GW - 28

GROUNDWATER MONITORING CORRESPONDENCE

2021

Certified Mail - Return Receipt Requested

September 9, 2021

Kawika Tupou
Environmental Manager
HollyFrontier Navajo Refining LLC
P.O. Box 159
Artesia, New Mexico 88211-0159

RE: APPROVAL WITH MODIFICATIONS
DOWNGRADIENT GROUNDWATER INVESTIGATION REPORT
HOLLYFRONTIER NAVAJO REFINING LLC – ARTESIA REFINERY
EPA ID NO. NMD048918817
HWB-NRC-21-001

Dear Mr. Tupou:

The New Mexico Environment Department (NMED) is in receipt of the HollyFrontier Navajo Refining LLC, Artesia Refinery's (Permittee) *Downgradient Groundwater Investigation Report* (Report), dated February 2021. NMED has reviewed the Report and hereby issues this Approval with Modifications with the following comments.

Comment 1

In Section 1.0, (Introduction), page 1, paragraph 2, the Permittee states, "[t]he groundwater investigation was conducted based on recommendations identified during a desktop groundwater receptor survey completed by TRC on behalf of HFNR and documented in the Artesia Refinery, *Desktop Groundwater Receptor Survey and Vapor Intrusion Evaluation Technical Memorandum* dated April 12, 2019 (April 2019 Receptor Survey Memo [HFNR 2019a]). No downgradient receptors were identified to be at risk for direct exposure to phase-separated hydrocarbons (PSH) or dissolved-phase hydrocarbons in exceedance of critical groundwater screening levels (CGWSLs). However, additional assessment was recommended to determine whether two downgradient residential properties and associated potential domestic water wells were potentially affected by the plumes by better defining the extent of PSH and dissolved-phase hydrocarbons in shallow groundwater in the vicinity of these receptors."

The Permittee's April 12, 2019 *Memorandum* was disapproved pending revisions; therefore, the investigation is considered to have been conducted at risk. The *Memorandum* states that potential shallow water supply wells located within 0.25 miles of the extent of benzene and

MTBE detections in shallow groundwater were evaluated. Accordingly, this investigation was conducted to address potential issues for shallow water supply wells located within 0.25 miles of the plumes. However, Comments 5 and 9 of the NMED's July 15, 2021 *Disapproval* states that "[b]ecause of the mobility of the plume, all residences located up to a mile from the plume boundaries must be identified." Based on the comments included in the July 15, 2021 *Disapproval*, additional evaluation/investigation may be warranted. Regardless, the scope of work described in the May 21, 2019 email from the Permittee to the New Mexico Oil Conservation Division (OCD) was approved by OCD on May 29, 2019. Note that NMED requires the submittal of a formal work plan and that the submittal of a work plan via email is not acceptable in the future. No revisions are required to the Report.

Comment 2

In Section 1.0, (Introduction), page 2, bullet 1, the Permittee states, "[m]onitoring well MW-145 was installed to the north of existing monitoring well MW-133 on HFNR property, near the southwestern corner of Parcel ID 4-153-098-515-219, to better delineate the crossgradient extent of the benzene and MTBE plumes." Although Comments 18 and 30 of the NMED's July 15, 2021 *Disapproval* and Comment 14 of the NMED's May 7, 2021 *Disapproval Evaluation of Methyl Tert-Butyl Ether (MTBE) in Groundwater* appear to be fulfilled by the installation of the new well, Comment 29 of the June 15, 2021 Disapproval was not addressed. Comment 29 requires the Permittee to "[p]ropose to install an additional well halfway between well MW-133 and the current location of the proposed well or propose another location for the proposed well to better define the plumes." Comment 29 was not addressed during this investigation and must be addressed to meet the requirements of the July 15, 2021 *Disapproval*. No revisions are required to the Report.

Comment 3

In Section 2.3, (Groundwater Conditions), page 5, paragraph 1, the Permittee states, "[t]he new monitoring wells described in this report (MW-145 through MW-148) were all installed in the shallow saturated zone." Comments 4, 15, 23, 24, 28, and 32 of the NMED's May 7, 2021 *Disapproval Evaluation of Methyl Tert-Butyl Ether (MTBE) in Groundwater* requires the Permittee to investigate the extent of MTBE in the Valley Fill and Artesian Aquifers. Nested wells screened across the Valley Fill zone may need to be installed to address these comments in the future. No revisions are required to the Report.

Comment 4

In Section 2.3.1, (Shallow Saturated Zone), page 5, paragraph 4, the Permittee states, "[c]oncentrations of dissolved-phase hydrocarbon constituents in the shallow saturated zone have generally exhibited a stable or decreasing trend over time." Although the statement is correct, the Permittee did not discuss why the trend occurs. The *Status Report Groundwater and PSH Recovery System Enhancements, Reinjection Pilot Test* (Status Report), dated May 18, 2021, states that "[a]s described in the 2020 Annual Groundwater Monitoring Report submitted to the NMED in February 2021, the increased occurrence and thickness of PSH in the East Field are attributed to reductions in groundwater elevations which have decreased across the

refinery since 2018." Revise Section 2.3.1 to include an additional statement from the May 18, 2021 Status Report that explains the increasing trends of PSH occurrence and thickness and provide replacement pages in the appropriate section(s) of the Report.

