check for Water - if water is detected report to OCD & NMED within 24 hours. Sample for GRO/DRO extended, Major Cations/Anions, VOCS	None	
GWM-3	Q	X	NA	Same as GWM-2	None	
NAPIS-1 [1]	Q	X	pH, EC, DO, ORP, Temp, TDS	Major Cations/Anions, BTEX+MTBE, SVOCS, GRO/DRO extended, WQCC Metals	None	
NAPIS-2 [1]	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as NAPIS-1	None	
NAPIS-3 [1]	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as NAPIS-1 and Method 8011 for 1,2-dibromoethane	None	
KA-3 [1]	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as NAPIS-1	None	
OAPIS-1	Q	X	pH, EC, DO, ORP, Temp, TDS	Major Cations/Anions, VOCS (Methods 8260 and 8011), SVOCS, GRO/DRO extended, WQCC Metals, Cyanide	None	
STP1-NW	Q	X	NA	Major Cations/Anions, VOCS, SVOCS, GRO/DRO extended, WQCC Metals	None	
STP1-SW	Q	X	NA	Same as STP1-NW	None	
Boiler Water (Reverse Osmosis)inlet to EP-2	SA	NA	pH, EC, DO, ORP, Temp, TDS	Major Cations/Anions	None	
Pond 1 [2]		NA		NO LONGER IN SERVICE	None	
Evaporation Ponds 2 - 9 [2]	SA	NA	pH, EC, DO, ORP, Temp, TDS	General Chemistry, VOCS, SVOCS, BOD, COD, E-Coli Bacteria, WQCC Metals and Pesticides by method 8081A for EP-3)	None	
Evaporation Pond 11 [2]	SA	NA	pH, EC, DO, ORP, Temp, TDS	Same as EP-2	None	

Appendix B - Table 2
Gallup Refinery - Requested/Approved Changes to the Ground Water Monitoring Schedule

Sampling Location ID	Sampling Frequency (Q - Quarterly A - Annual SA - Semi-Annual)	Collect GW Elevation, DTW, DTP	Water Quality Parameters	Analytical Suite	2019 Requested Changes	Rationale for Requested Changes
Evaporation Pond 12A [2]	SA	NA	pH, EC, DO, ORP, Temp, TDS	Same as EP-2, and Pesticides by method 8081A	None	
Evaporation Pond 12B [2]	SA	NA	pH , EC, DO, ORP, Temp, TDS	Same as EP-2, and Pesticides by method 8081A	None	
Any temporary Pond containing fluid	SA	NA	pH, EC, DO, ORP, Temp, TDS	Same as EP-2	None	
STP-1 TO EP-2 (EP-2 Inlet)	Q	NA	NA	VOCS, GRO/DRO extended, BOD, COD, TDS, WQCC Metals, TSS	None	
BW-1A	A	X	pH, EC, DO, ORP, Temp, TDS	Major Cations/Anions, VOCS, WQCC METALS, GRO/DRO extended	None	
BW-1B	A	X	pH, EC, DO, ORP, Temp, TDS	Same as BW-1A	None	
BW-1C	A	X	pH, EC, DO, ORP, Temp, TDS	Same as BW-1A	None	
BW-2A	A	X	pH, EC, DO, ORP, Temp, TDS	Same as BW-1A	None	
BW-2B	A	X	pH, EC, DO, ORP, Temp, TDS	Same as BW-1A	None	
BW-2C	A	X	pH, EC, DO, ORP, Temp, TDS	Same as BW-1A	None	
BW-3A	A	X	pH, EC, DO, ORP, Temp, TDS	Same as BW-1A	None	
BW-3B	A	X	pH, EC, DO, ORP, Temp, TDS	Same as BW-1A	None	
BW-3C	A	X	pH, EC, DO, ORP, Temp, TDS	Same as BW-1A	None	
BW-4A	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as BW-1A	None	
BW-4B	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as BW-1A	None	
BW-5A	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as BW-1A	None	
BW-5B	Q	X	pH, EC, DO, ORP, Temp, TDS	Major Cations/Anions, VOCS (8260 & 8011 for 1,2-dibromoethane) , WQCC METALS, GRO/DRO extended	None	
BW-5C	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as BW-5B	None	

Appendix B - Table 2
Gallup Refinery - Requested/Approved Changes to the Ground Water Monitoring Schedule

Sampling Location ID	Sampling Frequency (Q - Quarterly A - Annual SA - Semi-Annual)	Collect GW Elevation, DTW, DTP	Water Quality Parameters	Analytical Suite	2019 Requested Changes	Rationale for Requested Changes
MW-1	A	X	pH, EC, DO, ORP, Temp, TDS	Major Cations/Anions, VOCS, SVOCs, GRO/DRO extended, WQCC Metals, Cyanide	None	
MW-2	A	X	pH, EC, DO, ORP, Temp, TDS	Same as MW-1	None	
MW-4	A	X	pH, EC, DO, ORP, Temp, TDS	Same as MW-1	None	
MW-5	A	X	pH, EC, DO, ORP, Temp, TDS	Same as MW-1	None	
OW-11	A	X	pH, EC, DO, ORP, Temp, TDS	Major Cations/Anions, VOCS, WQCC Metals, GRO/DRO-extended	None	
OW-12	A	X	pH, EC, DO, ORP, Temp, TDS	VOCS, WQCC Metals, GRO/DRO extended	None	
OW-50	Q	X	pH, EC, DO, ORP, Temp, TDS	VOCS (Methods 8260 & 8011 for 1,2-dibromoethane) , GRO/DRO extended, WQCC Metals, GEN CHEM.	None	
OW-52	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as OW-50	None	
SMW-2	A	X	pH, EC, DO, ORP, Temp, TDS	Major Cations/Anions, VOCS, SVOCs, GRO/DRO extended, WQCC Metals, Cyanide	None	
SMW-4	A	X	pH, EC, DO, ORP, Temp, TDS	Major Cations/Anions, VOCS, SVOCS, GRO/DRO extended, WQCC Metals, Cyanide	None	
PW-3	Q	X	pH, EC, DO, ORP, Temp, TDS	VOCS, SVOCS, WQCC Metals, Cyanide, Nitrate, Nitrite	None	
PW-2	Every 3 years. Starting in 2008	X	pH, EC, DO, ORP, Temp, TDS	VOCS, SVOCS, WQCC Metals, Cyanide, Nitrate, Nitrite	None	
PW-4	Q	X	pH, EC, DO, ORP, Temp, TDS	VOCS, SVOCS, WQCC Metals, Cyanide, Nitrate, Nitrite	None	
MKTF-01	Q	X	pH, EC, DO, ORP, Temp, TDS	VOCS (Methods 8260 & 8011 for 1,2-dibromoethane), SVOCS, WQCC Metals, GRO/DRO extended, Major Cations/Anions. Ground water samples will not be collected if SPH is present in any of the wells.	None	
MKTF-02	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	
MKTF-03	Q	X	pH, EC, DO, ORP, Temp, TDS	VOCS, SVOCS, WQCC Metals, GRO/DRO extended, Major Cations/Anions	None	
MKTF-04	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	
MKTF-05	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03	None	
MKTF-06	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03	None	

Appendix B - Table 2
Gallup Refinery - Requested/Approved Changes to the Ground Water Monitoring Schedule

Sampling Location ID	Sampling Frequency (Q - Quarterly A - Annual SA - Semi-Annual)	Collect GW Elevation, DTW, DTP	Water Quality Parameters	Analytical Suite	2019 Requested Changes	Rationale for Requested Changes
MKTF-07	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03	None	
MKTF-08	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03	None	
MKTF-09	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03	None	
MKTF-10	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03	None	
MKTF-11	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03	None	
MKTF-12	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03	None	
MKTF-13	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03	None	
MKTF-14	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03	None	
MKTF-15	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03	None	
MKTF-16	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03	None	
MKTF-17	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03	None	
MKTF-18	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	
MKTF-19	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	
MKTF-20	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03	None	
MKTF-21	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03	None	
MKTF-22	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03	None	
MKTF-23	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	
MKTF-24	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	
MKTF-25	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	
MKTF-26	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	
MKTF-27	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	
MKTF-28	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03	None	

Appendix B - Table 2
Gallup Refinery - Requested/Approved Changes to the Ground Water Monitoring Schedule

Sampling Location ID	Sampling Frequency (Q - Quarterly A - Annual SA - Semi-Annual)	Collect GW Elevation, DTW, DTP	Water Quality Parameters	Analytical Suite	2019 Requested Changes	Rationale for Requested Changes
MKTF-29	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03	None	
MKTF-30	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	
MKTF-31	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	
MKTF-32	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	
MKTF-33	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	
MKTF-34	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	
MKTF-35	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	
MKTF-36	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	
MKTF-37	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	
MKTF-38	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03	None	
MKTF-39	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03	None	
MKTF-40	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	
MKTF-41	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	
MKTF-42	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-01	None	
MKTF-43	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03	None	
MKTF-44	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03	None	
MKTF-45	Q	X	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03	None	
MKTF-46	Q	x	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-01	Add to Monitoring Schedule	New well
MKTF-47	Q	x	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03	Add to Monitoring Schedule	New well
MKTF-48	Q	x	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03	Add to Monitoring Schedule	New well
MKTF-49	Q	x	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03	Add to Monitoring Schedule	New well
MKTF-50	Q	x	pH, EC, DO, ORP, Temp, TDS	Same as MKTF-03	Add to Monitoring Schedule	New well

DEFINITIONS:

STP-1 TO EP-2 - Sample collected at the inlet to Evaporation Pond 2 from STP-1
NAPIS 1 = (KA-1R); NAPIS-2 = (KA-2R), NAPIS-3 = KA-3R) - monitor wells positioned around NAPIS to detect leakage
DO- Dissolved Oxygen; ORP - Oxygen Reduction Potential; Temp - Temperature; EC - Electrical or Specific Conductivity
TDS - Total Dissolved Solids; VOC - Volatile Organic Compounds-EPA Method 8260, must include MTBE
SVOC - Semi-Volatile Organic Compounds - EPA Method 8270, must include phenol
DRO - Diesel Range Organics - EPA Method 8015B (or as modified); GRO - Gasoline Range Organics - EPA Method 8015B (or as modified)
BTEX - Benzene, Toluene, Ethylbenzene, Xylene, plus Methyl Tert-Butyl Ether (MTBE) - EPA Method 8021+MTBE
General Chemistry - pH, specific conductance, cations, Anions
DTW - Depth to Water; DTP - Depth to Product; EP - Evaporation Pond; BW - Boundary Wells
GWM wells - located around the aeration lagoons to detect leakage
MW - Monitor Well; OW - Observation Well; RW - Recovery Well; PW - Raw Water Production Well
WQCC metals include the RCRA 8 metals, must be analyzed as totals and dissolved
NA - Not Applicable

NOTES:

1) NAPIS 1, NAPIS 2, NAPIS 3, KA-3: Detection of product during quarterly monitoring must comply with Section II.F.2 (twenty-four hour reporting) of NMED Post-Closure Care Permit
2) Sample using the State of New Mexico approved analytical methods as required by 20.6.4.14 NMAC, as amended through February 16, 2006 (use methods 9221-E and 9221-F, until EPA approves 40 CFR 136 methods. (Colilert, Colilert - 18, m-Coliblue24, membrane filter method)). Parameters are subject to change. Evaporation Pond samples must be collected at the inlet where waste water flows into the evaporation ponds.

APPENDIX C

APPENDIX C-1
2019 FLUID LEVEL MEASUREMENTS

Date of Installation	Well ID Number	Inspection or Sample Date	Casing Diameter (Inch)	Ground Level Elevation (ft)	Well Casing Rim Elevation (ft)	Stick-up length (ft)	Well Casing Bottom Elevation (ft)	Total Well Depth (ft)	Depth to SPH (ft)	SPH Column Thickness (ft)	Depth to Water (ft)	Ground water Elevation (ft)	Corrected Water Table [1] Elevation (ft)	Screened Interval Depth Top to Bottom (ft)	Stratigraphic unit in which screen exists
11/10/03	BW-1A	08/14/19	2.00	6,883.17	6,885.12	1.95	6,847.50	42.61	ND	NA	DRY	DRY	NA	30 - 35	Upper Sand
10/28/03	BW-1B	08/14/19	2.00	6,883.17	6,885.78	2.61	6,818.33	73.55	ND	NA	72.22	6,813.56	NA	54.6 - 64.6	Chinle/Alluvial Interface
11/10/03	BW-1C	08/14/19	2.00	6,883.17	6,885.68	2.51	6,749.29	145.29	ND	NA	12.39	6,873.29	NA	125 -135	Sonsela Sandstone
11/10/03	BW-2A	08/14/19	2.00	6,871.88	6,874.69	2.81	6,807.12	67.57	ND	NA	32.26	6,842.43	NA	55 - 65	Upper Sand
10/28/03	BW-2B	08/14/19	2.00	6,871.66	6,874.50	2.84	6,782.24	92.26	ND	NA	28.45	6,846.05	NA	80 - 90	Chinle/Alluvial Interface
10/28/03	BW-2C	08/14/19	2.00	6,872.90	6,875.30	2.40	6,722.46	152.84	ND	NA	21.20	6,854.10	NA	139.5 - 149.5	Sonsela Sandstone
06/15/04	BW-3A	08/14/19	2.00	6,875.94	6,878.39	2.45	6,826.04	52.38	ND	NA	DRY	DRY	NA	39.5 - 49.5	Upper Sand
10/15/03	BW-3B	08/14/19	2.00	6,876.16	6,878.59	2.43	6,809.19	69.40	ND	NA	33.31	6,845.28	NA	63 - 73	Chinle/Alluvial Interface
07/20/04	BW-3C	08/14/19	2.00	6,875.72	6,877.95	2.23	6,723.40	154.55	ND	NA	7.86	6,870.09	NA	144.5 - 154.5	Sonsela Sandstone
06/29/17	BW-4A	03/27/19	2.00	6,869.28	6,872.20	2.92	6,907.60	38.32	ND	NA	DRY	DRY	NA	21 - 36	Upper Sand
06/29/17	BW-4A	05/21/19	2.00	6,869.28	6,872.20	2.92	6,907.60	38.32	ND	NA	DRY	DRY	NA	21 - 36	Upper Sand
06/29/17	BW-4A	08/23/19	2.00	6,869.28	6,872.20	2.92	6,907.60	38.32	ND	NA	DRY	DRY	NA	21 - 36	Upper Sand
06/29/17	BW-4A	10/16/19	2.00	6,869.28	6,872.20	2.92	6,907.60	38.32	ND	NA	DRY	DRY	NA	21 - 36	Upper Sand
06/29/17	BW-4B	03/27/19	2.00	6,869.45	6,872.24	2.79	6,932.95	63.50	ND	NA	39.30	6,832.94	NA	41 - 61	Chinle/Alluvial Interface
06/29/17	BW-4B	05/21/19	2.00	6,869.45	6,872.24	2.79	6,932.95	63.50	ND	NA	46.01	6,826.23	NA	41 - 61	Chinle/Alluvial Interface
06/29/17	BW-4B	08/23/19	2.00	6,869.45	6,872.24	2.79	6,932.95	63.50	ND	NA	46.00	6,826.24	NA	41 - 61	Chinle/Alluvial Interface
06/29/17	BW-4B	10/16/19	2.00	6,869.45	6,872.24	2.79	6,932.95	63.50	ND	NA	47.50	6,824.74	NA	41 - 61	Chinle/Alluvial Interface
06/29/17	BW-5A	03/27/19	2.00	6,873.18	6,876.06	2.88	6,896.18	23.00	ND	NA	23.25	6,852.81	NA	10 - 20	Upper Sand
06/29/17	BW-5A	05/21/19	2.00	6,873.18	6,876.06	2.88	6,896.18	23.00	ND	NA	23.30	6,852.76	NA	10 - 20	Upper Sand
06/29/17	BW-5A	08/15/19	2.00	6,873.18	6,876.06	2.88	6,896.20	23.02	ND	NA	21.26	6,854.80	NA	10 - 20	Upper Sand
06/29/17	BW-5A	10/16/19	2.00	6,873.18	6,876.06	2.88	6,896.48	23.30	ND	NA	23.25	6,852.81	NA	10 - 20	Upper Sand
06/29/17	BW-5B	03/27/19	2.00	6,873.30	6,875.84	2.54	6,934.75	61.45	ND	NA	9.38	6,866.46	NA	48 - 58	Chinle/Alluvial Interface

APPENDIX C-1
2019 FLUID LEVEL MEASUREMENTS

Date of Installation	Well ID Number	Inspection or Sample Date	Casing Diameter (Inch)	Ground Level Elevation (ft)	Well Casing Rim Elevation (ft)	Stick-up length (ft)	Well Casing Bottom Elevation (ft)	Total Well Depth (ft)	Depth to SPH (ft)	SPH Column Thickness (ft)	Depth to Water (ft)	Ground water Elevation (ft)	Corrected Water Table [1] Elevation (ft)	Screened Interval Depth Top to Bottom (ft)	Stratigraphic unit in which screen exists
06/29/17	BW-5B	05/21/19	2.00	6,873.30	6,875.84	2.54	6,934.75	61.45	ND	NA	9.20	6,866.64	NA	48 - 58	Chinle/Alluvial Interface
06/29/17	BW-5B	08/15/19	2.00	6,873.30	6,875.84	2.54	6,934.75	61.45	ND	NA	9.67	6,866.17	NA	48 - 58	Chinle/Alluvial Interface
06/29/17	BW-5B	10/16/19	2.00	6,873.30	6,875.84	2.54	6,934.75	61.45	ND	NA	10.27	6,865.57	NA	48 - 58	Chinle/Alluvial Interface
06/29/17	BW-5C	03/27/19	2.00	6,872.92	6,877.30	4.38	6,949.27	76.35	ND	NA	1.99	6,875.31	NA	64.3-74.30	Sonsela Sandstone
06/29/17	BW-5C	05/21/19	2.00	6,872.92	6,877.30	4.38	6,949.27	76.35	ND	NA	1.60	6,875.70	NA	64.3-74.30	Sonsela Sandstone
06/29/17	BW-5C	08/15/19	2.00	6,872.92	6,877.30	4.38	6,949.27	76.35	ND	NA	2.69	6,874.61	NA	64.3-74.30	Sonsela Sandstone
06/29/17	BW-5C	10/16/19	2.00	6,872.92	6,877.30	4.38	6,949.27	76.35	ND	NA	3.50	6,873.80	NA	64.3-74.30	Sonsela Sandstone
07/08/04	GWM-1	03/28/19	2.00	6,910.22	6,912.61	2.39	6,886.41	26.20	21.59	0.48	22.07	6,890.54	6890.92	17.5 - 23.5	Chinle/Alluvial Interface
07/08/04	GWM-1	05/08/19	2.00	6,910.22	6,912.61	2.39	6,886.41	26.20	21.32	0.29	21.61	6,891.00	6891.23	17.5 - 23.5	Chinle/Alluvial Interface
07/08/04	GWM-1	08/06/19	2.00	6,910.22	6,912.61	2.39	6,886.41	26.42	20.77	0.13	20.90	6,891.71	6891.81	17.5 - 23.5	Chinle/Alluvial Interface
07/08/04	GWM-1	10/21/19	2.00	6,910.22	6,912.61	2.39	6,886.41	26.20	20.64	0.19	20.83	6,891.78	6891.93	17.5 - 23.5	Chinle/Alluvial Interface
09/25/05	GWM-2	03/28/19	2.00	6,910.32	6,913.09	2.77	6,894.28	19.09	ND	NA	DRY	NA	NA	3.2 - 16.2	Chinle/Alluvial Interface
09/25/05	GWM-2	05/08/19	2.00	6,910.32	6,913.09	2.77	6,894.28	19.09	ND	NA	DRY	NA	NA	3.2 - 16.2	Chinle/Alluvial Interface
09/25/05	GWM-2	08/06/19	2.00	6,910.32	6,913.09	2.77	6,894.28	19.04	ND	NA	DRY	NA	NA	3.2 - 16.2	Chinle/Alluvial Interface
09/25/05	GWM-2	10/19/19	2.00	6,910.32	6,913.09	2.77	6,894.28	18.81	ND	NA	DRY	NA	NA	3.2 - 16.2	Chinle/Alluvial Interface
09/25/05	GWM-3	03/28/19	2.00	6,907.35	6,910.25	2.90	6,892.45	18.06	ND	NA	DRY	DRY	NA	3 - 15	Chinle/Alluvial Interface
09/25/05	GWM-3	05/08/19	2.00	6,907.35	6,910.25	2.90	6,892.45	18.06	ND	NA	DRY	DRY	NA	3 - 15	Chinle/Alluvial Interface
09/25/05	GWM-3	08/06/19	2.00	6,907.35	6,910.25	2.90	6,892.45	18.04	ND	NA	DRY	DRY	NA	3 - 15	Chinle/Alluvial Interface
09/25/05	GWM-3	10/19/19	2.00	6,907.35	6,910.25	2.90	6,892.45	17.80	ND	NA	DRY	DRY	NA	3 - 15	Chinle/Alluvial Interface
06/11/07	KA-3	03/28/19	2.00	6,913.29	6,912.52	-0.77	6,889.32	NM	NM	NA	NM	NA	NA	15 - 25	Chinle/Alluvial Interface
06/11/07	KA-3	05/28/19	2.00	6,913.29	6,912.52	-0.77	6,889.32	23.20	ND	NA	9.95	6,902.57	NA	15 - 25	Chinle/Alluvial Interface
06/11/07	KA-3	08/22/19	2.00	6,913.29	6,912.52	-0.77	6,889.32	23.20	ND	NA	9.05	6,903.47	NA	15 - 25	Chinle/Alluvial Interface
06/11/07	KA-3	10/21/19	2.00	6,913.29	6,912.52	-0.77	6,889.32	23.20	ND	NA	9.16	6,903.36	NA	15 - 25	Chinle/Alluvial Interface
10/14/81	MW-1	08/12/19	5.00	6,876.63	6,878.12	1.49	6,747.29	130.83	ND	NA	6.94	6,871.18	NA	117.72 - 127.72	Sonsela Sandstone

APPENDIX C-1
2019 FLUID LEVEL MEASUREMENTS

Date of Installation	Well ID Number	Inspection or Sample Date	Casing Diameter (Inch)	Ground Level Elevation (ft)	Well Casing Rim Elevation (ft)	Stick-up length (ft)	Well Casing Bottom Elevation (ft)	Total Well Depth (ft)	Depth to SPH (ft)	SPH Column Thickness (ft)	Depth to Water (ft)	Ground water Elevation (ft)	Corrected Water Table [1] Elevation (ft)	Screened Interval Depth Top to Bottom (ft)	Stratigraphic unit in which screen exists
10/15/81	MW-2	08/13/19	5.00	6,878.39	6,880.30	1.91	6,742.82	137.48	ND	NA	9.00	6,871.30	NA	112 - 122	Sonsela Sandstone
10/16/81	MW-4	08/13/19	5.00	6,879.89	6,881.63	1.74	6,759.91	121.72	ND	NA	7.00	6,874.63	NA	101 - 121	Sonsela Sandstone
07/21/86	MW-5	08/14/19	4.00	6,880.20	6,882.83	2.63	6,752.00	130.83	ND	NA	11.05	6,871.78	NA	115 - 125	Sonsela Sandstone
03/14/08	NAPIS-1	03/28/19	2.00	6,913.62	6,913.86	0.24	6,900.33	NM	NM	NA	NM	NA	NA	3.7 - 13.7	Chinle/Alluvial Interface
03/14/08	NAPIS-1	05/28/19	2.00	6,913.62	6,913.86	0.24	6,900.33	13.53	7.72	0.16	7.88	6,905.98	6906.11	3.7 - 13.7	Chinle/Alluvial Interface
03/14/08	NAPIS-1	08/22/19	2.00	6,913.62	6,913.86	0.24	6,900.33	13.53	7.45	0.08	7.53	6,906.33	6906.39	3.7 - 13.7	Chinle/Alluvial Interface
03/14/08	NAPIS-1	10/21/19	2.00	6,913.62	6,913.86	0.24	6,900.33	13.53	7.66	0.20	7.86	6,906.00	6906.16	3.7 - 13.7	Chinle/Alluvial Interface
03/14/08	NAPIS-2	03/28/19	2.00	6,913.40	6,912.65	-0.75	6,899.04	NM	NM	NA	NM	NA	NA	4.2 - 14.2	Chinle/Alluvial Interface
03/14/08	NAPIS-2	05/28/19	2.00	6,913.40	6,912.65	-0.75	6,899.04	13.61	ND	NA	9.54	6,903.11	NA	4.2 - 14.2	Chinle/Alluvial Interface
03/14/08	NAPIS-2	08/22/19	2.00	6,913.40	6,912.65	-0.75	6,899.04	13.61	ND	NA	9.15	6,903.50	NA	4.2 - 14.2	Chinle/Alluvial Interface
03/14/08	NAPIS-2	10/21/19	2.00	6,913.40	6,912.65	-0.75	6,899.04	13.61	ND	NA	9.40	6,903.25	NA	4.2 - 14.2	Chinle/Alluvial Interface
03/14/08	NAPIS-3	03/28/19	2.00	6,913.38	6,912.76	-0.62	6,882.34	NM	NM	NA	NM	NA	NA	25.4 - 30-4	Chinle/Alluvial Interface
03/14/08	NAPIS-3	05/28/19	2.00	6,913.38	6,912.76	-0.62	6,882.34	30.42	ND	NA	10.57	6,902.19	NA	25.4 - 30-4	Chinle/Alluvial Interface
03/14/08	NAPIS-3	08/22/19	2.00	6,913.38	6,912.76	-0.62	6,882.34	30.42	ND	NA	10.18	6,902.58	NA	25.4 - 30-4	Chinle/Alluvial Interface
03/14/08	NAPIS-3	10/21/19	2.00	6,913.38	6,912.76	-0.62	6,882.34	30.42	ND	NA	10.02	6,902.74	NA	25.4 - 30-4	Chinle/Alluvial Interface
07/17/12	OAPIS-1	03/28/19	2.00	6,914.37	6,916.73	2.36	6,888.37	26.00	ND	NA	11.43	6,905.30	NA	16 - 26	Chinle/Alluvial Interface
07/17/12	OAPIS-1	05/08/19	2.00	6,914.37	6,916.73	2.36	6,888.37	26.00	ND	NA	12.09	6,904.64	NA	16 - 26	Chinle/Alluvial Interface
07/17/12	OAPIS-1	08/22/19	2.00	6,914.37	6,916.73	2.36	6,888.37	27.86	ND	NA	11.09	6,905.64	NA	16 - 26	Chinle/Alluvial Interface
07/17/12	OAPIS-1	10/21/19	2.00	6,914.37	6,916.73	2.36	6,888.37	27.78	ND	NA	11.44	6,905.29	NA	16 - 26	Chinle/Alluvial Interface
01/05/81	OW-1	03/27/19	4.00	6,866.32	6,866.62	0.30	6,772.07	94.55	ND	NA	1.69	6,864.93	NA	89.3 - 99.3	Sonsela Sandstone

APPENDIX C-1
2019 FLUID LEVEL MEASUREMENTS

Date of Installation	Well ID Number	Inspection or Sample Date	Casing Diameter (Inch)	Ground Level Elevation (ft)	Well Casing Rim Elevation (ft)	Stick-up length (ft)	Well Casing Bottom Elevation (ft)	Total Well Depth (ft)	Depth to SPH (ft)	SPH Column Thickness (ft)	Depth to Water (ft)	Ground water Elevation (ft)	Corrected Water Table [1] Elevation (ft)	Screened Interval Depth Top to Bottom (ft)	Stratigraphic unit in which screen exists
01/05/81	OW-1	05/21/19	4.00	6,866.32	6,866.62	0.30	6,772.07	94.55	ND	NA	1.73	6,864.89	NA	89.3 - 99.3	Sonsela Sandstone
01/05/81	OW-1	08/15/19	4.00	6,866.32	6,866.62	0.30	6,772.07	94.55	ND	NA	1.37	6,865.25	NA	89.3 - 99.3	Sonsela Sandstone
01/05/81	OW-1	10/16/19	4.00	6,866.32	6,866.62	0.30	6,772.07	94.55	ND	NA	1.45	6,865.17	NA	89.3 - 99.3	Sonsela Sandstone
11/25/80	OW-10	03/27/19	4.00	6,873.67	6,874.91	1.24	6,814.58	60.33	ND	NA	0.00	6,874.91	NA	40 - 60	Sonsela Sandstone
11/25/80	OW-10	05/22/19	4.00	6,873.67	6,874.91	1.24	6,814.58	60.33	ND	NA	0.00	6,874.91	NA	40 - 60	Sonsela Sandstone
11/25/80	OW-10	08/15/19	4.00	6,873.67	6,874.91	1.24	6,814.58	60.13	ND	NA	1.02	6,873.89	NA	40 - 60	Sonsela Sandstone
11/25/80	OW-10	10/17/19	4.00	6,873.67	6,874.91	1.24	6,814.58	60.33	ND	NA	2.33	6,872.58	NA	40 - 60	Sonsela Sandstone
09/25/81	OW-11	08/20/19	4.00	6,922.05	6,923.51	1.46	6,857.72	65.79	ND	NA	17.70	6,905.81	NA	43 - 65	Sonsela Sandstone
12/15/80	OW-12	08/21/19	4.00	6,939.57	6,940.69	1.12	6,811.84	128.85	ND	NA	45.92	6,894.77	NA	117.8 - 137.8	Sonsela Sandstone
12/10/80	OW-13	02/05/19	4.00	6,918.95	6,920.07	1.12	6,820.92	99.15	ND	NA	20.38	6,899.69	NA	78.2 - 98.2	Sonsela Sandstone
12/10/80	OW-13	05/01/19	4.00	6,918.95	6,920.07	1.12	6,820.92	99.15	ND	NA	20.00	6,900.07	NA	78.2 - 98.2	Sonsela Sandstone
12/10/80	OW-13	08/12/19	4.00	6,918.95	6,920.07	1.12	6,820.92	102.00	ND	NA	20.50	6,899.57	NA	78.2 - 98.2	Sonsela Sandstone
12/10/80	OW-13	10/14/19	4.00	6,918.95	6,920.07	1.12	6,820.92	99.15	ND	NA	20.74	6,899.33	NA	78.2 - 98.2	Sonsela Sandstone
12/17/80	OW-14	02/05/19	4.00	6,924.55	6,926.65	2.10	6,880.13	46.52	ND	NA	21.64	6,905.01	NA	35 - 45	Chinle/Alluvial Interface
12/17/80	OW-14	05/01/19	4.00	6,924.55	6,926.65	2.10	6,880.13	46.52	ND	NA	21.45	6,905.20	NA	35 - 45	Chinle/Alluvial Interface
12/17/80	OW-14	08/12/19	4.00	6,924.55	6,926.65	2.10	6,880.13	46.78	NM	NA	NM	NA	NA	35 - 45	Chinle/Alluvial Interface
12/17/80	OW-14	11/01/19	4.00	6,924.55	6,926.65	2.10	6,880.13	46.52	NM	NA	NM	NA	NA	35 - 45	Chinle/Alluvial Interface
08/23/96	OW-29	02/05/19	4.00	6,913.89	6,917.00	3.11	6,865.92	51.08	ND	NA	16.92	6,900.08	NA	37.5 - 47.5	Chinle/Alluvial Interface
08/23/96	OW-29	05/01/19	4.00	6,913.89	6,917.00	3.11	6,865.92	51.08	ND	NA	16.71	6,900.29	NA	37.5 - 47.5	Chinle/Alluvial Interface
08/23/96	OW-29	08/12/19	4.00	6,913.89	6,917.00	3.11	6,865.92	52.40	ND	NA	17.16	6,899.84	NA	37.5 - 47.5	Chinle/Alluvial Interface

APPENDIX C-1
2019 FLUID LEVEL MEASUREMENTS

Date of Installation	Well ID Number	Inspection or Sample Date	Casing Diameter (Inch)	Ground Level Elevation (ft)	Well Casing Rim Elevation (ft)	Stick-up length (ft)	Well Casing Bottom Elevation (ft)	Total Well Depth (ft)	Depth to SPH (ft)	SPH Column Thickness (ft)	Depth to Water (ft)	Ground water Elevation (ft)	Corrected Water Table [1] Elevation (ft)	Screened Interval Depth Top to Bottom (ft)	Stratigraphic unit in which screen exists
08/23/96	OW-29	10/14/19	4.00	6,913.89	6,917.00	3.11	6,865.92	51.08	ND	NA	17.24	6,899.76	NA	37.5 - 47.5	Chinle/Alluvial Interface
08/28/96	OW-30	03/27/19	4.00	6,921.81	6,924.69	2.88	6,874.79	49.90	ND	NA	21.13	6,903.56	NA	37.9 - 47.9	Chinle/Alluvial Interface
08/28/96	OW-30	06/05/19	4.00	6,921.81	6,924.69	2.88	6,874.79	49.90	ND	NA	21.14	6,903.55	NA	37.9 - 47.9	Chinle/Alluvial Interface
08/28/96	OW-30	08/12/19	4.00	6,921.81	6,924.69	2.88	6,874.79	51.40	NM	NA	NM	NA	NA	37.9 - 47.9	Chinle/Alluvial Interface
08/28/96	OW-30	11/01/19	4.00	6,921.81	6,924.69	2.88	6,874.79	49.90	ND	NA	NM	NA	NA	37.9 - 47.9	Chinle/Alluvial Interface
10/05/09	OW-50	03/27/19	2.00	6,912.63	6,914.21	1.58	6,850.21	64.00	ND	NA	14.40	6,899.81	NA	48 - 63	Chinle/Alluvial Interface
10/05/09	OW-50	05/01/19	2.00	6,912.63	6,914.21	1.58	6,850.21	64.00	ND	NA	14.39	6,899.82	NA	49 - 63	Chinle/Alluvial Interface
10/05/09	OW-50	08/16/19	2.00	6,912.63	6,914.21	1.58	6,850.21	64.00	ND	NA	14.74	6,899.47	NA	50 - 63	Chinle/Alluvial Interface
10/05/09	OW-50	10/15/19	2.00	6,912.63	6,914.21	1.58	6,850.21	64.00	ND	NA	14.92	6,899.29	NA	48 - 63	Chinle/Alluvial Interface
10/06/09	OW-52	03/27/19	2.00	6,906.53	6,907.68	1.15	6,829.94	77.74	ND	NA	13.97	6,893.71	NA	64 - 79	Chinle/Alluvial Interface
10/06/09	OW-52	05/01/19	2.00	6,906.53	6,907.68	1.15	6,829.94	77.74	ND	NA	13.74	6,893.94	NA	65 - 79	Chinle/Alluvial Interface
10/06/09	OW-52	08/16/19	2.00	6,906.53	6,907.68	1.15	6,829.94	77.74	ND	NA	14.21	6,893.47	NA	66 - 79	Chinle/Alluvial Interface
10/06/09	OW-52	10/15/19	2.00	6,906.53	6,907.68	1.15	6,829.94	77.74	ND	NA	14.40	6,893.28	NA	64 - 79	Chinle/Alluvial Interface
05/31/16	OW-53	02/06/19	2.00	6,911.71	6,914.38	2.67	6,945.62	33.91	ND	NA	DRY	NA	NA	16 - 31	Chinle/Alluvial Interface
05/31/16	OW-53	05/02/19	2.00	6,911.71	6,914.38	2.67	6,945.62	33.91	ND	NA	DRY	NA	NA	16 - 31	Chinle/Alluvial Interface
05/31/16	OW-53	08/21/19	2.00	6,911.71	6,914.38	2.67	6,945.62	33.91	ND	NA	DRY	NA	NA	16 - 31	Chinle/Alluvial Interface
05/31/16	OW-53	10/15/19	2.00	6,911.71	6,914.38	2.67	6,945.62	33.91	ND	NA	DRY	NA	NA	16 - 31	Chinle/Alluvial Interface
06/01/16	OW-54	02/06/19	2.00	6,916.27	6,918.92	2.65	6,947.31	31.04	ND	NA	17.58	6,901.34	NA	13 - 28	Chinle/Alluvial Interface
06/01/16	OW-54	05/02/19	2.00	6,916.27	6,918.92	2.65	6,947.31	31.04	ND	NA	17.52	6,901.40	NA	13 - 28	Chinle/Alluvial Interface
06/01/16	OW-54	08/21/19	2.00	6,916.27	6,918.92	2.65	6,945.89	29.62	ND	NA	18.00	6,900.92	NA	13 - 28	Chinle/Alluvial Interface