Comment 5

In Section 2.3.3, (Deep Artesian Aquifer), page 6, paragraph 6, the Permittee states, "[m]ethyl tert-butyl ether (MTBE) has been detected in RA-4798 at levels below the WQCC standard, but these detections cannot be attributed to historical Refinery operations based on all available data as described in the report titled *Evaluation of Methyl Tert-Butyl Ether (MTBE) in Groundwater* that was submitted to NMED on September 13, 2019 (Wood 2019)." Comment 24 of the NMED's May 7, 2021 *Disapproval Evaluation of Methyl Tert-Butyl Ether (MTBE) in Groundwater* states that "the extent of MTBE in the Artesian Aquifer has not been delineated." Since the presence/absence of MTBE in the Artesian Aquifer has not been fully investigated, the statement that "these [MTBE] detections cannot be attributed to historical Refinery operations" is incorrect. Remove the statement and provide replacement pages for the appropriate sections of the Report.

Comment 6

In Section 6.1, (Soil Sampling), page 13, paragraph 2, the Permittee states, "[o]ne discrete, grab soil sample was also collected for laboratory analysis from each soil boring immediately above the water table at the follow depths:

- MW-145: 17 feet bgs
- MW-146: 18 feet bgs
- MW-147: 30 feet bgs
- MW-148: 28 feet bgs"

The soil samples were collected at depths two to six feet above the depths of the water table except for the soil sample collected from boring MW-147, which was collected at the same depth of the water table. In addition, the PID readings were not elevated at the sampling depths according to Appendix B (Boring Logs and Well Construction Diagrams). Explain why soil samples collected from borings MW-145, MW-146, and MW-148 were selected from depths above the water table in the response letter.

Comment 7

In Section 6.4.2, (Groundwater Sample Collection and Handling), page 15, paragraph 3, the Permittee states that "[c]opies of the chain-of- custody forms are included in Appendix C with the laboratory analytical reports." Hard copies of the laboratory analytical reports are no longer required. Only include electronic copies on disc of the laboratory analytical reports with future reports.

Comment 8

In Section 6.6, (Groundwater Sampling Analytical Results), page 15, paragraph 5, the Permittee

states, "[g]roundwater analytical results are summarized in Table 3." According to Table 3, (Summary of Groundwater Analytical Results), page 1 of 1, all groundwater samples were only collected on October 6, 2020. The scope of work described in the May 21, 2019 email indicates that two rounds of groundwater sampling were proposed. Explain why only one round of groundwater sampling was conducted and reported in the response letter.

Comment 9

In Section 8.0, (Recommendations), page 18, paragraph 1, the Permittee states that "[n]o additional groundwater investigation is recommended based on these investigation results." Soil or groundwater contamination may not have been detected during this investigation; however, all comments in the NMED's May 7, 2021 and July 15, 2021 *Disapprovals* must be addressed before such recommendations are made. Remove the statement and provide replacement pages for the appropriate section(s) of the Report.

The Permittee must address all comments in this Approval with Modifications, the May 7, 2021 and July 15, 2021 Disapproval letters. The Permittee must also submit a response letter, replacement pages, and redline-strikeout and clean electronic versions of the revised Report no later than **February 27, 2022**.

This approval is based on the information presented in the document as it relates to the objectives of the work identified by NMED at the time of review. Approval of this document does not constitute agreement with all information or every statement presented in the document.

Should you have any questions, please contact Michiya Suzuki of my staff at 505-690-6930.

Sincerely,

for

Ricardo Maestas
Acting Chief
Hazardous Waste Bureau

cc: D. Cobrain, NMED HWB
L. Tsinnajinnie, NMED HWB
M. Suzuki, NMED HWB
J. Leik, HFNR LLC, Artesia Refinery
T. McDill, NMED EMNRD OCD
L. King EPA Region 6 (6LCRRC)
File: Reading File and NRC 2021 file

HollyFrontier Navajo Refining LLC
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Tel: 575-748-3311
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June 30, 2021

Mr. Kevin Pierard
Chief, Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505

Ms. Teresa McDill
New Mexico Energy, Minerals & Natural Resources Department
Oil Conservation Division, Environmental Bureau
TeresaL.McDill@state.nm.us

Re: Submittal of the 2021 Facility-Wide Groundwater Monitoring Work Plan for the HollyFrontier Navajo Refining LLC, Artesia Refinery
RCRA Permit No. NMD048918817
Discharge Permit GW-028

Dear Mr. Pierard and Ms. McDill:

Enclosed is the annual update to the Facility Wide Groundwater Monitoring Work Plan (FWGMWP) for the Artesia Refinery. This update has been prepared and is being submitted according to the requirements of the Post Closure Care Permit issued by the New Mexico Environment Department (NMED) Hazardous Waste Bureau. The FWGMWP also incorporates the requirements of the Discharge Permit issued by the New Mexico Energy, Minerals and Natural Resources Department Oil Conservation Division (OCD). The updated FWGMWP is being submitted in both hard copy and electronic format to NMED, electronic format only to OCD.