APPENDIX C-1
2019 FLUID LEVEL MEASUREMENTS

Date of Installation	Well ID Number	Inspection or Sample Date	Casing Diameter (Inch)	Ground Level Elevation (ft)	Well Casing Rim Elevation (ft)	Stick-up length (ft)	Well Casing Bottom Elevation (ft)	Total Well Depth (ft)	Depth to SPH (ft)	SPH Column Thickness (ft)	Depth to Water (ft)	Ground water Elevation (ft)	Corrected Water Table [1] Elevation (ft)	Screened Interval Depth Top to Bottom (ft)	Stratigraphic unit in which screen exists
06/01/16	OW-54	10/15/19	2.00	6,916.27	6,918.92	2.65	6,947.33	31.06	ND	NA	18.09	6,900.83	NA	13 - 28	Chinle/Alluvial Interface
06/01/16	OW-55	02/06/19	2.00	6,921.02	6,923.25	2.23	6,951.72	30.70	ND	NA	17.37	6,905.88	NA	13 - 28	Chinle/Alluvial Interface
06/01/16	OW-55	05/02/19	2.00	6,921.02	6,923.25	2.23	6,951.72	30.70	ND	NA	17.38	6,905.87	NA	13 - 28	Chinle/Alluvial Interface
06/01/16	OW-55	08/21/19	2.00	6,921.02	6,923.25	2.23	6,951.72	30.70	ND	NA	17.70	6,905.55	NA	13 - 28	Chinle/Alluvial Interface
06/01/16	OW-55	10/15/19	2.00	6,921.02	6,923.25	2.23	6,951.92	30.90	ND	NA	17.73	6,905.52	NA	13 - 28	Chinle/Alluvial Interface
06/01/16	OW-56	02/06/19	2.00	6,917.61	6,920.18	2.57	6,936.20	18.59	ND	NA	13.00	6,907.18	NA	6 - 16	Chinle/Alluvial Interface
06/01/16	OW-56	05/02/19	2.00	6,917.61	6,920.18	2.57	6,936.20	18.59	ND	NA	12.50	6,907.68	NA	6 - 16	Chinle/Alluvial Interface
06/01/16	OW-56	08/21/19	2.00	6,917.61	6,920.18	2.57	6,936.20	18.59	ND	NA	13.66	6,906.52	NA	6 - 16	Chinle/Alluvial Interface
06/01/16	OW-56	10/15/19	2.00	6,917.61	6,920.18	2.57	6,936.19	18.58	ND	NA	14.38	6,905.80	NA	6 - 16	Chinle/Alluvial Interface
10/05/16	OW-57	02/19/19	2.00	6,930.64	6,933.10	2.46	6,958.74	28.10	ND	NA	20.29	6,912.81	NA	15 - 25	Chinle/Alluvial Interface
10/05/16	OW-57	05/15/19	2.00	6,930.64	6,933.10	2.46	6,958.74	28.10	ND	NA	20.02	6,913.08	NA	15 - 25	Chinle/Alluvial Interface
10/05/16	OW-57	08/20/19	2.00	6,930.64	6,933.10	2.46	6,958.71	28.07	ND	NA	19.78	6,913.32	NA	15 - 25	Chinle/Alluvial Interface
10/05/16	OW-57	11/04/19	2.00	6,930.64	6,933.10	2.46	6,958.99	28.35	ND	NA	19.97	6,913.13	NA	15 - 25	Chinle/Alluvial Interface
10/03/16	OW-58	03/28/19	2.00	6,934.71	6,934.50	-0.21	6,982.01	47.30	ND	NA	24.28	6,910.22	NA	38 - 48	Chinle/Alluvial Interface
10/03/16	OW-58	06/05/19	2.00	6,934.71	6,934.50	-0.21	6,982.01	47.30	ND	NA	24.09	6,910.41	NA	38 - 48	Chinle/Alluvial Interface
10/03/16	OW-58	08/20/19	2.00	6,934.71	6,934.50	-0.21	6,982.20	47.49	ND	NA	24.00	6,910.50	NA	38 - 48	Chinle/Alluvial Interface
10/03/16	OW-58	11/18/19	2.00	6,934.71	6,934.50	-0.21	6,982.21	47.50	ND	NA	23.99	6,910.51	NA	38 - 48	Chinle/Alluvial Interface
06/29/17	OW-59	02/13/19	2.00	6,986.40	6,988.66	2.26	7,024.70	38.30	ND	NA	23.90	6,964.76	NA	20 - 35	Chinle/Alluvial Interface
06/29/17	OW-59	05/02/19	2.00	6,986.40	6,988.66	2.26	7,024.70	38.30	ND	NA	23.80	6,964.86	NA	20 - 35	Chinle/Alluvial Interface
06/29/17	OW-59	08/21/19	2.00	6,986.40	6,988.66	2.26	7,024.92	38.52	ND	NA	24.02	6,964.64	NA	20 - 35	Chinle/Alluvial Interface
06/29/17	OW-59	10/15/19	2.00	6,986.40	6,988.66	2.26	7,024.90	38.50	ND	NA	24.11	6,964.55	NA	20 - 35	Chinle/Alluvial Interface
06/29/17	OW-60	02/13/19	2.00	6,911.71	6,914.38	2.67	6,957.21	45.50	ND	NA	16.43	6,897.95	NA	25 - 45	Chinle/Alluvial Interface
06/29/17	OW-60	05/02/19	2.00	6,911.71	6,914.38	2.67	6,957.21	45.50	ND	NA	16.55	6,897.83	NA	25 - 45	Chinle/Alluvial Interface
06/29/17	OW-60	08/21/19	2.00	6,911.71	6,914.38	2.67	6,958.13	46.42	ND	NA	16.53	6,897.85	NA	25 - 45	Chinle/Alluvial Interface
06/29/17	OW-60	10/15/19	2.00	6,911.71	6,914.38	2.67	6,957.41	45.70	ND	NA	16.41	6,897.97	NA	25 - 45	Chinle/Alluvial Interface

APPENDIX C-1
2019 FLUID LEVEL MEASUREMENTS

Date of Installation	Well ID Number	Inspection or Sample Date	Casing Diameter (Inch)	Ground Level Elevation (ft)	Well Casing Rim Elevation (ft)	Stick-up length (ft)	Well Casing Bottom Elevation (ft)	Total Well Depth (ft)	Depth to SPH (ft)	SPH Column Thickness (ft)	Depth to Water (ft)	Ground water Elevation (ft)	Corrected Water Table [1] Elevation (ft)	Screened Interval Depth Top to Bottom (ft)	Stratigraphic unit in which screen exists
03/14/18	OW-61	02/19/19	4.00	6,959.29	6,961.88	2.59	6,991.29	32.00	18.00	4.09	22.09	6,939.79	6943.06	8 - 28	Chinle/Alluvial Interface
03/14/18	OW-61	05/15/19	4.00	6,959.29	6,961.88	2.59	6,991.29	32.00	17.62	3.51	21.13	6,940.75	6943.56	8 - 28	Chinle/Alluvial Interface
03/14/18	OW-61	08/20/19	4.00	6,959.29	6,961.88	2.59	6,990.99	31.70	17.42	2.73	20.15	6,941.73	6943.91	8 - 28	Chinle/Alluvial Interface
03/14/18	OW-61	11/04/19	4.00	6,959.29	6,961.88	2.59	6,991.29	32.00	17.54	3.09	20.63	6,941.25	6943.722	8 - 28	Chinle/Alluvial Interface
03/15/18	OW-62	02/19/19	4.00	6,933.21	6,936.09	2.88	6,964.68	31.47	23.75	1.20	24.95	6,911.14	6912.10	8 - 28	Chinle/Alluvial Interface
03/15/18	OW-62	05/15/19	4.00	6,933.21	6,936.09	2.88	6,964.68	31.47	23.40	0.60	24.00	6,912.09	6912.57	8 - 28	Chinle/Alluvial Interface
03/15/18	OW-62	08/20/19	4.00	6,933.21	6,936.09	2.88	6,964.68	31.47	23.86	0.43	24.29	6,911.80	6912.14	8 - 28	Chinle/Alluvial Interface
03/15/18	OW-62	11/18/19	4.00	6,933.21	6,936.09	2.88	6,964.68	31.47	23.72	0.62	24.34	6,911.75	6912.25	8 - 28	Chinle/Alluvial Interface
03/14/18	OW-63	02/19/19	4.00	6,930.87	6,933.87	3.00	6,962.87	32.00	ND	NA	20.74	6,913.13	NA	9 - 29	Chinle/Alluvial Interface
03/14/18	OW-63	05/15/19	4.00	6,930.87	6,933.87	3.00	6,962.87	32.00	ND	NA	20.35	6,913.52	NA	9 - 29	Chinle/Alluvial Interface
03/14/18	OW-63	08/19/19	4.00	6,930.87	6,933.87	3.00	6,963.07	32.20	ND	NA	20.12	6,913.75	NA	9 - 29	Chinle/Alluvial Interface
03/14/18	OW-63	11/18/19	4.00	6,930.87	6,933.87	3.00	6,962.87	32.00	ND	NA	20.30	6,913.57	NA	9 - 29	Chinle/Alluvial Interface
03/16/18	OW-64	02/19/19	4.00	6,943.32	6,946.09	2.77	6,970.95	27.63	7.00	0.02	7.02	6,939.07	6939.09	4 - 24	Chinle/Alluvial Interface
03/16/18	OW-64	05/15/19	4.00	6,943.32	6,946.09	2.77	6,970.95	27.63	ND	NA	6.83	6,939.26	NA	4 - 24	Chinle/Alluvial Interface
03/16/18	OW-64	08/19/19	4.00	6,943.32	6,946.09	2.77	6,970.67	27.35	ND	NA	7.10	6,938.99	NA	4 - 24	Chinle/Alluvial Interface
03/16/18	OW-64	11/18/19	4.00	6,943.32	6,946.09	2.77	6,970.67	27.35	ND	NA	8.40	6,937.69	NA	4 - 24	Chinle/Alluvial Interface
03/12/18	OW-65	02/19/19	4.00	6,949.95	6,952.83	2.88	6,989.95	40.00	22.24	9.27	31.51	6,921.32	6928.74	17 - 37	Chinle/Alluvial Interface
03/12/18	OW-65	05/15/19	4.00	6,949.95	6,952.83	2.88	6,989.95	40.00	23.47	8.74	32.21	6,920.62	6927.61	17 - 37	Chinle/Alluvial Interface
03/12/18	OW-65	08/20/19	4.00	6,949.95	6,952.83	2.88	6,991.61	41.66	21.97	9.18	31.15	6,921.68	6929.02	17 - 37	Chinle/Alluvial Interface
03/12/18	OW-65	11/04/19	4.00	6,949.95	6,952.83	2.88	6,989.95	40.00	22.30	8.55	30.85	6,921.98	6928.82	17 - 37	Chinle/Alluvial Interface
03/28/95	RW-1	03/28/19	4.00	6,942.86	6,946.06	3.20	6,903.02	NM	NM	NA	NA	NA	NA	25 - 40	Chinle/Alluvial Interface
03/28/95	RW-1	05/08/19	4.00	6,942.86	6,946.06	3.20	6,903.02	NM	NM	NA	NA	NA	NA	25 - 40	Chinle/Alluvial Interface
03/28/95	RW-1	08/16/19	4.00	6,942.86	6,946.06	3.20	6,903.02	NM	NM	NA	NA	NA	NA	25 - 40	Chinle/Alluvial Interface
03/28/95	RW-1	11/01/19	4.00	6,942.86	6,946.06	3.20	6,903.02	NM	NM	NA	NM	NA	NA	25 - 40	Chinle/Alluvial Interface
03/29/95	RW-2	03/28/19	4.00	6,926.40	6,928.53	2.13	6,888.73	NM	NM	NA	NM	NA	NA	26.1 - 36.1	Chinle/Alluvial Interface
03/29/95	RW-2	05/08/19	4.00	6,926.40	6,928.53	2.13	6,888.73	NM	NM	NA	NM	NA	NA	26.1 - 36.1	Chinle/Alluvial Interface

APPENDIX C-1
2019 FLUID LEVEL MEASUREMENTS

Date of Installation	Well ID Number	Inspection or Sample Date	Casing Diameter (Inch)	Ground Level Elevation (ft)	Well Casing Rim Elevation (ft)	Stick-up length (ft)	Well Casing Bottom Elevation (ft)	Total Well Depth (ft)	Depth to SPH (ft)	SPH Column Thickness (ft)	Depth to Water (ft)	Ground water Elevation (ft)	Corrected Water Table [1] Elevation (ft)	Screened Interval Depth Top to Bottom (ft)	Stratigraphic unit in which screen exists
03/29/95	RW-2	08/16/19	4.00	6,926.40	6,928.53	2.13	6,888.73	NM	NM	NA	NM	NA	NA	26.1 - 36.1	Chinle/Alluvial Interface
03/29/95	RW-2	11/01/19	4.00	6,926.40	6,928.53	2.13	6,888.73	NM	NM	NA	NM	NA	NA	26.1 - 36.1	Chinle/Alluvial Interface
08/27/97	RW-5	03/28/19	4.00	6,941.53	6,943.57	2.04	6,903.98	NM	NM	NA	NM	NA	NA	29.5 - 39.5	Chinle/Alluvial Interface
08/27/97	RW-5	05/08/19	4.00	6,941.53	6,943.57	2.04	6,903.98	NM	NM	NA	NM	NA	NA	29.5 - 39.5	Chinle/Alluvial Interface
08/27/97	RW-5	08/16/19	4.00	6,941.53	6,943.57	2.04	6,903.98	NM	NM	NA	NM	NA	NA	29.5 - 39.5	Chinle/Alluvial Interface
08/27/97	RW-5	11/01/19	4.00	6,941.53	6,943.57	2.04	6,903.98	NM	NM	NA	NM	NA	NA	29.5 - 39.5	Chinle/Alluvial Interface
08/27/97	RW-6	03/28/19	4.00	6,941.96	6,944.01	2.05	6,903.11	NM	NM	NA	NM	NA	NA	28.5 - 38.5	Chinle/Alluvial Interface
08/27/97	RW-6	05/08/19	4.00	6,941.96	6,944.01	2.05	6,903.11	NM	NM	NA	NM	NA	NA	28.5 - 38.5	Chinle/Alluvial Interface
08/27/97	RW-6	08/16/19	4.00	6,941.96	6,944.01	2.05	6,903.11	NM	NM	NA	NM	NA	NA	28.5 - 38.5	Chinle/Alluvial Interface
08/27/97	RW-6	11/01/19	4.00	6,941.96	6,944.01	2.05	6,903.11	NM	NM	NA	NM	NA	NA	28.5 - 38.5	Chinle/Alluvial Interface
09/26/85	SMW-2	08/19/19	2.00	6,881.63	6,883.97	2.34	6,831.17	52.80	ND	NA	25.30	6,858.67	NA	34.31 - 54.31	Chinle/Alluvial Interface and Upper Sand Well
09/25/85	SMW-4	08/13/19	2.00	6,877.63	6,879.52	1.89	6,809.84	69.68	ND	NA	29.10	6,850.42	NA	51.7 - 71.7	Chinle/Alluvial Interface
05/06/14	STP1-NW	02/13/19	2.00	6,904.50	6,904.47	-0.03	6,854.47	50.00	ND	NA	20.35	6,884.12	NA	20 - 50	Chinle/Alluvial Interface
05/06/14	STP1-NW	05/08/19	2.00	6,904.50	6,904.47	-0.03	6,854.47	50.00	ND	NA	19.54	6,884.93	NA	20 - 50	Chinle/Alluvial Interface
05/06/14	STP1-NW	08/21/19	2.00	6,904.50	6,904.47	-0.03	6,854.47	50.00	ND	NA	20.79	6,883.68	NA	20 - 50	Chinle/Alluvial Interface
05/06/14	STP1-NW	10/22/19	2.00	6,904.50	6,904.47	-0.03	6,854.47	50.00	ND	NA	20.76	6,883.71	NA	20 - 50	Chinle/Alluvial Interface
05/06/14	STP1-SW	02/13/19	2.00	6,912.40	6,912.38	-0.02	6,854.47	NM	NM	NA	NM	NA	NA	15 - 30	Chinle/Alluvial Interface
05/06/14	STP1-SW	05/08/19	2.00	6,912.40	6,912.38	-0.02	6,854.47	NM	NM	NA	NM	NA	NA	15 - 30	Chinle/Alluvial Interface
05/06/14	STP1-SW	08/21/19	2.00	6,912.40	6,912.38	-0.02	6,854.47	NM	NM	NA	NM	NA	NA	15 - 30	Chinle/Alluvial Interface
05/06/14	STP1-SW	10/22/19	2.00	6,912.40	6,912.38	-0.02	6,854.47	NM	NM	NA	NM	NA	NA	15 - 30	Chinle/Alluvial Interface

DEFINITIONS:

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

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

NOTES:

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

12/06/18 - 10-Year Post Closure Sampling Event for the LTU (Land Treatment Unit)
02/09/18 - Was not able to gauge or sample wells around the NAPIS Unit due to elevated H_2S readings in the ambient air.
11/07/18 - Did not gauge or sample wells due to recovery apparatus installed on all the RW wells.

APPENDIX C-1.1
2019 FLUID LEVEL MEASUREMENTS FOR MKTF WELLS

Date of Installation	Well ID Number	Inspection or Sample Date	Casing Diameter (Inch)	Ground Level Elevation (ft)	Well Casing Rim Elevation (ft)	Stick-up length (ft)	Well Casing Bottom Elevation (ft)	Total Well Depth (ft)	Depth to SPH (ft)	SPH Column Thickness (ft)	Depth to Water (ft)	Ground-water Elevation (ft)	Corrected Water Table[1] Elevation (ft)	Screened Interval Depth Top to Bottom (ft)
11/14/13	MKTF-01	02/19/19	4.00	6,918.28	6,920.67	2.39	6,903.25	17.42	4.40	0.34	4.74	6,915.93	6916.20	5 - 15
11/14/13	MKTF-01	05/06/19	4.00	6,918.28	6,920.67	2.39	6,903.25	17.42	4.39	0.35	4.74	6,915.93	6916.21	5 - 15
11/14/13	MKTF-01	08/30/19	4.00	6,918.28	6,920.67	2.39	6,903.25	17.42	4.58	0.37	4.95	6,915.72	6916.02	5 - 15
11/14/13	MKTF-01	11/19/19	4.00	6,918.28	6,920.67	2.39	6,903.25	17.42	5.14	0.31	5.45	6,915.22	6915.47	5 - 15
11/14/13	MKTF-02	03/28/19	4.00	6,915.00	6,917.45	2.45	6,896.97	20.48	ND	NA	6.34	6,911.11	NA	7 - 17
11/14/13	MKTF-02	05/06/19	4.00	6,915.00	6,917.45	2.45	6,896.97	20.48	ND	NA	6.24	6,911.21	NA	7 - 17
11/14/13	MKTF-02	08/23/19	4.00	6,915.00	6,917.45	2.45	6,897.02	20.43	ND	NA	7.05	6,910.40	NA	7 - 17
11/14/13	MKTF-02	11/19/19	4.00	6,915.00	6,917.45	2.45	6,897.10	20.35	ND	NA	7.14	6,910.31	NA	7 - 17
11/07/13	MKTF-03	03/25/19	4.00	6,931.73	6,931.69	-0.04	6,913.24	18.45	4.50	1.10	5.60	6,926.09	6,926.97	3 - 18
11/07/13	MKTF-03	05/13/19	4.00	6,931.73	6,931.69	-0.04	6,913.24	18.45	4.55	1.11	5.66	6,926.03	6,926.92	3 - 18
11/07/13	MKTF-03	08/21/19	4.00	6,931.73	6,931.69	-0.04	6,913.16	18.53	6.04	1.23	7.27	6,924.42	6,925.40	3 - 18
11/07/13	MKTF-03	10/30/19	4.00	6,931.73	6,931.69	-0.04	6,913.24	18.45	6.70	1.30	8.00	6,923.69	6,924.73	3 - 18
11/12/13	MKTF-04	03/25/19	4.00	6,933.90	6,933.57	-0.33	6,911.42	22.15	ND	NA	6.45	6,927.12	NA	10 - 22
11/12/13	MKTF-04	05/13/19	4.00	6,933.90	6,933.57	-0.33	6,911.42	22.15	ND	NA	6.55	6,927.02	NA	10 - 22
11/12/13	MKTF-04	08/21/19	4.00	6,933.90	6,933.57	-0.33	6,911.18	22.39	ND	NA	8.27	6,925.30	NA	10 - 22
11/12/13	MKTF-04	10/30/19	4.00	6,933.90	6,933.57	-0.33	6,911.27	22.30	ND	NA	8.93	6,924.64	NA	10 - 22
11/20/13	MKTF-05	02/19/19	4.00	6,939.49	6,942.22	2.73	6,924.47	17.75	13.87	0.10	13.97	6,928.25	6,928.33	4 - 14
11/20/13	MKTF-05	05/13/19	4.00	6,939.49	6,942.22	2.73	6,924.47	17.75	12.95	0.17	13.12	6,929.10	6,929.24	4 - 14
11/20/13	MKTF-05	08/30/19	4.00	6,939.49	6,942.22	2.73	6,924.47	17.75	13.40	0.20	13.60	6,928.62	6,928.78	4 - 14
11/20/13	MKTF-05	10/30/19	4.00	6,939.49	6,942.22	2.73	6,924.47	17.75	13.90	0.30	14.20	6,928.02	6,928.26	4 - 14
11/20/13	MKTF-05	11/12/19	4.00	6,939.49	6,942.22	2.73	6,924.47	17.75	11.64	5.09	16.73	6,925.49	6929.56	4 - 14
11/20/13	MKTF-05	11/13/19	4.00	6,939.49	6,942.22	2.73	6,924.47	17.75	10.96	6.19	17.15	6,925.07	6930.02	4 - 14
11/20/13	MKTF-05	11/14/19	4.00	6,939.49	6,942.22	2.73	6,924.47	17.75	10.78	6.39	17.17	6,925.05	6930.16	4 - 14
11/20/13	MKTF-05	11/15/19	4.00	6,939.49	6,942.22	2.73	6,924.47	17.75	10.54	6.62	17.16	6,925.06	6930.36	4 - 14
11/20/13	MKTF-05	11/19/19	4.00	6,939.49	6,942.22	2.73	6,924.47	17.75	10.04	7.14	17.18	6,925.04	6930.75	4 - 14
11/20/13	MKTF-05	11/21/19	4.00	6,939.49	6,942.22	2.73	6,924.47	17.75	9.97	7.21	17.18	6,925.04	6930.81	4 - 14
11/20/13	MKTF-05	12/02/19	4.00	6,939.49	6,942.22	2.73	6,924.47	17.75	10.64	6.53	17.17	6,925.05	6930.27	4 - 14
11/11/13	MKTF-06	02/19/19	4.00	6,944.24	6,946.81	2.57	6,923.04	23.77	15.79	0.76	16.55	6,930.26	6,930.87	8 - 20
11/11/13	MKTF-06	05/13/19	4.00	6,944.24	6,946.81	2.57	6,923.04	23.77	15.55	0.84	16.39	6,930.42	6,931.09	8 - 20
11/11/13	MKTF-06	08/30/19	4.00	6,944.24	6,946.81	2.57	6,923.02	23.79	15.82	0.78	16.60	6,930.21	6,930.83	8 - 20
11/11/13	MKTF-06	10/30/19	4.00	6,944.24	6,946.81	2.57	6,923.04	23.77	16.80	1.11	17.91	6,928.90	6,929.79	8 - 20
11/11/13	MKTF-06	11/12/19	4.00	6,944.24	6,946.81	2.57	6,923.04	23.77	16.52	0.96	17.48	6,929.33	6930.10	8 - 20
11/11/13	MKTF-06	11/13/19	4.00	6,944.24	6,946.81	2.57	6,923.04	23.77	16.33	0.85	17.18	6,929.63	6930.31	8 - 20
11/11/13	MKTF-06	11/14/19	4.00	6,944.24	6,946.81	2.57	6,923.04	23.77	16.42	0.89	17.31	6,929.50	6930.21	8 - 20
11/11/13	MKTF-06	11/15/19	4.00	6,944.24	6,946.81	2.57	6,923.04	23.77	16.35	0.85	17.20	6,929.61	6930.29	8 - 20
11/11/13	MKTF-06	11/19/19	4.00	6,944.24	6,946.81	2.57	6,923.04	23.77	16.08	0.75	16.83	6,929.98	6930.58	8 - 20

APPENDIX C-1.1
2019 FLUID LEVEL MEASUREMENTS FOR MKTF WELLS

Date of Installation	Well ID Number	Inspection or Sample Date	Casing Diameter (Inch)	Ground Level Elevation (ft)	Well Casing Rim Elevation (ft)	Stick-up length (ft)	Well Casing Bottom Elevation (ft)	Total Well Depth (ft)	Depth to SPH (ft)	SPH Column Thickness (ft)	Depth to Water (ft)	Ground-water Elevation (ft)	Corrected Water Table[1] Elevation (ft)	Screened Interval Depth Top to Bottom (ft)
11/11/13	MKTF-06	11/21/19	4.00	6,944.24	6,946.81	2.57	6,923.04	23.77	15.93	1.31	17.24	6,929.57	6930.62	8 - 20
11/11/13	MKTF-06	12/02/19	4.00	6,944.24	6,946.81	2.57	6,923.04	23.77	14.75	6.61	21.36	6,925.45	6930.74	8 - 20
11/11/13	MKTF-07	02/19/19	4.00	6,944.40	6,947.18	2.78	6,929.56	17.62	10.39	1.21	11.60	6,935.58	6,936.55	4 - 14
11/11/13	MKTF-07	05/13/19	4.00	6,944.40	6,947.18	2.78	6,929.56	17.62	10.72	0.10	10.82	6,936.36	6,936.44	4 - 14
11/11/13	MKTF-07	08/30/19	4.00	6,944.40	6,947.18	2.78	6,929.71	17.47	11.18	1.11	12.29	6,934.89	6,935.78	4 - 14
11/11/13	MKTF-07	10/30/19	4.00	6,944.40	6,947.18	2.78	6,929.56	17.62	12.20	1.19	13.39	6,933.79	6,934.74	4 - 14
11/11/13	MKTF-07	11/12/19	4.00	6,944.40	6,947.18	2.78	6,929.56	17.62	12.03	1.16	13.19	6,933.99	6934.92	4 - 14
11/11/13	MKTF-07	11/13/19	4.00	6,944.40	6,947.18	2.78	6,929.56	17.62	11.81	1.08	12.89	6,934.29	6935.15	4 - 14
11/11/13	MKTF-07	11/14/19	4.00	6,944.40	6,947.18	2.78	6,929.56	17.62	11.98	1.16	13.14	6,934.04	6934.97	4 - 14
11/11/13	MKTF-07	11/15/19	4.00	6,944.40	6,947.18	2.78	6,929.56	17.62	12.00	1.16	13.16	6,934.02	6934.95	4 - 14
11/11/13	MKTF-07	11/19/19	4.00	6,944.40	6,947.18	2.78	6,929.56	17.62	11.40	2.77	14.17	6,933.01	6935.23	4 - 14
11/11/13	MKTF-07	11/21/19	4.00	6,944.40	6,947.18	2.78	6,929.56	17.62	10.83	5.72	16.55	6,930.63	6935.21	4 - 14
11/11/13	MKTF-07	12/02/19	4.00	6,944.40	6,947.18	2.78	6,929.56	17.62	11.38	5.74	17.12	6,930.06	6934.65	4 - 14
11/11/13	MKTF-08	02/19/19	4.00	6,944.02	6,947.09	3.07	6,925.11	21.98	11.35	0.65	12.00	6,935.09	6,935.61	8 - 18
11/11/13	MKTF-08	05/13/19	4.00	6,944.02	6,947.09	3.07	6,925.11	21.98	11.95	0.48	12.43	6,934.66	6,935.04	8 - 18
11/11/13	MKTF-08	08/30/19	4.00	6,944.02	6,947.09	3.07	6,925.11	21.98	12.50	0.40	12.90	6,934.19	6,934.51	8 - 18
11/11/13	MKTF-08	10/30/19	4.00	6,944.02	6,947.09	3.07	6,925.11	21.98	13.54	0.45	13.99	6,933.10	6,933.46	8 - 18
11/11/13	MKTF-08	11/21/19	4.00	6,944.02	6,947.09	3.07	6,925.11	21.98	13.47	0.38	13.85	6,933.24	6933.54	8 - 18
11/11/13	MKTF-08	12/02/19	4.00	6,944.02	6,947.09	3.07	6,925.11	21.98	13.72	0.41	14.13	6,932.96	6933.29	8 - 18
11/11/13	MKTF-09	03/25/19	4.00	6,943.57	6,946.50	2.93	6,923.80	22.70	ND	NA	11.10	6,935.40	NA	7 - 19
11/11/13	MKTF-09	05/13/19	4.00	6,943.57	6,946.50	2.93	6,923.80	22.70	ND	NA	12.27	6,934.23	NA	7 - 19
11/11/13	MKTF-09	08/28/19	4.00	6,943.57	6,946.50	2.93	6,923.76	22.74	ND	NA	13.28	6,933.22	NA	7 - 19
11/11/13	MKTF-09	11/18/19	4.00	6,943.57	6,946.50	2.93	6,923.75	22.75	ND	NA	13.97	6,932.53	NA	7 - 19
10/31/13	MKTF-10	03/25/19	4.00	6,937.51	6,937.16	-0.35	6,921.17	15.99	ND	NA	5.70	6,931.46	NA	7 - 17
10/31/13	MKTF-10	05/13/19	4.00	6,937.51	6,937.16	-0.35	6,921.17	15.99	ND	NA	6.23	6,930.93	NA	7 - 17
10/31/13	MKTF-10	08/21/19	4.00	6,937.51	6,937.16	-0.35	6,920.88	16.28	ND	NA	7.65	6,929.51	NA	7 - 17
10/31/13	MKTF-10	10/30/19	4.00	6,937.51	6,937.16	-0.35	6,921.17	15.99	ND	NA	7.28	6,929.88	NA	7 - 17
10/31/13	MKTF-11	03/25/19	4.00	6,931.61	6,931.34	-0.27	6,913.20	18.14	ND	NA	4.96	6,926.38	NA	8 - 18
10/31/13	MKTF-11	05/13/19	4.00	6,931.61	6,931.34	-0.27	6,913.20	18.14	ND	NA	5.24	6,926.10	NA	8 - 18
10/31/13	MKTF-11	08/21/19	4.00	6,931.61	6,931.34	-0.27	6,912.86	18.48	ND	NA	6.22	6,925.12	NA	8 - 18
10/31/13	MKTF-11	10/30/19	4.00	6,931.61	6,931.34	-0.27	6,913.20	18.14	ND	NA	7.06	6,924.28	NA	8 - 18
11/07/13	MKTF-12	03/26/19	4.00	6,939.70	6,942.11	2.41	6,916.51	25.60	16.65	0.35	17.00	6,925.11	6,925.39	12 - 22
11/07/13	MKTF-12	05/09/19	4.00	6,939.70	6,942.11	2.41	6,916.51	25.60	17.25	0.10	17.35	6,924.76	6,924.84	12 - 22
11/07/13	MKTF-12	08/20/19	4.00	6,939.70	6,942.11	2.41	6,916.51	25.60	17.92	0.09	18.01	6,924.10	6,924.17	12 - 22
11/07/13	MKTF-12	10/28/19	4.00	6,939.70	6,942.11	2.41	6,916.51	25.60	18.35	0.12	18.47	6,923.64	6,923.74	12 - 22
11/07/13	MKTF-12	11/12/19	4.00	6,939.70	6,942.11	2.41	6,916.51	25.60	18.14	0.08	18.22	6,923.89	6923.95	12 - 22
11/07/13	MKTF-12	11/13/19	4.00	6,939.70	6,942.11	2.41	6,916.51	25.60	18.02	0.10	18.12	6,923.99	6924.07	12 - 22
11/07/13	MKTF-12	11/14/19	4.00	6,939.70	6,942.11	2.41	6,916.51	25.60	18.11	0.08	18.19	6,923.92	6923.98	12 - 22
11/07/13	MKTF-12	11/15/19	4.00	6,939.70	6,942.11	2.41	6,916.51	25.60	18.10	0.08	18.18	6,923.93	6923.99	12 - 22
11/07/13	MKTF-12	11/19/19	4.00	6,939.70	6,942.11	2.41	6,916.51	25.60	18.00	0.09	18.09	6,924.02	6924.09	12 - 22