No substantial changes to the current facility-wide groundwater monitoring program have been proposed in the FWGMWP. If you should have any questions or comments regarding this FWGMWP, please contact me at (575) 746-5487 or Jason Leik at (214) 970-8902.

Sincerely,

Kawika Tupou
Environmental Manager
HollyFrontier Navajo Refining LLC

2021 Facility-Wide Groundwater Monitoring Work Plan

HollyFrontier Navajo Refining LLC

Artesia Refinery

NMD048918817 and DP GW-028

June 2021

Prepared For:

HollyFrontier Navajo Refining LLC

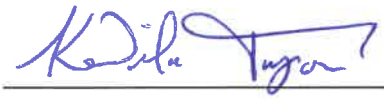
501 E Main Street,

Artesia, NM 88210

HOLLYFRONTIER®

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.



Kawika Tupou

Environmental Manager, HollyFrontier Navajo Refining LLC

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FIGURES

ABBREVIATION AND ACRONYM LIST

%	percent
° C	degrees Celsius
bgs	below ground surface
city	City of Artesia
CGWSL	Critical groundwater screening level
COC	Constituent of Concern
DO	Dissolved Oxygen
DRO	Diesel Range Organics
EDB	1,2-Dibromomethane
EDC	1,2-Dichloroethane
EP	Evaporation Ponds
EPA	Environmental Protection Agency
FWGMWP	Facility-Wide Groundwater Monitoring Work Plan
GRO	Gasoline Range Organics
HFNR	HollyFrontier Navajo Refining LLC
HSWA	Hazardous and Solid Waste Amendment
HWB	Hazardous Waste Bureau
IDW	Investigation-Derived Waste
mg/L	Milligrams per liter
mL	Milliliter
MTBE	Methyl Tert-Butyl Ether
NCL	North Colony Landfarm
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
OCD	New Mexico Energy, Minerals and Natural Resources Department Oil Conservation Division
ORP	Oxidation-Reduction Potential

PCC Permit	Post-Closure Care Permit
PIANO	Paraffins, Isoparaffins, Aromatics, Naphthenes, and Olefins
PSH	Phase-Separated Hydrocarbons
QA/QC	Quality Assurance/Quality Control
Refinery	HollyFrontier Navajo Refining LLC Artesia Refinery
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RO	Reverse Osmosis
SVOCs	Semi-Volatile Organic Compounds
SWMU	Solid Waste Management Units
TBA	Tert-Butyl Alcohol
TDS	Total Dissolved Solids
TEL	Tetra Ethyl Lead
TMD	Three Mile Ditch
TOC	Top of Casing
TRC	TRC Environmental Corporation
VOCs	Volatile Organic Compounds
WQCC	Water Quality Control Commission

Executive Summary

This *2021 Facility-Wide Groundwater Monitoring Work Plan* (2021 FWGMWP) details the proposed groundwater monitoring program to be implemented at the HollyFrontier Navajo Refining LLC (HFNR) Artesia Refinery (Refinery) located at 501 East Main Street in Artesia, New Mexico.

The Refinery is subject to (1) a Post-Closure Care Permit (PCC Permit) issued by the New Mexico Environment Department (NMED) in October 2003 and later modified in December 2010; and (2) the renewed Discharge Permit GW-028 issued by New Mexico Energy, Minerals and Natural Resources Department Oil Conservation Division (OCD) on May 25, 2017 and modified in June 2017, December 2018, and August 2019. Both the PCC Permit and Discharge Permit require HFNR to conduct facility-wide groundwater monitoring to evaluate the presence, nature, and extent of groundwater impacts. This 2021 FWGMWP details all groundwater monitoring activities that will be conducted to satisfy both the NMED PCC Permit and the OCD Discharge Permit upon approval by NMED and OCD.

This 2021 FWGMWP serves as the annual update to the facility-wide groundwater monitoring program required by Section 4.7.6.a of the modified PCC Permit. The groundwater monitoring program covers the following Refinery areas:

- The closed Tetra Ethyl Lead (TEL) Impoundment;
- The closed North Colony Landfarm (NCL);
- The inactive Evaporation Ponds (EP);
- Three Mile Ditch (TMD); and
- The vadose zone located beneath the Refinery.

This 2021 FWGMWP describes the procedures to be followed during routine groundwater monitoring activities across the Refinery areas, including well gauging, groundwater sampling, investigation-derived waste (IDW) management, decontamination, analytical requirements, and quality assurance/quality control (QA/QC) requirements.

No substantial changes to the current facility-wide monitoring program are proposed in this 2021 FWGMWP. Samples collected from select wells in the North Refinery Area (MW-23, MW-43, MW-61, MW-62, MW-93, MW-137, and MW-138) are proposed to be analyzed for semi-volatile organic compounds (SVOCs) based on sampling results conducted in 2019 and 2020 in accordance with the December 28, 2018, submittal letter of *SWMU / AOC Group 3 Additional Corrective Action Investigation Report – Revision 2* (SWMU/AOC Group 3 Rev 2 transmittal letter), and NMED's subsequent response letter dated March 22, 2019.

In accordance with NMED's May 7, 2021, comments letter on the September 2019 report titled *Evaluation of Methyl Tert-Butyl Ether (MTBE) in Groundwater*, select groundwater samples collected will be analyzed for 1,2-dibromomethane (EDB), 1,4-dioxane, and tert-butyl alcohol (TBA) during upcoming groundwater monitoring events. The results will be evaluated after completion of two to four required consecutive sampling events to determine if theses analytes should be included in future FWGMWP updates.

1.0 Introduction

This *2021 Facility-Wide Groundwater Monitoring Work Plan* (2021 FWGMWP) details the proposed groundwater monitoring program to be implemented at the HollyFrontier Navajo Refining LLC (HFNR) Artesia Refinery (Refinery) located at 501 East Main Street in Artesia, New Mexico. The location of the Refinery is shown on Figure 1. The Refinery is subject to (1) a Post-Closure Care Permit (PCC Permit) issued by the New Mexico Environment Department (NMED) in October 2003 (NMED 2003) and later modified in December 2010 (NMED 2010); and (2) the renewed Discharge Permit GW-028 issued by New Mexico Energy, Minerals and Natural Resources Department Oil Conservation Division (OCD) on May 25, 2017 (OCD 2017a) and modified in June 2017 (OCD 2017b), December 2018 (OCD 2018), and August 2019 (OCD 2019). The PCC Permit authorizes and requires HFNR (the Permittee) to conduct facility-wide groundwater monitoring, with the purpose of evaluating the presence, nature and extent of hazardous and regulated constituents pursuant to Section 20.4.1.500 of the New Mexico Administrative Code (NMAC) and the Water Quality Control Commission (WQCC) standards included in 20.6.2 NMAC. The Discharge Permit also requires the Permittee to conduct facility-wide groundwater monitoring.

This 2021 FWGMWP serves as the annual update to the facility-wide groundwater monitoring program required by Section 4.7.6.a of the modified PCC Permit. The previous annual FWGMWP, the *2020 Facility-Wide Groundwater Monitoring Work Plan* (2020 FWGMWP), was submitted to NMED and OCD in June 2020 (TRC 2020) and approved with modifications by NMED on December 15, 2020 (NMED 2020b). This 2021 FWGMWP details all groundwater monitoring activities that will be conducted to satisfy the requirements of both the NMED PCC Permit and the OCD Discharge Permit upon approval by NMED and OCD. This 2021 FWGMWP describes the procedures to be followed during routine groundwater monitoring activities, including well gauging, groundwater sampling, managing investigation-derived waste (IDW), decontamination, laboratory analysis, and quality assurance/quality control (QA/QC). The format of this 2021 FWGMWP follows the general outline specified for an investigation work plan in Appendix E.2 of the PCC Permit, while incorporating the requirements of Section 5 of the Discharge Permit.

The groundwater monitoring program covers the following Refinery areas:

- The closed Tetra Ethyl Lead (TEL) Impoundment, an approximately 0.9-acre land treatment unit located along the northern portion of the Refinery to the south and east of Eagle Creek (or Eagle Draw);
- The closed North Colony Landfarm (NCL), an approximately 4.25-acre land treatment unit located near the northwestern corner of the Refinery;
- The inactive Evaporation Ponds (EPs), located approximately three miles east of the active Refinery and immediately south/west of the Pecos River;
- The inactive Three Mile Ditch (TMD), an approximately 3-mile long former open wastewater conveyance ditch located between the northern portion of the active Refinery and the inactive Evaporation Ponds; and
- The vadose zone located beneath the Refinery (including the areas referred to as North

Refinery, South Refinery, Field East of Refinery, North Reverse Osmosis [RO] Reject Field, South RO Reject Field, Cross-Gradient of Refinery, and Up-Gradient of Refinery).

The locations of these areas and the monitoring wells, recovery wells, and irrigation wells included in the facility-wide groundwater monitoring program are provided on Figure 2.

2.0 Site Background

HFNR owns and operates the Refinery which is an active petroleum refinery located in Artesia, New Mexico. The Refinery has been in operation since the 1920s and can process heavy, sour, light, and sweet crude oils into petroleum products for wholesale markets. The Refinery runs a predominant slate of Permian Basin crudes that are gathered in west Texas and southeast New Mexico and can also source a variety of crude oils from Cushing, Oklahoma, including Canadian crudes. The Refinery serves markets in the southwestern United States and northern Mexico. A site location map is provided as Figure 1. A facility-wide site plan is provided as Figure 2 and shows the locations of wells included in the facility-wide groundwater monitoring program.