APPENDIX C-1.1
2019 FLUID LEVEL MEASUREMENTS FOR MKTF WELLS

Date of Installation	Well ID Number	Inspection or Sample Date	Casing Diameter (Inch)	Ground Level Elevation (ft)	Well Casing Rim Elevation (ft)	Stick-up length (ft)	Well Casing Bottom Elevation (ft)	Total Well Depth (ft)	Depth to SPH (ft)	SPH Column Thickness (ft)	Depth to Water (ft)	Ground-water Elevation (ft)	Corrected Water Table[1] Elevation (ft)	Screened Interval Depth Top to Bottom (ft)
11/07/13	MKTF-12	11/21/19	4.00	6,939.70	6,942.11	2.41	6,916.51	25.60	18.04	0.16	18.20	6,923.91	6924.04	12 - 22
11/07/13	MKTF-12	12/02/19	4.00	6,939.70	6,942.11	2.41	6,916.51	25.60	17.70	0.05	17.75	6,924.36	6924.40	12 - 22
11/12/13	MKTF-13	03/26/19	4.00	6,933.67	6,935.18	1.51	6,913.93	21.25	ND	NA	10.90	6,924.28	NA	8 - 18
11/12/13	MKTF-13	05/09/19	4.00	6,933.67	6,935.18	1.51	6,913.93	21.25	ND	NA	11.60	6,923.58	NA	8 - 18
11/12/13	MKTF-13	08/20/19	4.00	6,933.67	6,935.18	1.51	6,913.63	21.55	ND	NA	12.45	6,922.73	NA	8 - 18
11/12/13	MKTF-13	10/28/19	4.00	6,933.67	6,935.18	1.51	6,913.93	21.25	ND	NA	12.95	6,922.23	NA	8 - 18
11/12/13	MKTF-13	11/12/19	4.00	6,933.67	6,935.18	1.51	6,913.93	21.25	ND	NA	12.82	6,922.36	NA	8 - 18
11/12/13	MKTF-13	11/13/19	4.00	6,933.67	6,935.18	1.51	6,913.93	21.25	ND	NA	12.75	6,922.43	NA	8 - 18
11/12/13	MKTF-13	11/14/19	4.00	6,933.67	6,935.18	1.51	6,913.93	21.25	ND	NA	12.85	6,922.33	NA	8 - 18
11/12/13	MKTF-13	11/15/19	4.00	6,933.67	6,935.18	1.51	6,913.93	21.25	ND	NA	12.80	6,922.38	NA	8 - 18
11/12/13	MKTF-13	11/19/19	4.00	6,933.67	6,935.18	1.51	6,913.93	21.25	ND	NA	12.71	6,922.47	NA	8 - 18
11/12/13	MKTF-13	11/21/19	4.00	6,933.67	6,935.18	1.51	6,913.93	21.25	ND	NA	12.75	6,922.43	NA	8 - 18
11/12/13	MKTF-13	12/02/19	4.00	6,933.67	6,935.18	1.51	6,913.93	21.25	ND	NA	12.40	6,922.78	NA	8 - 18
11/12/13	MKTF-14	03/25/19	4.00	6,925.65	6,928.02	2.37	6,910.56	17.46	3.89	0.36	4.25	6,923.77	6,924.06	4 - 14
11/12/13	MKTF-14	05/09/19	4.00	6,925.65	6,928.02	2.37	6,910.56	17.46	4.65	0.39	5.04	6,922.98	6,923.29	4 - 14
11/12/13	MKTF-14	08/20/19	4.00	6,925.65	6,928.02	2.37	6,910.57	17.45	5.64	0.28	5.92	6,922.10	6,922.32	4 - 14
11/12/13	MKTF-14	10/28/19	4.00	6,925.65	6,928.02	2.37	6,910.56	17.46	6.02	0.37	6.39	6,921.63	6,921.93	4 - 14
10/29/13	MKTF-15	03/25/19	2.00	6,943.74	6,943.48	-0.26	6,924.00	19.48	10.98	0.02	11.00	6,932.48	6,932.50	9 - 19
10/29/13	MKTF-15	05/13/19	2.00	6,943.74	6,943.48	-0.26	6,924.00	19.48	ND	NA	11.59	6,931.89	NA	9 - 19
10/29/13	MKTF-15	08/21/19	2.00	6,943.74	6,943.48	-0.26	6,923.98	19.50	12.02	0.01	12.03	6,931.45	NA	9 - 19
10/29/13	MKTF-15	10/30/19	2.00	6,943.74	6,943.48	-0.26	6,924.00	19.48	12.65	0.05	12.70	6,930.78	6,930.82	9 - 19
11/07/13	MKTF-16	02/20/19	2.00	6,951.00	6,950.58	-0.42	6,936.48	14.10	ND	NA	7.05	6,943.53	NA	4 - 14
11/07/13	MKTF-16	05/13/19	2.00	6,951.00	6,950.58	-0.42	6,936.48	14.10	ND	NA	8.35	6,942.23	NA	4 - 14
11/07/13	MKTF-16	08/21/19	2.00	6,951.00	6,950.58	-0.42	6,936.50	14.08	ND	NA	9.22	6,941.36	NA	4 - 14
11/07/13	MKTF-16	10/30/19	2.00	6,951.00	6,950.58	-0.42	6,936.48	14.10	ND	NA	9.89	6,940.69	NA	4 - 14
11/14/13	MKTF-17	03/25/19	2.00	6,945.79	6,945.76	-0.03	6,921.65	24.11	ND	NA	10.70	6,935.06	NA	14 - 24
11/14/13	MKTF-17	05/09/19	2.00	6,945.79	6,945.76	-0.03	6,921.65	24.11	ND	NA	14.05	6,931.71	NA	14 - 24
11/14/13	MKTF-17	08/19/19	2.00	6,945.79	6,945.76	-0.03	6,921.08	24.68	ND	NA	10.79	6,934.97	NA	14 - 24
11/14/13	MKTF-17	10/28/19	2.00	6,945.79	6,945.76	-0.03	6,921.11	24.65	ND	NA	9.00	6,936.76	NA	14 - 24
11/14/13	MKTF-17	10/29/19	2.00	6,945.79	6,945.76	-0.03	6,921.11	24.65	ND	NA	15.20	6,930.56	NA	14 - 24
11/14/13	MKTF-17	11/12/19	2.00	6,945.79	6,945.76	-0.03	6,921.11	24.65	ND	NA	11.86	6,933.90	NA	14 - 24
11/14/13	MKTF-17	11/19/19	2.00	6,945.79	6,945.76	-0.03	6,921.11	24.65	12.35	1.60	13.95	6,931.81	6,933.09	14 - 24
11/14/13	MKTF-17	11/21/19	2.00	6,945.79	6,945.76	-0.03	6,921.11	24.65	12.42	2.88	15.30	6,930.46	6,932.76	14 - 24
11/14/13	MKTF-17	12/02/19	2.00	6,945.79	6,945.76	-0.03	6,921.11	24.65	13.17	4.88	18.05	6,927.71	6,931.61	14 - 24
11/15/13	MKTF-18	03/25/19	2.00	6,950.97	6,950.65	-0.32	6,925.27	25.38	ND	NA	7.32	6,943.33	NA	17 - 27
11/15/13	MKTF-18	05/16/19	2.00	6,950.97	6,950.65	-0.32	6,925.27	25.38	ND	NA	7.54	6,943.11	NA	17 - 27
11/15/13	MKTF-18	08/19/19	2.00	6,950.97	6,950.65	-0.32	6,923.20	27.45	7.71	0.01	7.72	6,942.93	6,942.94	17 - 27
11/15/13	MKTF-18	10/28/19	2.00	6,950.97	6,950.65	-0.32	6,925.27	25.38	ND	NA	7.79	6,942.86	NA	17 - 27
11/15/13	MKTF-18	10/29/19	2.00	6,950.97	6,950.65	-0.32	6,925.27	25.38	ND	NA	8.30	6,942.35	NA	17 - 27
11/15/13	MKTF-18	11/12/19	2.00	6,950.97	6,950.65	-0.32	6,925.27	25.38	ND	NA	8.19	6,942.46	NA	17 - 27

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Date of Installation	Well ID Number	Inspection or Sample Date	Casing Diameter (Inch)	Ground Level Elevation (ft)	Well Casing Rim Elevation (ft)	Stick-up length (ft)	Well Casing Bottom Elevation (ft)	Total Well Depth (ft)	Depth to SPH (ft)	SPH Column Thickness (ft)	Depth to Water (ft)	Ground-water Elevation (ft)	Corrected Water Table[1] Elevation (ft)	Screened Interval Depth Top to Bottom (ft)
11/05/13	MKTF-19	03/25/19	2.00	6,944.89	6,944.67	-0.22	6,927.20	17.47	ND	NA	11.40	6,933.27	NA	10 - 20
11/05/13	MKTF-19	05/09/19	2.00	6,944.89	6,944.67	-0.22	6,927.20	17.47	ND	NA	11.31	6,933.36	NA	10 - 20
11/05/13	MKTF-19	08/19/19	2.00	6,944.89	6,944.67	-0.22	6,925.37	19.30	ND	NA	11.06	6,933.61	NA	10 - 20
11/05/13	MKTF-19	10/28/19	2.00	6,944.89	6,944.67	-0.22	6,926.47	18.20	ND	NA	10.91	6,933.76	NA	10 - 20
11/05/13	MKTF-19	10/29/19	2.00	6,944.89	6,944.67	-0.22	6,926.47	18.20	ND	NA	15.76	6,928.91	NA	10 - 20
11/05/13	MKTF-19	11/12/19	2.00	6,944.89	6,944.67	-0.22	6,926.47	18.20	ND	NA	10.85	6,933.82	NA	10 - 20
11/05/13	MKTF-19	11/19/19	2.00	6,944.89	6,944.67	-0.22	6,926.47	18.20	ND	NA	10.90	6,933.77	NA	10 - 20
11/05/13	MKTF-19	11/21/19	2.00	6,944.89	6,944.67	-0.22	6,926.47	18.20	ND	NA	11.05	6,933.62	NA	10 - 20
11/05/13	MKTF-19	12/02/19	2.00	6,944.89	6,944.67	-0.22	6,926.47	18.20	11.63	0.87	12.50	6,932.17	6,932.87	10 - 20
02/10/14	MKTF-20	02/20/19	4.00	6,951.89	6,951.78	-0.11	6,942.95	8.83	ND	NA	6.29	6,945.49	NA	2 - 10
02/10/14	MKTF-20	05/13/19	4.00	6,951.89	6,951.78	-0.11	6,942.95	8.83	ND	NA	7.14	6,944.64	NA	2 - 10
02/10/14	MKTF-20	08/20/19	4.00	6,951.89	6,951.78	-0.11	6,942.95	8.83	ND	NA	8.03	6,943.75	NA	2 - 10
02/10/14	MKTF-20	11/04/19	4.00	6,951.89	6,951.78	-0.11	6,942.95	8.83	ND	NA	7.68	6,944.10	NA	2 - 10
02/10/14	MKTF-21	02/20/19	4.00	6,952.68	6,952.57	-0.11	6,943.76	8.81	ND	NA	5.62	6,946.95	NA	2 - 10
02/10/14	MKTF-21	05/13/19	4.00	6,952.68	6,952.57	-0.11	6,943.76	8.81	ND	NA	6.70	6,945.87	NA	2 - 10
02/10/14	MKTF-21	08/20/19	4.00	6,952.68	6,952.57	-0.11	6,943.76	8.81	ND	NA	7.22	6,945.35	NA	2 - 10
02/10/14	MKTF-21	10/30/19	4.00	6,952.68	6,952.57	-0.11	6,943.76	8.81	ND	NA	8.32	6,944.25	NA	2 - 10
11/08/13	MKTF-22	03/25/19	2.00	6,939.76	6,942.31	2.55	6,907.06	35.25	ND	NA	24.43	6,917.88	NA	22 - 32
11/08/13	MKTF-22	05/09/19	2.00	6,939.76	6,942.31	2.55	6,907.06	35.25	ND	NA	24.64	6,917.67	NA	22 - 32
11/08/13	MKTF-22	08/20/19	2.00	6,939.76	6,942.31	2.55	6,906.69	35.62	ND	NA	24.95	6,917.36	NA	22 - 32
11/08/13	MKTF-22	10/24/19	2.00	6,939.76	6,942.31	2.55	6,906.71	35.60	ND	NA	25.40	6,916.91	NA	22 - 32
11/04/13	MKTF-23	03/25/19	2.00	6,927.23	6,929.98	2.75	6,909.62	20.36	ND	ND	12.55	6,917.43	NA	7 - 17
11/04/13	MKTF-23	05/09/19	2.00	6,927.23	6,929.98	2.75	6,909.62	20.36	12.95	0.07	13.02	6,916.96	6,917.02	7 - 17
11/04/13	MKTF-23	08/20/19	2.00	6,927.23	6,929.98	2.75	6,909.60	20.38	13.47	0.03	13.50	6,916.48	6,916.50	7 - 17
11/04/13	MKTF-23	10/28/19	2.00	6,927.23	6,929.98	2.75	6,909.62	20.36	ND	NA	13.95	6,916.03	NA	7 - 17
10/29/13	MKTF-24	02/25/19	2.00	6,926.07	6,928.72	2.65	6,898.25	30.47	ND	NA	22.43	6,906.29	NA	18 - 28
10/29/13	MKTF-24	05/06/19	2.00	6,926.07	6,928.72	2.65	6,898.25	30.47	ND	NA	21.53	6,907.19	NA	18 - 28
10/29/13	MKTF-24	08/23/19	2.00	6,926.07	6,928.72	2.65	6,897.87	30.85	ND	NA	22.05	6,906.67	NA	18 - 28
10/29/13	MKTF-24	10/22/19	2.00	6,926.07	6,928.72	2.65	6,897.90	30.82	ND	NA	23.21	6,905.51	NA	18 - 28
10/30/13	MKTF-25	02/14/19	2.00	6,913.35	6,916.19	2.84	6,896.76	19.43	ND	NA	13.13	6,903.06	NA	6 - 16
10/30/13	MKTF-25	05/06/19	2.00	6,913.35	6,916.19	2.84	6,896.76	19.43	ND	NA	12.00	6,904.19	NA	6 - 16
10/30/13	MKTF-25	08/23/19	2.00	6,913.35	6,916.19	2.84	6,896.41	19.78	ND	NA	13.12	6,903.07	NA	6 - 16
10/30/13	MKTF-25	08/27/19	2.00	6,913.35	6,916.19	2.84	6,895.41	20.78	ND	NA	13.23	6,902.96	NA	7 - 16
10/30/13	MKTF-25	10/22/19	2.00	6,913.35	6,916.19	2.84	6,896.39	19.80	ND	NA	13.72	6,902.47	NA	6 - 16
10/30/13	MKTF-26	02/14/19	2.00	6,912.55	6,915.31	2.76	6,898.16	17.15	8.38	0.77	9.15	6,906.16	6,906.78	4 - 14
10/30/13	MKTF-26	05/06/19	2.00	6,912.55	6,915.31	2.76	6,898.16	17.15	7.80	0.85	8.65	6,906.66	6,907.34	4 - 14
10/30/13	MKTF-26	08/23/19	2.00	6,912.55	6,915.31	2.76	6,898.14	17.17	8.22	0.83	9.05	6,906.26	6,906.92	4 - 14
10/30/13	MKTF-26	10/22/19	2.00	6,912.55	6,915.31	2.76	6,898.16	17.15	8.63	0.73	9.36	6,905.95	6,906.53	4 - 14
10/30/13	MKTF-27	02/25/19	2.00	6,915.36	6,917.90	2.54	6,903.18	14.72	ND	NA	3.75	6,914.15	NA	1 - 12
10/30/13	MKTF-27	05/06/19	2.00	6,915.36	6,917.90	2.54	6,903.18	14.72	ND	NA	5.73	6,912.17	NA	1 - 12

APPENDIX C-1.1
2019 FLUID LEVEL MEASUREMENTS FOR MKTF WELLS

Date of Installation	Well ID Number	Inspection or Sample Date	Casing Diameter (Inch)	Ground Level Elevation (ft)	Well Casing Rim Elevation (ft)	Stick-up length (ft)	Well Casing Bottom Elevation (ft)	Total Well Depth (ft)	Depth to SPH (ft)	SPH Column Thickness (ft)	Depth to Water (ft)	Ground-water Elevation (ft)	Corrected Water Table[1] Elevation (ft)	Screened Interval Depth Top to Bottom (ft)
10/30/13	MKTF-27	08/21/19	2.00	6,915.36	6,917.90	2.54	6,903.18	14.72	ND	NA	5.66	6,912.24	NA	1 - 12
10/30/13	MKTF-27	10/30/19	2.00	6,915.36	6,917.90	2.54	6,903.18	14.72	ND	NA	6.14	6,911.76	NA	1 - 12
04/02/14	MKTF-28	02/25/19	2.00	6,918.67	6,921.52	2.85	6,905.36	16.16	ND	NA	4.91	6,916.61	NA	3 - 13
04/02/14	MKTF-28	05/06/19	2.00	6,918.67	6,921.52	2.85	6,905.36	16.16	ND	NA	9.27	6,912.25	NA	3 - 13
04/02/14	MKTF-28	08/21/19	2.00	6,918.67	6,921.52	2.85	6,905.37	16.15	ND	NA	3.82	6,917.70	NA	3 - 13
04/02/14	MKTF-28	10/22/19	2.00	6,918.67	6,921.52	2.85	6,905.39	16.13	ND	NA	6.38	6,915.14	NA	3 - 13
04/02/14	MKTF-29	02/25/19	2.00	6,898.83	6,901.62	2.79	6,878.78	22.84	ND	NA	3.73	6,897.89	NA	10 - 20
04/02/14	MKTF-29	05/06/19	2.00	6,898.83	6,901.62	2.79	6,878.78	22.84	ND	NA	3.72	6,897.90	NA	10 - 20
04/02/14	MKTF-29	08/23/19	2.00	6,898.83	6,901.62	2.79	6,878.80	22.82	ND	NA	5.83	6,895.79	NA	10 - 20
04/02/14	MKTF-29	10/22/19	2.00	6,898.83	6,901.62	2.79	6,878.82	22.80	ND	NA	6.32	6,895.30	NA	10 - 20
04/01/14	MKTF-30	03/28/19	2.00	6,898.10	6,900.80	2.70	6,877.60	23.20	ND	NA	13.68	6,887.12	NA	10 - 20
04/01/14	MKTF-30	05/06/19	2.00	6,898.10	6,900.80	2.70	6,877.60	23.20	ND	NA	13.81	6,886.99	NA	10 - 20
04/01/14	MKTF-30	08/23/19	2.00	6,898.10	6,900.80	2.70	6,877.60	23.20	ND	NA	14.88	6,885.92	NA	10 - 20
04/01/14	MKTF-30	10/22/19	2.00	6,898.10	6,900.80	2.70	6,877.61	23.19	ND	NA	15.82	6,884.98	NA	10 - 20
04/01/14	MKTF-31	02/14/19	2.00	6,904.26	6,906.87	2.61	6,884.06	22.81	ND	NA	8.25	6,898.62	NA	6 - 21
04/01/14	MKTF-31	05/06/19	2.00	6,904.26	6,906.87	2.61	6,884.06	22.81	ND	NA	7.72	6,899.15	NA	6 - 21
04/01/14	MKTF-31	08/23/19	2.00	6,904.26	6,906.87	2.61	6,887.52	19.35	ND	NA	8.30	6,898.57	NA	6 - 21
04/01/14	MKTF-31	10/22/19	2.00	6,904.26	6,906.87	2.61	6,887.57	19.30	ND	NA	8.64	6,898.23	NA	6 - 21
03/31/14	MKTF-32	02/13/19	2.00	6,908.44	6,911.11	2.67	6,883.36	27.75	ND	NA	13.49	6,897.62	NA	9 - 24
03/31/14	MKTF-32	05/07/19	2.00	6,908.44	6,911.11	2.67	6,883.36	27.75	ND	NA	13.25	6,897.86	NA	9 - 24
03/31/14	MKTF-32	08/20/19	2.00	6,908.44	6,911.11	2.67	6,883.34	27.77	ND	NA	14.03	6,897.08	NA	9- 24
03/31/14	MKTF-32	10/23/19	2.00	6,908.44	6,911.11	2.67	6,883.36	27.75	ND	NA	14.01	6,897.10	NA	9 - 24
04/03/14	MKTF-33	03/25/19	2.00	6,936.59	6,939.75	3.16	6,906.55	33.20	ND	NA	22.00	6,917.75	NA	20 - 30
04/03/14	MKTF-33	05/09/19	2.00	6,936.59	6,939.75	3.16	6,906.55	33.20	ND	NA	22.04	6,917.71	NA	20 - 30
04/03/14	MKTF-33	08/20/19	2.00	6,936.59	6,939.75	3.16	6,906.52	33.23	ND	NA	22.35	6,917.40	NA	20 - 30
04/03/14	MKTF-33	10/24/19	2.00	6,936.59	6,939.75	3.16	6,906.53	33.22	ND	NA	22.50	6,917.25	NA	20 - 30
03/31/14	MKTF-34	03/25/19	2.00	6,942.42	6,945.35	2.93	6,917.67	27.68	ND	NA	16.95	6,928.40	NA	9 - 24
03/31/14	MKTF-34	05/09/19	2.00	6,942.42	6,945.35	2.93	6,917.67	27.68	ND	NA	18.09	6,927.26	NA	9 - 24
03/31/14	MKTF-34	08/19/19	2.00	6,942.42	6,945.35	2.93	6,917.65	27.70	ND	NA	17.70	6,927.65	NA	9 - 24
03/31/14	MKTF-34	10/29/19	2.00	6,942.42	6,945.35	2.93	6,917.65	27.70	ND	NA	18.03	6,927.32	NA	9 - 24
03/31/14	MKTF-34	11/12/19	2.00	6,942.42	6,945.35	2.93	6,917.65	27.70	ND	NA	18.06	6,927.29	NA	9 - 24
11/19/14	MKTF-35	03/25/19	2.00	6,951.90	6,951.65	-0.25	6,935.20	16.45	ND	NA	8.54	6,943.11	NA	6 - 16
11/19/14	MKTF-35	05/16/19	2.00	6,951.90	6,951.65	-0.25	6,935.20	16.45	ND	NA	8.49	6,943.16	NA	6 - 16
11/19/14	MKTF-35	08/19/19	2.00	6,951.90	6,951.65	-0.25	6,935.17	16.48	ND	NA	8.09	6,943.56	NA	6 - 16
11/19/14	MKTF-35	10/28/19	2.00	6,951.90	6,951.65	-0.25	6,935.20	16.45	ND	NA	8.42	6,943.23	NA	6 - 16
11/19/14	MKTF-35	10/29/19	2.00	6,951.90	6,951.65	-0.25	6,935.20	16.45	ND	NA	8.40	6,943.25	NA	6 - 16
11/19/14	MKTF-35	11/12/19	2.00	6,951.90	6,951.65	-0.25	6,935.20	16.45	ND	NA	8.60	6,943.05	NA	6 - 16
11/19/14	MKTF-36	03/25/19	2.00	6,950.67	6,950.12	-0.55	6,934.67	NM	NM	NA	NM	NA	NA	5 - 15
11/19/14	MKTF-36	05/14/19	2.00	6,950.67	6,950.12	-0.55	6,934.67	NM	NM	NA	NM	NA	NA	5 - 15
11/19/14	MKTF-36	08/19/19	2.00	6,950.67	6,950.12	-0.55	6,934.67	NM	NM	NA	NM	NA	NA	5 - 15