The Refinery is regulated under the Resource Conservation and Recovery Act (RCRA) with Environmental Protection Agency (EPA) ID Number NMD 048918817. The NMED issued a Hazardous Waste Facility Permit to HFNR effective August 21, 1989 (NMED 1989), part of which included a Hazardous and Solid Waste Amendment (HSWA) Permit issued by the EPA. The HSWA permit required HFNR to identify all historical and current non-hazardous solid waste management units (SWMUs) and investigate those that had the potential to pose a threat to human health or the environment. RCRA Facility Investigations (RFIs) were conducted at the TMD and EP areas in 1990 (Mariah Associates, Inc. 1990) and from 1991 through 1993 (K.W. Brown Environmental Services 1993). Corrective actions were recommended for soil (K.W. Brown Environmental Services 1996) and groundwater (Foster Wheeler 1997) at the TMD and EPs based on the RFI results. RFI activities were conducted at the NCL area from 1994 through 1997 (Covenant Technical Associates, Inc. 1997) and RFI results indicated groundwater impacts associated with historical operations were present at the NCL.

At the request of NMED, HFNR submitted a PCC Permit Application in June 1998 and revisions to the application in 2001 (Navajo 2001). The original intent of this application was to address only closure and post-closure activities at the EPs and TMD, but the application was expanded to include a complete RCRA Permit renewal application. The NMED issued a PCC Permit to HFNR effective October 5, 2003 (NMED 2003). The PCC Permit was modified in December 2010 (NMED 2010). The PCC Permit authorizes and requires the Permittee to monitor the groundwater, maintain all groundwater monitoring wells, and comply with applicable regulations of 20.4.1.500 NMAC during the post-closure period. Specific groundwater monitoring requirements are included in the PCC Permit for the areas of the TMD, NCL, EPs, and other areas identified through implementation of the investigations of various SWMUs.

The Refinery previously applied reject fluids from the RO system to the Refinery North and South RO Reject Fields under Discharge Permit GW-028. The OCD originally issued the Discharge Permit to HFNR on October 21, 1991, and most recently issued a renewal on May 25, 2017 (OCD 2017a) and modifications on June 29, 2017 (OCD 2017b), December 14, 2018 (OCD 2018), and August 30, 2019 (OCD 2019). The Discharge Permit requires the Permittee to conduct facility-wide groundwater monitoring. In 2018, HFNR installed a Class I injection well (WDW-4) as an alternative disposal method for the RO reject fluids and the well became operational in January 2019. Land application of RO reject water to the North and South RO Reject Fields ceased on January 22, 2019. HFNR submitted a *Stage 1 Abatement Plan for the Reverse Osmosis Reject Discharge Fields* (Stage 1 Abatement Plan) to OCD on March 21, 2019 (Wood 2019a), and an amendment of the Stage 1 Abatement Plan on May 24, 2019

(Wood 2019b), which was approved by OCD in an email on June 7, 2019. HFNR characterized the North and South RO Reject Fields in accordance with the amended Stage 1 Abatement Plan and documented the activities and results in the *Reverse Osmosis Reject Discharge Fields Stage 1 Abatement – Final Report* (Stage 1 AP Report) on November 19, 2020 (Wood 2020).

In 2006, HFNR submitted a Groundwater Monitoring Work Plan that combined the requirements of the two permits into a comprehensive facility-wide groundwater monitoring program (Navajo 2006). This 2021 FWGMWP comprises the annual update of the work plan, as required by Section 4.7.6.a of the PCC Permit.

3.0 Site Conditions

This section describes the current surface and subsurface conditions at the Refinery.

3.1 Surface Conditions

The surface conditions at the Refinery are described below.

3.1.1 Topography

The Refinery is located on the east side of the City of Artesia (city) in the broad Pecos River Valley of Eastern New Mexico. The topography at and surrounding the Refinery is shown on Figure 1. The average elevation of the city is 3,380 feet above mean sea level. The plain on which the city is located slopes eastward at about 30 feet per mile.

3.1.2 Surface Water Drainage

Surface drainage in the region is dominated by minor ephemeral creeks and arroyos that flow eastward to the Pecos River, located approximately three miles east of the city. The major drainage feature in the immediate area of the Refinery is Eagle Creek, which runs southwest to northeast adjacent to the northern process area of the Refinery and then eastward to the Pecos River. Eagle Creek is an ephemeral watercourse that primarily flows only following rain events. Upstream of the Refinery, Eagle Creek functions as a major stormwater conveyance for the city. Eagle Creek also drains outlying areas west of the city and is periodically scoured by intense rain events.

Natural surface drainage at the Refinery is to the north and east. Stormwater within the process areas is captured and routed to the Refinery wastewater treatment system. Stormwater from non-process areas is contained within the Refinery property inside stormwater berms and routed to stormwater retention basins. Stormwater from within the Refinery boundary is not allowed to discharge to Eagle Creek.

The elevation of Eagle Creek is 3,360 feet at its entrance to the Refinery and decreases to approximately 3,305 feet at its confluence with the Pecos River. Eagle Creek was channelized from west of the city of Artesia to the Pecos River to help control and minimize flood events. In the vicinity of the Refinery, the Eagle Creek channel was cemented to provide further protection during flood events. A check dam was also constructed west of the city along Eagle Creek. Federal floodplain maps indicate that most of the city and the Refinery have been effectively removed from the 100-year floodplain.

3.1.3 Area Land Uses

The areas north, south, and east of the Refinery are sparsely populated and used primarily for agricultural purposes. The primary business and residential areas of the city are located to the west, southwest, and northwest of the Refinery. There are commercial/industrial businesses present south of the Refinery along Highway 82, including an oil-field pipe company located at the southeast corner of the Refinery. HFNR owns a majority of the land bounded by Hermosa Drive to the south, East Richey Avenue to the north, the railroad easement that parallels Highway 285 (or Freeman Avenue on the south side of Highway 82) to the west, and Bolton Road to the east. A majority of the land located east

of the Refinery between Bolton Road and Haldeman Road is cultivated as pecan orchards or used for other agricultural purposes.

The Refinery is currently constructing a Renewable Diesel Unit (RDU) in the North Plant Process Area of the Refinery and Pretreatment Unit (PTU) on property owned by HFNR directly south of Highway 82 and the Refinery. The PTU will be used to process plant- and animal-based oils and fats and convert them to a feedstock that will be used at the RDU. The PTU area is shown on Figure 1.

The active Refinery and much of the surrounding property owned by HFNR is fenced and guarded with controlled entry points.

3.2 Subsurface Conditions

The subsurface conditions at the Refinery are described below.

3.2.1 Surficial Soils

Surficial soil at the Refinery is predominantly comprised of approximately 60 percent (%) Pima series and 40% Karro series. The Pima and Karro series both consist of deep, well drained soils that formed in alluvial settings. They are both calcareous and have slow to medium runoff.

3.2.2 Geology

The City of Artesia is located on the northwest shelf of the Permian Basin. In this region, the deposits comprise of approximately 250 to 300 feet of Quaternary alluvium uncomformably overlying approximately 2,000 feet of Permian clastic and carbonate rocks. These Permian deposits uncomformably overlie Precambrian syenite, gneiss, and diabase crystalline rocks.

3.2.2.1 Quaternary Alluvium

The Quaternary alluvium in the Refinery area is dominantly comprised of clays, silts, sands and gravels deposited in the Pecos River Valley. These “valley fill” deposits extend in a north-south belt approximately 20 miles wide, generally west of the Pecos River. The thickness of the valley fill varies from a thin veneer on the western margins of the Pecos River valley to a maximum of 300 feet in depressions, one of which is located beneath the Refinery. These depressions have resulted from dissolution of the underlying Permian carbonates and evaporites.

3.2.2.2 Permian Artesian Group

The Permian Artesian Group is comprised of the following five formations from shallowest to deepest: the Tansill, Yates, Seven Rivers, Queen and Grayburg Formations. The Tansill and Yates Formations outcrop at the surface east of the Pecos River and are not present in the vicinity of the Refinery. The Seven Rivers Formation is present at an approximate depth of 300 feet in the area between the Pecos River and the Refinery. However, the Seven Rivers Formation thins and pinches to the west and it is not evident based on boring logs that this formation has been encountered beneath the Refinery process areas.

In the area of the Refinery, the Queen and Grayburg Formations have been mapped as a single unit consisting of approximately 700 feet of interbedded dolomite and calcareous dolomite, gypsum, fine-grained sandstone, carbonates, siltstone and mudstone. In locations where the Seven Rivers Formation is absent, the upper portion of the Queen Formation acts as a confining bed between the deep artesian aquifer and the valley fill aquifer.

3.2.2.3 San Andres Formation

The San Andres Formation lies beneath the Grayburg and Queen Formations and immediately above the Precambrian crystalline basement rocks. The San Andres Formation is greater than 700 feet thick and composed mainly of limestone and dolomite with irregular and erratic solution cavities ranging up to several feet in diameter. The upper portion of the formation is composed of oolitic dolomite with some anhydrite cement.

3.3 Hydrogeology

The principal aquifers in the Artesia area are within the San Andres Formation and the valley fill alluvium. There are two distinct water-bearing zones within the valley fill alluvium in the vicinity of the Refinery and are referred to as the "shallow saturated zone" and the "valley fill zone". The deeper carbonate aquifer within the San Andres Formation is referred to as the "deep artesian aquifer".

3.3.1 Shallow Saturated Zone

The shallow saturated zone occurs in fractured caliche and interbedded sand and gravel channels at 10 to 30 feet below ground surface (bgs). Groundwater in this zone is under confined conditions for some or most of the year, with static water levels measured in groundwater monitoring wells 3 to 5 feet above the shallow saturated zone. The general direction of flow in this shallow saturated zone is to the east toward the Pecos River. Groundwater flow direction and gradient in the shallow saturated zone have remained generally consistent over time, as documented in previous annual groundwater monitoring reports.

Major sources of water in the shallow saturated zone are likely to be recharge from Eagle Creek and lawn watering runoff from the grass-covered urban park that occupies the Eagle Creek Channel immediately upstream of the Refinery. The water in the shallow saturated zone is highly variable in quality, volume, areal extent, and saturated thickness. Concentrations of total dissolved solids (TDS) exceeding 4,000 milligrams per liter (mg/L) and sulfate exceeding 2,000 mg/L have been recorded in most of the wells located west and northwest (up-gradient) of the Refinery, which significantly exceed the WQCC standards of 1,000 mg/L for TDS and 600 mg/L for sulfate.