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2019 FLUID LEVEL MEASUREMENTS FOR MKTF WELLS

Date of Installation	Well ID Number	Inspection or Sample Date	Casing Diameter (Inch)	Ground Level Elevation (ft)	Well Casing Rim Elevation (ft)	Stick-up length (ft)	Well Casing Bottom Elevation (ft)	Total Well Depth (ft)	Depth to SPH (ft)	SPH Column Thickness (ft)	Depth to Water (ft)	Ground-water Elevation (ft)	Corrected Water Table[1] Elevation (ft)	Screened Interval Depth Top to Bottom (ft)
11/19/14	MKTF-36	11/06/19	2.00	6,950.67	6,950.12	-0.55	6,934.72	15.40	5.08	5.25	10.33	6,939.79	6,943.99	5 - 15
11/19/14	MKTF-36	11/07/19	2.00	6,953.90	6,953.51	-0.39	6,937.90	15.61	4.30	5.91	10.21	6,943.30	6,948.03	5 - 15
11/19/14	MKTF-36	11/12/19	2.00	6,953.90	6,953.51	-0.39	6,937.90	15.61	6.80	2.85	9.65	6,943.86	6,946.14	5 - 15
11/19/14	MKTF-36	11/13/19	2.00	6,953.90	6,953.51	-0.39	6,937.90	15.61	6.95	2.45	9.40	6,944.11	6,946.07	5 - 15
11/19/14	MKTF-36	11/14/19	2.00	6,953.90	6,953.51	-0.39	6,937.90	15.61	7.14	2.47	9.61	6,943.90	6,945.88	5 - 15
11/19/14	MKTF-36	11/15/19	2.00	6,953.90	6,953.51	-0.39	6,937.90	15.61	7.31	2.15	9.46	6,944.05	6,945.77	5 - 15
11/19/14	MKTF-36	11/19/19	2.00	6,953.90	6,953.51	-0.39	6,937.90	15.61	7.80	1.18	8.98	6,944.53	6,945.47	5 - 15
11/19/14	MKTF-36	11/21/19	2.00	6,953.90	6,953.51	-0.39	6,937.90	15.61	8.00	0.78	8.78	6,944.73	6,945.35	5 - 15
11/19/14	MKTF-36	12/02/19	2.00	6,953.90	6,953.51	-0.39	6,937.90	15.61	8.25	0.70	8.95	6,944.56	6,945.12	5 - 15
11/18/14	MKTF-37	03/25/19	2.00	6,959.07	6,958.87	-0.20	6,934.27	24.60	ND	NA	8.39	6,950.48	NA	4 - 24
11/18/14	MKTF-37	05/16/19	2.00	6,959.07	6,958.87	-0.20	6,934.27	24.60	9.10	0.08	9.18	6,949.69	6,949.75	4 - 24
11/18/14	MKTF-37	08/23/19	2.00	6,959.07	6,958.87	-0.20	6,934.28	24.59	8.85	0.02	8.87	6,950.00	6,950.02	4 - 24
11/18/14	MKTF-37	10/28/19	2.00	6,959.07	6,958.87	-0.20	6,934.27	24.60	9.30	0.03	9.33	6,949.54	6,949.56	4 - 24
11/18/14	MKTF-37	10/29/19	2.00	6,959.07	6,958.87	-0.20	6,934.27	24.60	9.17	0.03	9.20	6,949.67	6,949.69	4 - 24
11/18/14	MKTF-37	11/12/19	2.00	6,959.07	6,958.87	-0.20	6,934.27	24.60	9.52	0.04	9.56	6,949.31	6,949.34	4 - 24
11/20/14	MKTF-38	03/26/19	2.00	6,955.17	6,954.89	-0.28	6,934.60	20.29	ND	NA	11.30	6,943.59	NA	5 - 20
11/20/14	MKTF-38	05/14/19	2.00	6,955.17	6,954.89	-0.28	6,934.60	20.29	ND	NA	8.66	6,946.23	NA	5 - 20
11/20/14	MKTF-38	06/27/19	2.00	6,955.17	6,954.89	-0.28	6,934.60	20.29	ND	NA	8.75	6,946.14	NA	5 - 20
11/20/14	MKTF-38	08/20/19	2.00	6,955.17	6,954.89	-0.28	6,934.62	20.27	ND	NA	8.77	6,946.12	NA	5 - 20
11/20/14	MKTF-38	12/03/19	2.00	6,955.17	6,954.89	-0.28	6,934.60	20.29	ND	NA	9.50	6,945.39	NA	5 - 20
11/14/14	MKTF-39	03/28/19	2.00	6,953.97	6,953.75	-0.22	6,938.55	15.20	NM	NA	NM	NA	NA	5 - 15
11/14/14	MKTF-39	06/05/19	2.00	6,953.97	6,953.75	-0.22	6,938.55	15.20	ND	NA	8.69	6,945.06	NA	5 - 15
11/14/14	MKTF-39	08/20/19	2.00	6,953.97	6,953.75	-0.22	6,938.55	15.20	ND	NA	9.04	6,944.71	NA	5 - 15
11/14/14	MKTF-39	11/04/19	2.00	6,953.97	6,953.75	-0.22	6,938.57	15.18	ND	NA	9.59	6,944.16	NA	5 - 15
11/13/14	MKTF-40	02/20/19	2.00	6,891.35	6,894.33	2.98	6,870.69	23.64	ND	NA	12.79	6,881.54	NA	5 - 20
11/13/14	MKTF-40	05/06/19	2.00	6,891.35	6,894.33	2.98	6,870.69	23.64	ND	NA	12.36	6,881.97	NA	5 - 20
11/13/14	MKTF-40	08/22/19	2.00	6,891.35	6,894.33	2.98	6,870.79	23.54	ND	NA	12.15	6,882.18	NA	5 - 20
11/13/14	MKTF-40	10/22/19	2.00	6,891.35	6,894.33	2.98	6,870.71	23.62	ND	NA	13.04	6,881.29	NA	5 - 20
11/14/14	MKTF-41	02/13/19	2.00	6,891.11	6,893.64	2.53	6,853.54	40.10	ND	NA	20.10	6,873.54	NA	22 - 37
11/14/14	MKTF-41	05/07/19	2.00	6,891.11	6,893.64	2.53	6,853.54	40.10	ND	NA	19.52	6,874.12	NA	22 - 37
11/14/14	MKTF-41	08/22/19	2.00	6,891.11	6,893.64	2.53	6,853.90	39.74	ND	NA	19.55	6,874.09	NA	22 - 37
11/14/14	MKTF-41	10/23/19	2.00	6,891.11	6,893.64	2.53	6,853.93	39.71	ND	NA	20.02	6,873.62	NA	22 - 37
11/12/14	MKTF-42	02/13/19	2.00	6,890.42	6,892.95	2.53	6,859.80	33.15	ND	NA	17.18	6,875.77	NA	10 - 30
11/12/14	MKTF-42	05/07/19	2.00	6,890.42	6,892.95	2.53	6,859.80	33.15	ND	NA	16.68	6,876.27	NA	10 - 30
11/12/14	MKTF-42	08/22/19	2.00	6,890.42	6,892.95	2.53	6,859.75	33.20	ND	NA	16.40	6,876.55	NA	10 - 30
11/12/14	MKTF-42	10/23/19	2.00	6,890.42	6,892.95	2.53	6,859.77	33.18	ND	NA	16.52	6,876.43	NA	10 - 30
11/11/14	MKTF-43	02/13/19	2.00	6,874.12	6,876.90	2.78	6,861.47	15.43	ND	NA	5.99	6,870.91	NA	2 - 12
11/11/14	MKTF-43	05/08/19	2.00	6,874.12	6,876.90	2.78	6,861.47	15.43	ND	NA	3.97	6,872.93	NA	2 - 12
11/11/14	MKTF-43	08/22/19	2.00	6,874.12	6,876.90	2.78	6,861.49	15.41	ND	NA	3.67	6,873.23	NA	2 - 12
11/11/14	MKTF-43	10/24/19	2.00	6,874.12	6,876.90	2.78	6,861.52	15.38	ND	NA	4.34	6,872.56	NA	2 - 12

APPENDIX C-1.1
2019 FLUID LEVEL MEASUREMENTS FOR MKTF WELLS

Date of Installation	Well ID Number	Inspection or Sample Date	Casing Diameter (Inch)	Ground Level Elevation (ft)	Well Casing Rim Elevation (ft)	Stick-up length (ft)	Well Casing Bottom Elevation (ft)	Total Well Depth (ft)	Depth to SPH (ft)	SPH Column Thickness (ft)	Depth to Water (ft)	Ground-water Elevation (ft)	Corrected Water Table[1] Elevation (ft)	Screened Interval Depth Top to Bottom (ft)
11/11/14	MKTF-44	02/13/19	2.00	6,867.41	6,869.95	2.54	6,818.80	51.15	ND	NA	33.39	6,836.56	NA	38 - 48
11/11/14	MKTF-44	05/08/19	2.00	6,867.41	6,869.95	2.54	6,818.80	51.15	ND	NA	34.20	6,835.75	NA	38 - 48
11/11/14	MKTF-44	08/22/19	2.00	6,867.41	6,869.95	2.54	6,818.75	51.20	ND	NA	30.96	6,838.99	NA	38 - 48
11/11/14	MKTF-44	10/24/19	2.00	6,867.41	6,869.95	2.54	6,818.79	51.16	ND	NA	38.54	6,831.41	NA	38 - 48
Pre-existing	MKTF-45	03/26/19	4.00	6,948.63	6,949.59	0.96	6,919.35	30.24	12.00	0.50	12.50	6,937.09	6,937.49	Unknown
Pre-existing	MKTF-45	05/14/19	4.00	6,948.63	6,949.59	0.96	6,919.35	30.24	12.43	0.59	13.02	6,936.57	6,937.04	Unknown
Pre-existing	MKTF-45	08/19/19	4.00	6,948.63	6,949.59	0.96	6,919.26	30.33	14.02	0.46	14.48	6,935.11	6,935.48	Unknown
Pre-existing	MKTF-45	10/28/19	4.00	6,948.63	6,949.59	0.96	6,919.35	30.24	11.97	1.03	13.00	6,936.59	6,937.41	Unknown
Pre-existing	MKTF-45	10/29/19	4.00	6,948.63	6,949.59	0.96	6,919.35	30.24	11.38	2.37	13.75	6,935.84	6,937.74	Unknown
Pre-existing	MKTF-45	11/06/19	4.00	6,948.63	6,949.59	0.96	6,919.35	30.24	9.57	12.95	22.52	6,927.07	6,937.43	Unknown
Pre-existing	MKTF-45	11/07/19	4.00	6,948.63	6,949.59	0.96	6,919.35	30.24	9.00	13.25	22.25	6,927.34	6,937.94	Unknown
Pre-existing	MKTF-45	11/11/19	4.00	6,948.63	6,949.59	0.96	6,919.35	30.24	8.75	14.85	23.60	6,925.99	6,937.87	Unknown
Pre-existing	MKTF-45	11/12/19	4.00	6,948.63	6,949.59	0.96	6,919.35	30.24	9.62	14.30	23.92	6,925.67	6,937.11	Unknown
Pre-existing	MKTF-45	11/13/19	4.00	6,948.63	6,949.59	0.96	6,919.35	30.24	9.70	16.23	25.93	6,923.66	6,936.64	Unknown
Pre-existing	MKTF-45	11/14/19	4.00	6,948.63	6,949.59	0.96	6,919.35	30.24	10.06	15.23	25.29	6,924.30	6,936.48	Unknown
Pre-existing	MKTF-45	11/15/19	4.00	6,948.63	6,949.59	0.96	6,919.35	30.24	10.28	14.29	24.57	6,925.02	6,936.45	Unknown
Pre-existing	MKTF-45	11/19/19	4.00	6,948.63	6,949.59	0.96	6,919.35	30.24	10.84	11.91	22.75	6,926.84	6,936.37	Unknown
Pre-existing	MKTF-45	11/21/19	4.00	6,948.63	6,949.59	0.96	6,919.35	30.24	11.00	10.90	21.90	6,927.69	6,936.41	Unknown
Pre-existing	MKTF-45	12/02/19	4.00	6,948.63	6,949.59	0.96	6,919.35	30.24	12.38	6.57	18.95	6,930.64	6,935.90	Unknown
10/12/19	MKTF-46	10/29/19	2.00	6,954.73	6,957.60	2.87	6,936.31	21.29	ND	NA	10.28	6,947.32	NA	3 - 18
10/12/19	MKTF-46	11/12/19	2.00	6,954.73	6,957.60	2.87	6,936.31	21.29	ND	NA	10.46	6,947.14	NA	3 - 18
10/12/19	MKTF-46	12/02/19	2.00	6,954.73	6,957.60	2.87	6,936.31	21.29	ND	NA	10.70	6,946.90	NA	3 - 18
10/14/19	MKTF-47	12/02/19	2.00	6,959.51	6,959.09	-0.42	6,944.79	14.30	ND	NA	9.78	6,949.31	NA	4 - 14
10/14/19	MKTF-48	12/02/19	2.00	6,959.24	6,961.73	2.49	6,940.81	20.92	ND	NA	11.85	6,949.88	NA	2 - 17
10/15/19	MKTF-49	12/03/19	2.00	6,944.00	6,946.76	2.76	6,921.86	24.90	ND	NA	19.90	6,926.86	NA	5 - 25
10/16/19	MKTF-50	12/03/19	2.00	6,939.68	6,942.82	3.14	6,921.17	21.65	ND	NA	15.61	6,927.21	NA	3 - 18

DEFINITIONS:

DTB - Depth to Bottom
DTW - Depth to Water
SPH = Separate Phase Hydrocarbons

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

NOTES:

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

08/19/19 - Not able to locate well to gauge or sample.

APPENDIX D

DiSorbo
Environmental Consulting Firm

Marathon Petroleum Company, LP
Gallup Refinery - Up-Gradient MKTF
Well Installations
WEST19032-02

Geologist	: Tracy Payne
Drilling Company	: Terracon
Driller	: Cothron
Drilling Rig	: CME 55 Track Rig
Drilling Method	: Hollow-Stem Augers 8"
Sampling Method	: 2' Split Spoon
Total Depth	: 18'
Saturation Depth	: 6.5'
Start Date/Time	: 10/11/19 - 10:00
Finish Date/Time	: 10/11/19 - 13:30

WELL NO. MKTF-46

(Sheet 1 of 1)

Elev., TOC (ft. msl)	: 6957.60
Elev., PAD (ft. msl)	: 6955.02
Elev., GL (ft. msl)	: 6954.73
N	: 1633095.72
E	: 2546068.60
Comments	: Hand augered to five feet.

Depth (ft.)	PID (ppm)	Saturation	Lithology	USCS	Recovery (%)	Sample	DESCRIPTION
0	0			CL	100		SILTY CLAY - low, firm, damp, light reddish brown, no odor.
2	0			CL	100		SILTY CLAY - Similar to above (STA).
4	0			CL	100		SILTY CLAY - STA.
5	0			CL	100		SILTY CLAY - STA.
6	105	▼		CL	70		SILTY CLAY - STA.
7	58.5			CL	70		SILTY SAND - fine, loose, moist to very moist, brown, no odor.
8							GRAVELLY CLAY - low, firm, damp, brown, no odor.
9	0			CH	100		CLAY - high, stiff, damp, brown grading to light grayish brown, small calcareous nodules present.
11	0			CL	70		SILTY CLAY - low, firm, damp, grayish brown, no odor.
13	0			CL	90		SILTY CLAY - STA, compact, light greenish gray silt at base approximately 1.5" thick, damp.
15	0			SS	70		SILTSTONE - very fine, compact, light olive gray, no odor, dense, damp.
17	0			SS	60		SILTSTONE - STA, harder than above.
18				SS	-		SILTSTONE - STA.