The shallow saturated zone contains phase-separated hydrocarbon (PSH) and dissolved-phase hydrocarbon constituents, as reported in the *2020 Annual Groundwater Monitoring Report* (TRC 2021b). With a few exceptions, concentrations of dissolved-phase hydrocarbon constituents in the shallow saturated zone are stable within the historical range of concentrations. .

3.3.2 Valley Fill Zone

The valley fill zone underlies the shallow saturated zone and occurs in Quaternary alluvial deposits of sand, silt, clay and gravel. These sediments are about 300 feet thick near the Refinery.

Irrigation and water production wells completed in the valley fill zone are typically screened across one to five water-producing intervals ranging in thickness of 20 to 170 feet, with a majority of the thicknesses being closer to 20 feet. Production intervals are non-continuous, consist principally of sand and gravel, and are separated by less permeable lenses of silt and clay of varying thickness. Based on logs of wells located immediately to the north and east of the Refinery, the thicknesses of silt and clay deposits range from 20 to 160 feet and are interspersed with thin zones of gravels in the upper 100 feet. Wells in the valley fill zone range from 40 to 60 feet bgs and the formation yields water containing TDS ranging from 1,500 to more than 7,000 mg/L.

The valley fill zone contains dissolved-phase hydrocarbon constituents, as reported in the *2020 Annual Groundwater Monitoring Report* (TRC 2021b). With a few exceptions, concentrations of dissolved-phase hydrocarbon constituents in the valley fill zone are stable within the historical range of concentrations.

The valley fill zone and the underlying San Andres aquifer are hydraulically connected in some areas.

3.3.3 Deep Artesian Aquifer

The deep artesian aquifer is closely related to the Permian San Andres Limestone and generally consists of one or more water-producing intervals of variable permeability located in the upper portion of the formation. However, in the Artesia area, the water-producing interval rises stratigraphically and includes the lower sections of the overlying Grayburg and Queen formations. Near the Refinery, the depth to the top of the water-producing interval is estimated to be about 440 feet bgs. The Seven Rivers formation and the other members of the Artesia Group are generally considered confining beds although some pumpage occurs locally from fractures and secondary porosity in the lower Grayburg and Queen members.

The deep artesian aquifer has been extensively developed for industrial, municipal, and agricultural use. TDS in this aquifer ranges from 500 mg/L to more than 5,000 mg/L depending on location. In the Artesia area, water from this aquifer is generally produced from depths ranging from 850 feet to 1,250 feet below ground surface. The aquifer recharges in the Sacramento Mountains to the west of Artesia. Extensive use of this aquifer in recent decades has lowered the potentiometric head in the aquifer in some locations from 50 to 80 feet bgs, although extensive rainfall in some years may bring the water levels in some wells close to ground surface.

Available well completion records for irrigation well RA-4798 indicate that it is screened in the deep artesian aquifer from 840 to 850 feet bgs. Analytical data from this well does not indicate the presence of hydrocarbon impacts from Refinery operations. Methyl tert-butyl ether (MTBE) has been detected in RA-4196 and RA-4798 at levels below the WQCC standard, and is stable within the historical range of detected concentrations. The source of these detections is being investigated.

4.0 Modifications to the Groundwater Monitoring Network

The following modifications to the facility-wide groundwater monitoring network have occurred since submittal of the 2020 FWGMWP. Well installation, repairs, and/or modifications made to the existing wells are described below.

4.1 New Monitoring Wells

Seven new monitoring wells (MW-62R, MW-137A, MW-138A, MW-145, MW-146, MW-147, and MW-148) were installed and one monitoring well was replaced (MW-53 replaced with MW-53R) since submittal of the 2020 FWGMWP. The monitoring wells were installed in September 2020 as follows:

- MW-53R was installed on September 23, 2020, along the US Highway 285 right of way, up-gradient of the NCL. MW-53R was installed in the shallow saturated zone as a replacement for MW-53, which was likely destroyed during road construction activities. The replacement well was completed consistent with the former well. MW-53 could not be located to plug and abandon.
- MW-62R, MW-137A, and MW-138A were installed on September 1 to 4, 2020, in the north central portion of the Refinery in the North Refinery Area at locations adjacent to existing wells MW-62, MW-137, and MW-138, respectively. The wells were installed in the shallow saturated zone in accordance with the *Nested Well Installation Work Plan for SWMU / AOC Group 3* (Wood 2019d) dated December 30, 2019, NMED's subsequent approval with modifications letter dated April 6, 2020 (NMED 2020a), and the subsequent response to NMED comments letter dated June 25, 2020 (HFNR 2020). Well installation and development activities will be documented in a forthcoming report.
- MW-145 through MW-148 were installed on September 22 to 24, 2020, down-gradient of the Refinery, in the Field East of Refinery. The wells were installed in the shallow saturated zone in accordance with the scope of work that was submitted to the NMED and the OCD in an email on May 21, 2019 (HFNR 2019), and approved with modifications by NMED and OCD in emails on May 29, 2019 (NMED 2019b; OCD 2019). Well installation, development, and sampling activities are documented in the February 2021 *Downgradient Groundwater Investigation Report* (TRC 2021a).