Completion Results

Well No. MKTF-46

- Steel Protective Casing
- Top of Casing 2.87' Above Ground Level
- Concrete Pad 4' x 4' x 4'
- Bentonite Pellets
- 2" Sch 40 PVC w/Threaded Joints
- 10/20 Sieve Sand Filter Pack
- 2" Sch 40 PVC Slotted 0.01" Screen w/Threaded Joints
- 2" Flush Threaded Sch 40 PVC Cap

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Marathon Petroleum Company, LP
Gallup Refinery - Up-Gradient MKTF
Well Installations
WEST19032-02

Geologist	: Tracy Payne
Drilling Company	: Terracon
Driller	: Cothron
Drilling Rig	: CME 55 Track Rig
Drilling Method	: Hollow-Stem Augers 8"
Sampling Method	: 2' Split Spoon
Total Depth	: 14'
Saturation Depth	: 10'
Start Date/Time	: 10/14/19 - 09:40
Finish Date/Time	: 10/14/19 - 12:25

WELL NO. MKTF-47

(Sheet 1 of 1)

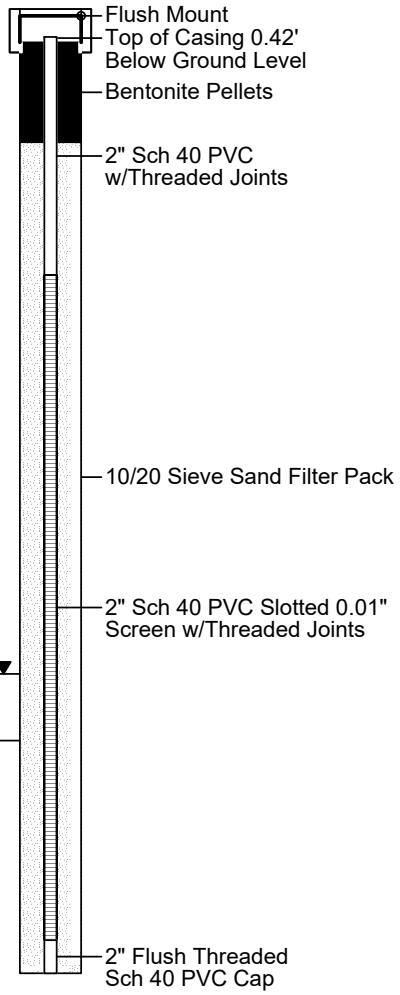
Elev., TOC (ft. msl)	: 6959.09
Elev., PAD (ft. msl)	: 6959.51 (flush w/ asphalt)
Elev., GL (ft. msl)	: 6956.51
N	: 1633268.22
E	: 2546444.16
Comments	: Cored through asphalt. Hand augered to 5'.

Saturation
▼ Saturation

Depth (ft.)	PID (ppm)	Saturation	Lithology	USCS	Recovery (%)	Sample	DESCRIPTION
0	-				-		ASPHALT
1	1.0			CL	100		SANDY GRAVELLY CLAY - low, stiff, damp, light reddish brown, no odor, 10-20 mm gravel.
2	4.6						
3	4.2						
4	4.5						
5	5.0			CL	70		GRAVELLY CLAY - Similar to above (STA).
6							
7	14.4			CL	50		SILTY CLAY - low, firm, damp, brown, no odor, trace gravel.
8				CL	80		SILTY CLAY - STA, no odor.
9	11.1			CL/GC	80		GRAVELLY CLAY/CLAYEY GRAVEL - low, firm, damp, brown clay with 5-30 mm gravel, chert and sandstone gravel.
10	11.1	▼		GC	90		CLAYEY GRAVEL - STA, very damp to very moist at base, no odor.
11	10.0			SS	90		SILTSTONE - very fine, dense, damp, gray.
12	9.0			SS	90		SILTSTONE - very fine, very dense, damp, brown with sandstone present, mudstone present at base, no odor.
13							
14				SS	-		SILTSTONE - STA.
15							

Completion Results

Well No. MKTF-47



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Marathon Petroleum Company, LP
Gallup Refinery - Up-Gradient MKTF
Well Installations
WEST19032-02

Geologist	: Tracy Payne
Drilling Company	: Terracon
Driller	: Cothron
Drilling Rig	: CME 55 Track Rig
Drilling Method	: Hollow-Stem Augers 8"
Sampling Method	: 2' Split Spoon
Total Depth	: 18'
Saturation Depth	: 4'
Start Date/Time	: 10/14/19 - 13:30
Finish Date/Time	: 10/14/19 - 16:50

WELL NO. MKTF-48

(Sheet 1 of 2)

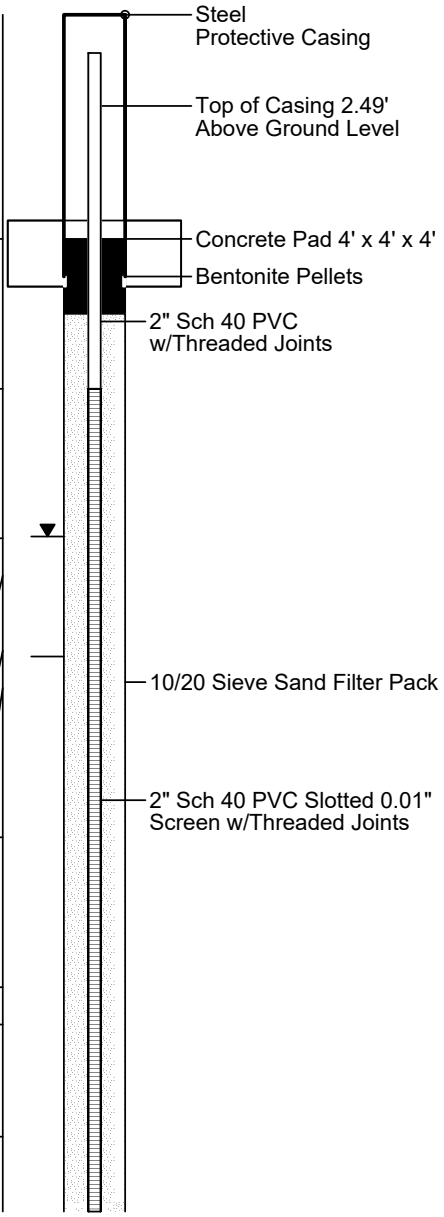
Elev., TOC (ft. msl)	: 6961.73
Elev., PAD (ft. msl)	: 6959.41
Elev., GL (ft. msl)	: 6959.24
N	: 1633715.07
E	: 2546508.76
Comments	: Hand augered to 4.5'. Refusal @ 4.5' in gravel.

Saturation
▼ Saturation
SPH - Separate Phase Hydrocarbon

Depth (ft.)	PID (ppm)	Saturation	Lithology	USCS	Recovery (%)	Sample	DESCRIPTION
0							SILTY CLAY - low, firm, damp, dark brown, odor.
1	83.9			CL	100		
2	181.6						SILTY CLAY - Similar to above (STA), black, hydrocarbon odor.
3	513			CL	100		
4	975	▼		SW	100		GRAVELLY SAND - fine, loose, moist to very moist, SPH present, hydrocarbon odor, oily clayey at 4.5' with gravel.
5	1414			CL	90		GRAVELLY SANDY CLAY - low, soft, damp, dark brown, moist to saturated in sand, small gravel lense from 5.25' to 5.5', SPH/oily.
6				CL	90		GRAVELLY CLAY - low, firm, damp, hydrocarbon odor, brown.
7	760			CL	100		SILTY CLAY - low, firm, damp, brown, hydrocarbon odor, light tan silt present in pockets.
8							CLAY - high, stiff, damp, brown, hydrocarbon odor, light tan silt in pockets.
9	160			CH	100		
10				CH	80		CLAY - STA.
11	392			CL	80		SANDY CLAY - low, firm, damp to moist in clayey sand lenses, hydrocarbon odor, brown.
12	511			CL			SILTY CLAY - low, firm, damp, brown grading to gray, trace gravel present, hydrocarbon odor.
13							

Completion Results

Well No. MKTF-48



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Marathon Petroleum Company, LP
Gallup Refinery - Up-Gradient MKTF
Well Installations
WEST19032-02

Geologist	: Tracy Payne
Drilling Company	: Terracon
Driller	: Cothron
Drilling Rig	: CME 55 Track Rig
Drilling Method	: Hollow-Stem Augers 8"
Sampling Method	: 2' Split Spoon
Total Depth	: 18'
Saturation Depth	: 4'
Start Date/Time	: 10/14/19 - 13:30
Finish Date/Time	: 10/14/19 - 16:15

WELL NO. MKTF-48

(Sheet 2 of 2)

Elev., TOC (ft. msl)	: 6946.76
Elev., PAD (ft. msl)	: 6959.41
Elev., GL (ft. msl)	: 6959.24
N	: 1633715.07
E	: 2546508.76
Comments	: Hand augered to 4.5'. Refusal @ 4.5' in gravel.

Saturation

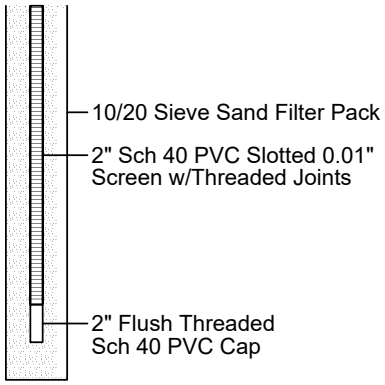
▼ Saturation

SPH - Separate Phase Hydrocarbon

Depth (ft.)	PID (ppm)	Saturation	Lithology	USCS	Recovery (%)	Sample	DESCRIPTION
13	511			CL	90		
14				SM	90		SILTY SAND/SANDY SILT - very fine grain, compact, damp, gray, hydrocarbon odor.
15	398			SS	100		SILTSTONE - very fine, dense, gray, damp, trace sandstone present, crumbly in lenses, hydrocarbon odor.
16							SILTSTONE - STA, trace clay and sand, hydrocarbon odor.
17	86			SS	100		
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							

Completion Results

Well No. MKTF-48



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Gallup Refinery - Up-Gradient MKTF
Well Installations
WEST19032-02

Geologist	: Tracy Payne
Drilling Company	: Terracon
Driller	: Cothron
Drilling Rig	: CME 55 Track Rig
Drilling Method	: Hollow-Stem Augers 8"
Sampling Method	: 2' Split Spoon
Total Depth	: 28'
Saturation Depth	: 16'
Start Date/Time	: 10/15/19 - 10:30
Finish Date/Time	: 10/15/19 - 15:00

WELL NO. MKTF-49

(Sheet 1 of 2)

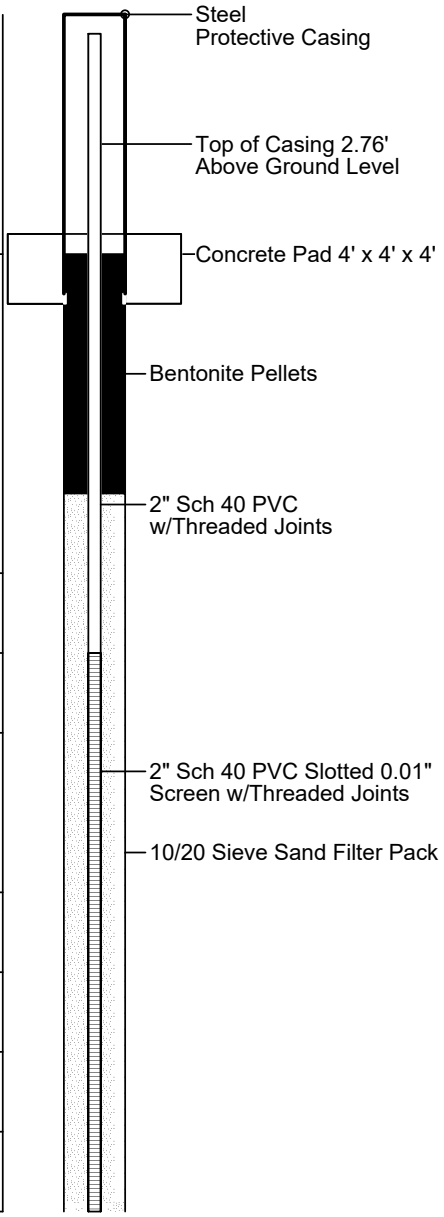
Elev., TOC (ft. msl)	: 6946.76
Elev., PAD (ft. msl)	: 6944.25
Elev., GL (ft. msl)	: 6944.00
N	: 1634064.06
E	: 2545788.35
Comments	: Hand augered to 5'.

Depth (ft.)	PID (ppm)	Saturation	Lithology	USCS	Recovery (%)	Sample	DESCRIPTION
0							GRAVELLY SILTY CLAY - low, firm, damp, brown, odor.
1	6.9						
2	9.1			CL	100		
3	6.6						
4							CLAY - high, firm, damp, brown, no odor.
5	4.5			CH	100		
6	9.9			CL	70		GRAVELLY SANDY CLAY - low, soft, damp, brown, no odor.
7	11.2			SM	70		GRAVELLY CLAYEY SAND - fine, crumbly, damp, brown, no odor.
8				SM	70		GRAVELLY CLAYEY SAND - Similar to above (STA), no odor.
9	11.3			CL	80		SANDY CLAY - low, firm, damp, brown, fine grain sand lenses throughout.
10				CL	80		SANDY CLAY - STA.
11	14			SM	80		SILTY SAND - fine, loose, damp, brown, no odor.
12							

Saturation
▼ Saturation

Completion Results

Well No. MKTF-49



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Geologist	: Tracy Payne
Drilling Company	: Terracon
Driller	: Cothron
Drilling Rig	: CME 55 Track Rig
Drilling Method	: Hollow-Stem Augers 8"
Sampling Method	: 2' Split Spoon
Total Depth	: 28'
Saturation Depth	: 16'
Start Date/Time	: 10/15/19 - 10:30
Finish Date/Time	: 10/15/19 - 15:00

WELL NO. MKTF-49

(Sheet 2 of 2)

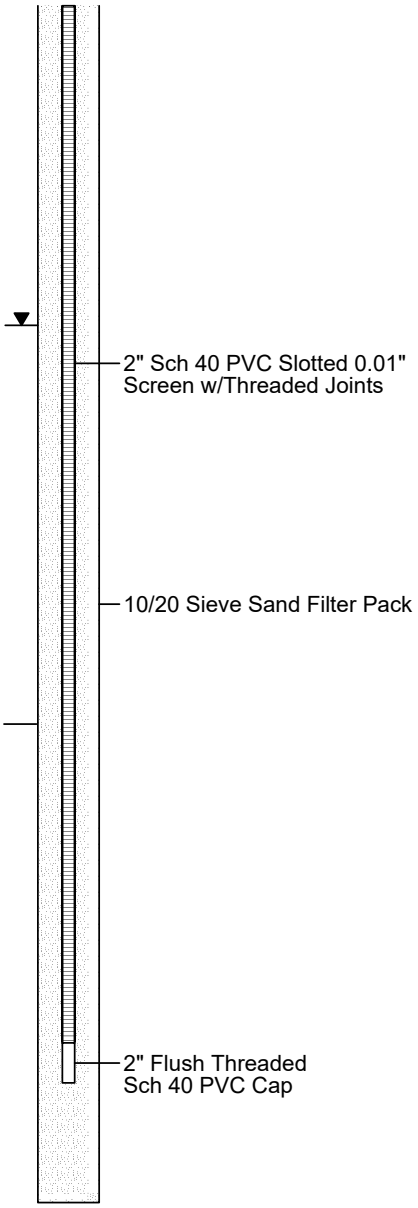
Elev., TOC (ft. msl)	: 6947.06
Elev., PAD (ft. msl)	: 6944.25
Elev., GL (ft. msl)	: 6944.00
N	: 1634064.06
E	: 2545788.35
Comments	: Hand augered to 5'.

Depth (ft.)	PID (ppm)	Saturation	Lithology	USCS	Recovery (%)	Sample	DESCRIPTION
12							
13	9.7			SC	70		CLAYEY SAND - fine, compact, damp, brown, no odor.
14				CH	80		CLAY - high, firm, damp, dark brown, no odor.
15	1600			CL/SC	80		CLAYEY SAND/SANDY CLAY - low, soft, damp to moist, dark brown, hydrocarbon odor, very fine grain sand.
16							
17	-			SC	80		CLAYEY SAND - STA, saturated, hydrocarbon odor.
18							
19	-			SW	70		CLAYEY GRAVELLY SAND - fine, compact to loose, saturated, brown gravel lense at 19.5', hydrocarbon odor.
20							
21	-			SW	70		GRAVELLY SAND - STA, trace clay, hydrocarbon odor, saturated.
22	2245			SC/CL	-		CLAYEY SAND /SANDY CLAY - low, firm, very fine sand, moist to very moist, dark brown, hydrocarbon odor.
23	482			CL	50		SANDY CLAY - low, firm, damp, brown, hydrocarbon odor, sand in lenses.
24							
25	20.4			CH	70		CLAY - high, stiff, damp, brown, odor.
26							
27	19.7			SC/CL			CLAYEY SAND/SANDY CLAY - low, firm, damp, brown, odor, sand in matrix.

Saturation
▼ Saturation

Completion Results

Well No. MKTF-49



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WEST19032-02

Geologist	: Tracy Payne
Drilling Company	: Terracon
Driller	: Cothron
Drilling Rig	: CME 55 Track Rig
Drilling Method	: Hollow-Stem Augers 8"
Sampling Method	: 2' Split Spoon
Total Depth	: 26'
Saturation Depth	: 14'
Start Date/Time	: 10/15/19 - 15:45
Finish Date/Time	: 10/16/19 - 11:15

WELL NO. MKTF-50

(Sheet 1 of 2)

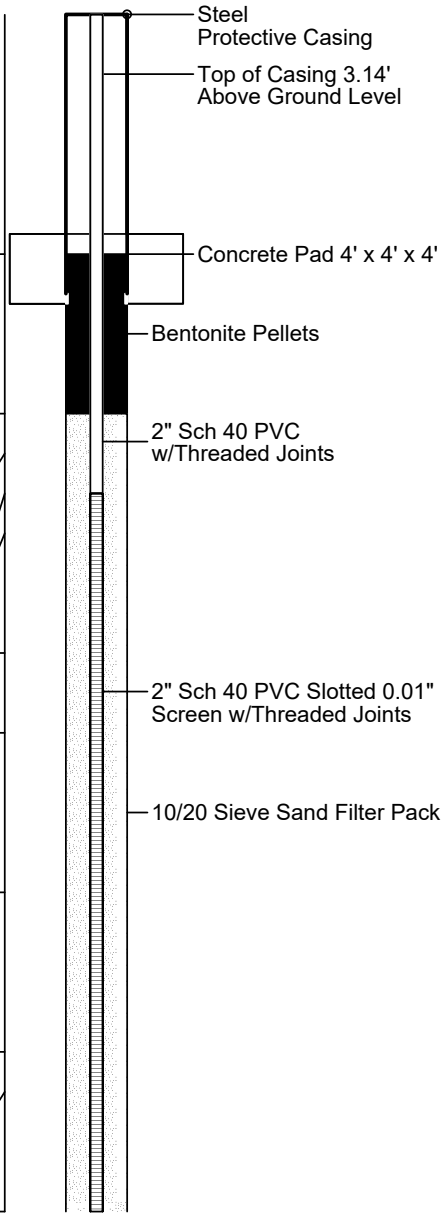
Elev., TOC (ft. msl)	: 6942.82
Elev., PAD (ft. msl)	: 6940.26
Elev., GL (ft. msl)	: 6939.68
N	: 1634294.68
E	: 2545881.16
Comments	: Hand augered to refusal at 3'.

Depth (ft.)	PID (ppm)	Saturation	Lithology	USCS	Recovery (%)	Sample	DESCRIPTION
0							GRAVELLY SILTY CLAY - low, firm, damp, brown, no odor.
1	3.2			CL	100		
2	169			CL	100		SILTY CLAY - low, loose, damp, dark brown, odor.
3	70			CL	100		SILTY CLAY - Similar to above (STA), brown, odor.
	158.6			CL	100		SILTY CLAY - STA.
4	148.9			SM	100		SILTY SAND - fine, loose, brown, faint odor.
5	494			CL	100		SILTY CLAY - low, firm, damp, brown, faint odor.
6	889			CL	50		SILTY CLAY - low to moderate, firm, damp, gray/brown, odor, becomes sandy at base, damp at base.
8	719			CL/SC	50		SANDY CLAY/CLAYEY SAND - very fine, low plasticity, soft/loose, damper than above, brown, odor.
10	1892			SC	80		CLAYEY SAND - STA, moist to very moist, odor, dark brown.
11	15,000			CL	80		CLAY - low, soft, damp, dark brown with black staining, odor, sticky.
12							

Saturation
▼ Saturation

Completion Results

Well No. MKTF-50



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Geologist	: Tracy Payne
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Driller	: Cothron
Drilling Rig	: CME 55 Track Rig
Drilling Method	: Hollow-Stem Augers 8"
Sampling Method	: 2' Split Spoon
Total Depth	: 26'
Saturation Depth	: 14'
Start Date/Time	: 10/15/19 - 15:45
Finish Date/Time	: 10/16/19 - 11:15

WELL NO. MKTF-50

(Sheet 2 of 2)

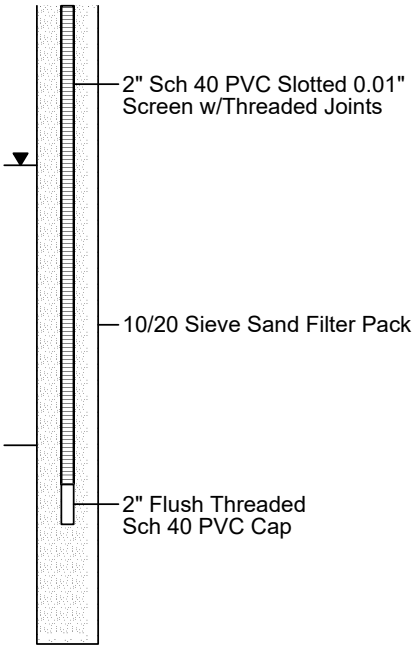
Elev., TOC (ft. msl)	: 6942.82
Elev., PAD (ft. msl)	: 6940.26
Elev., GL (ft. msl)	: 6939.68
N	: 1634294.68
E	: 2545881.16
Comments	: Hand augered to refusal at 3'.

Saturation
▼ Saturation

Depth (ft.)	PID (ppm)	Saturation	Lithology	USCS	Recovery (%)	Sample	DESCRIPTION
12							
13	15,000	▼		CL	80		CLAY - STA, oily, black, very soft, strong hydrocarbon odor.
14							CLAYEY SILTY SAND - fine, very soft, saturated, black, strong hydrocarbon odor.
15				SC/SM	80		
16	-						CLAYEY SILTY SAND - STA, dark brown, saturated, hydrocarbon odor.
17				SC/SM	80		
18	149			SS	80		SANDSTONE/SILTSTONE/CLAYSTONE - fine grain grading to very fine, compact, dense, damp, odor, gray with traces of brown.
19	189			SS	90		SILTSTONE - very dense, damp, light gray, faint odor.
20							
21							
22							
23							
24							
25							
26							
27							

Completion Results

Well No. MKTF-50



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02-28-2020 C:\Users\jreis\Desktop\All\WEST\Marketing Tank Farm\MKTF 50.bor

DiSorbo
Environmental Consulting Firm

Marathon Petroleum Company, LP
Gallup Refinery - OW-58A
WEST20004-Phase 01

Geologist	: Tracy Payne
Drilling Company	: Terracon
Driller	: Cothron
Drilling Rig	: CME 55 Track Rig
Drilling Method	: Hollow-Stem Augers 10"
Sampling Method	: 2' Split Spoon
Total Depth	: 36'
Saturation Depth	: 28'
Start Date/Time	: 10/17/19 - 08:15
Finish Date/Time	: 10/17/19 - 15:25

WELL NO. OW-58A

(Sheet 1 of 2)

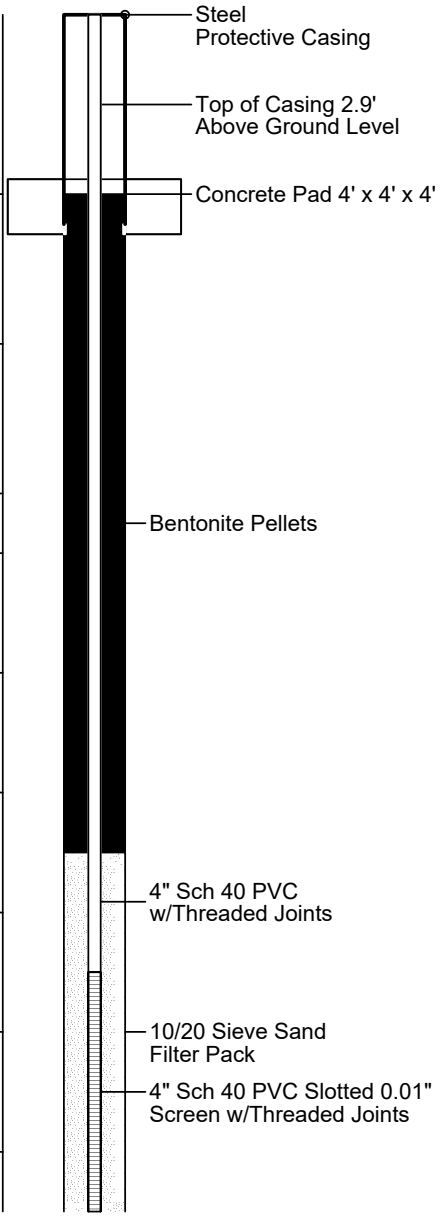
Elev., TOC (ft. msl)	: 6935.88
Elev., PAD (ft. msl)	: 6933.39
Elev., GL (ft. msl)	: 6932.98
N	: 1634802.47
E	: 2547429.22
Comments	: Hand Augered to five feet.

Saturation
▼ Saturation
SPH - Separate Phase Hydrocarbon

Depth (ft.)	PID (ppm)	Saturation	Lithology	USCS	Recovery (%)	Sample	DESCRIPTION
0	3.0			CL	100		GRAVELLY SILTY CLAY - moderate, firm to stiff, damp, brown, odor.
2	6.8						
2	9.5						
2	9.5			CH	100		CLAY - high, firm, damp, reddish brown, odor, specks of black discoloration.
4	4.2						
5	7.4			CH	70		CLAY - Similar to above (STA), no odor.
6	9.1			CH	50		CLAY - STA, faint odor.
8	12.7			CH	80		CLAY - STA, faint odor.
10	65			CH	90		CLAY - high, stiff, damp, reddish brown, odor, black discoloration.
12	121			CH	100		CLAY - STA, odor, trace very fine grain sand.
14	340			CL	90		SILTY SANDY CLAY - low, firm, crumbly, damp, brown, odor, fine grain sand, no discoloration.
16	757			CL			SILTY SANDY CLAY - STA, stiff, no discoloration, odor.

Completion Results

Well OW-58A



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Drilling Method	: Hollow-Stem Augers 10"
Sampling Method	: 2' Split Spoon
Total Depth	: 36'
Saturation Depth	: 28'
Start Date/Time	: 10/17/19 - 08:15
Finish Date/Time	: 10/17/19 - 15:25

WELL NO. OW-58A

(Sheet 2 of 2)

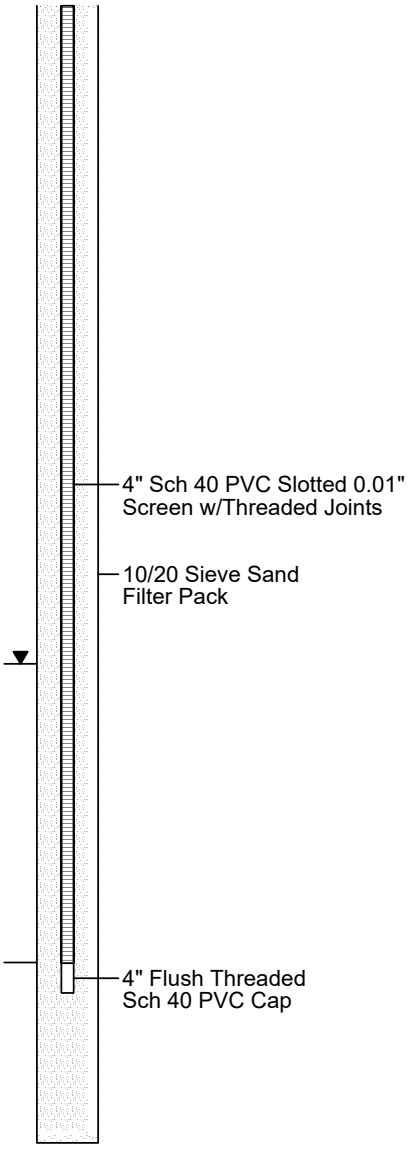
Elev., TOC (ft. msl)	: 6935.88
Elev., PAD (ft. msl)	: 6933.39
Elev., GL (ft. msl)	: 6932.98
N	: 1634802.47
E	: 2547429.22
Comments	: Hand Augered to five feet.

Saturation
▼ Saturation
SPH - Separate Phase Hydrocarbon

Depth (ft.)	PID (ppm)	Saturation	Lithology	USCS	Recovery (%)	Sample	DESCRIPTION
17							
18	757			CL	80		
19	326			CL	90		SANDY CLAY - low, stiff, damp, light brown, crumbly, fine grain sand, odor.
20	1001			CL	90		CLAY - moderate, very stiff, damp, brown, odor.
21	1564			CL	90	X	CLAY - STA, oily, sweet/chemical odor, glossy oil spots on core.
22							
23	1350			CL	90		CLAY - STA, increase of SPH on core and weeping from clay.
24							
25	1670			CL	100		SILTY CLAY - low, firm, damp, brown, hydrocarbon odor, oil on outside of core and weeping from core.
26							
27	1848			CL	100	X	SILTY CLAY - moderate, stiff, damp, brown, hydrocarbon odor, silty sand seams at 27', black discoloration, SPH weeping from core.
28		▼					
29	-			CL	100		SILTY CLAY - STA, saturated silty sand seams approximately 2" thick @ 28', 28.75' & 29.25'.
30				CL	100		SILTY CLAY - low, firm to soft, damp to very moist, brown, hydrocarbon odor.
31	-			SM	100		SILTY SAND - fine, loose to compact, saturated, dark brown, hydrocarbon odor, clayey at base.
32				SM	90		SILTY SAND - STA, saturated, hydrocarbon odor.
33	1429			CH	90		CLAY/SILTY CLAY - moderate to high, soft, damp, brown, hydrocarbon odor.
34							CLAY/SILTY CLAY - STA, hydrocarbon odor.
35	575			CH	90	X	
36							
37							

Completion Results

Well OW-58A



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APPENDIX E

Nitrate-Nitrite Test Kit

NI-12 (1408100)

DOC326.97.00083

Test preparation

CAUTION: ⚠ Review the Safety Data Sheets (MSDS/SDS) for the chemicals that are used. Use the recommended personal protective equipment.

- Put the color disc on the center pin in the color comparator box (numbers to the front).
- Use sunlight or a lamp as a light source to find the color match with the color comparator box.
- Rinse the tubes with sample before the test. Rinse the tubes with deionized water after the test.
- If the color match is between two segments, use the value that is in the middle of the two segments.
- If the color disc becomes wet internally, pull apart the flat plastic sides to open the color disc. Remove the thin inner disc. Dry all parts with a soft cloth. Assemble when fully dry.
- If the sample contains more than 40 mg/L nitrate-nitrogen or more than 0.4 mg/L nitrite-nitrogen, dilute the sample as follows. Use the dropper to add 1 mL of sample to each tube. Dilute the sample to the 5-mL mark with deionized water. Use the diluted sample in the test procedure and multiply the result by 5.

Nitrate

- The reagent contains a small quantity of cadmium metal that does not dissolve. Dispose of reacted solutions according to local, state and federal regulations.
- To verify the test accuracy, use a standard solution as the sample.
- To record the test result as mg/L NO_3^-, multiply the test result by 4.4.

Nitrite

- Undissolved reagent does not have an effect on test accuracy.
- Strong oxidizing and reducing substances interfere with the test. Cupric and ferrous ions cause low results. Ferric, mercurous, silver, bismuth, antimonous, lead, auric, chloroplatinate and metavanadate ions cause a precipitate to develop.
- To record the test result as mg/L NO_2^-, multiply the test result by 3.33.
- Nitrite-nitrogen develops during the biological decomposition of organic nitrogen compounds. Nitrite is also used as a corrosion inhibitor in industrial process water and as a food preservative in the food industry. Nitrites react with oxygen to form nitrates and are not usually found in surface waters.

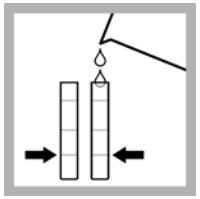
Replacement items

Description	Unit	Item no.
NitraVer® 5 Nitrate Reagent Powder Pillows, 5 mL	100/pkg	1403599
NitriVer® 3 Nitrite Reagent Powder Pillows, 5 mL	100/pkg	1407899
Color disc, nitrate nitrogen, 0–40 mg/L	each	9261400
Color disc, nitrite nitrogen, 0–0.4 mg/L	each	9262300
Color comparator box	each	173200
Dropper, glass, 0.5- and 1.0-mL marks	5/pkg	1419705
Glass viewing tubes, 18 mm	6/pkg	173006
Stopper, rubber, size 2	12/pkg	211802

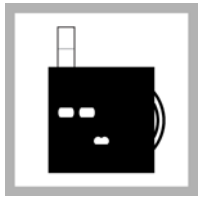
Optional items

Description	Unit	Item no.
Nitrate nitrogen standard solution, 10.0 mg/L NO_3–N	500 mL	30749
Plastic viewing tubes, 18 mm, with caps	4/pkg	4660004
Caps for plastic viewing tubes (4660004)	4/pkg	4660014
Water, deionized	500 mL	27249

Test procedure—Nitrate-nitrogen (0–40 mg/L NO_3^-–N)



1. Fill two tubes to the first line (5 mL) with sample.

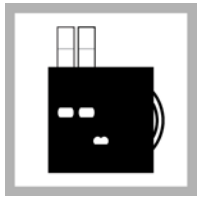


2. Put one tube into the left opening of the color comparator box.

3. Add one NitraVer 5 Nitrate Reagent Powder Pillow to the second tube.

4. Put a cap on the tube. Shake vigorously for 1 minute.

5. Wait 1 minute. An amber color develops.

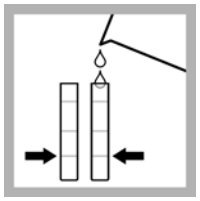


6. Put the second tube into the color comparator box.

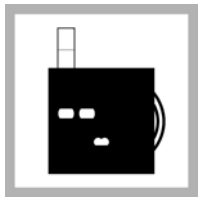
7. Hold the color comparator box in front of a light source. Turn the color disc to find the color match.

8. Read the result in mg/L in the scale window.

Test procedure—Nitrite-nitrogen LR (0–0.4 mg/L NO_2^-–N)



1. Fill two tubes to the first line (5 mL) with sample.

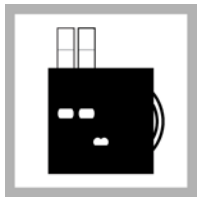


2. Put one tube into the left opening of the color comparator box.

3. Add one NitriVer 3 Nitrite Reagent Powder Pillow to the second tube.

4. Put a cap on the tube. Shake for 1 minute. A pink color develops.

5. Wait 10 minutes. Read the result within 15 minutes.



6. Put the second tube into the color comparator box.

7. Hold the color comparator box in front of a light source. Turn the color disc to find the color match.

8. Read the result in mg/L in the scale window.