Boring and well construction logs were provided in the *2020 Annual Groundwater Monitoring Report* (TRC 2021b). The well locations are shown on Figure 2 and the well construction details are provided in Table 1.

4.2 Well Abandonment

No monitoring wells have been abandoned since submittal of the 2020 FWGMWP.

4.3 Well Repairs and Modifications

The following well maintenance and repairs were performed on existing wells since submittal of the 2020 FWGMWP:

- Locking well J-plugs and locks were replaced on various monitoring wells as required.
- PSH absorbent socks were installed and maintained in wells MW-64, MW-65, MW-85, MW-86, MW-99, NCL-34A, KWB-4, KWB-7, KWB-8, KWB-11B, RW-17A, RW-17G, and TEL-3.

5.0 Monitoring Program Scope of Services

The proposed groundwater monitoring program consists of semi-annual gauging of select wells; semi-annual, annual, or biennial groundwater sampling of select wells; and annual reporting. No substantial changes to the previous facility-wide monitoring program are proposed in this 2021 FWGMWP. Groundwater samples collected from the following North Refinery Area wells are proposed to be analyzed for semi-volatile organic compounds (SVOCs): MW-23, MW-43, MW-61, MW-62, MW-93, MW-137, and MW-138. SVOC analysis is proposed for these wells based on the results of sampling conducted in 2019 and 2020 in accordance with the December 28, 2018, submittal letter of *SWMU / AOC Group 3 Additional Corrective Action Investigation Report – Revision 2* (SWMU/AOC Group 3 Rev 2 transmittal letter [Wood 2018]), and NMED's subsequent response letter dated March 22, 2019 (NMED 2019). The SVOC results were presented in the *2020 Annual Groundwater Monitoring Report* (TRC 2021b), and exceedances of critical groundwater screening level (CGWSLs) are summarized below:

- Naphthalenes (1-methylnaphthalene, 2-methylnaphthalene, and/or naphthalene by Method 8270) exceeded the CGWSL for total naphthalene in wells MW-23, MW-43, MW-61, MW-62, MW-93, and MW-137 during at least one event.
- Phenol exceeded the CGWSL in wells MW-23 and MW-43 during at least one event.
- Bis(2-ethylhexyl)phthalate exceeded the CGWSL in wells MW-61 and TEL-4 during one event (April 2019). However, the reported April 2019 exceedance in TEL-4 was not confirmed because the detected concentration in the associated duplicate sample was three orders of magnitude lower and below the CGWSL (i.e., below the acceptable relative percent difference), and results of the subsequent samples (including a duplicate) collected in October 2019 were both less than the CGWSL.
- Dibenzofuran exceeded the CGWSL in wells MW-23 and MW-62 during one event (April 2019).

The SVOC exceedances of CGWSLs were in isolated wells except for naphthalenes. Naphthalene is already evaluated across the facility-wide groundwater monitoring program as a target volatile organic compound (VOC) using Method 8260. The SWMU/AOC Group 3 Rev 2 transmittal letter and NMED's subsequent response also required groundwater samples collected from wells MW-97 and RW-2R to be analyzed for SVOCs for two events, but groundwater samples have not been collected from these wells due to the presence of PSH. The required two rounds of SVOC sampling will be conducted at MW-97 and RW-2R when PSH is no longer present at a thickness of 0.03 feet or greater in these wells.

5.1 Scheduling and Notification

The schedule of the semi-annual groundwater monitoring events is dependent on the flood irrigation season of the pecan orchard located east of the Refinery, which is typically conducted between April and October. The first semi-annual event is typically conducted before the start of the flood irrigation (in March or April of each calendar year) and the second semi-annual event will be conducted after completion of the flood irrigation season (in October or November of each calendar year). The second semi-annual event of 2021 may be conducted in September 2021 (if flood irrigation season allows) due to refinery turnaround scheduled in early October 2021.

Wells that will be sampled on an annual or biennial basis will be sampled during the first semi-annual monitoring event (i.e., the annual event). Biennial events will be completed during the first semi-annual event of odd-numbered calendar years. The NMED and OCD will be notified of the monitoring schedule prior to each monitoring event. The sampling frequency for each well is provided on Table 1 and Figure 3.

5.2 Gauging Requirements

Synoptic fluid level gauging will be completed semi-annually at all active and accessible monitoring and recovery wells. Wells will be gauged for depth to PSH, if present, depth to water, and total depth. Dedicated tubing and pumps (if present) will remain in the wells during gauging to minimize disturbance to the water column, if possible. All synoptic well gauging will be completed in as short a time-period as possible, typically within 48 hours. Each monitoring well will also be gauged immediately prior to commencing purging/sampling activities.

5.3 Sampling Requirements

Sampling frequency and target analytes for each well were selected based on historical data, dissolved-phase concentration trends, and well location relative to the Refinery and area boundaries. Select groundwater samples will be analyzed for VOCs, SVOCs, diesel range organics (DRO), gasoline range organics (GRO), total metals, dissolved metals (first semi-annual event only), cations, anions, nitrates/nitrites, cyanide, and/or TDS. Select groundwater samples will be analyzed for 1,4-dioxane, 1,2-dibromomethane (EDB), and tert-butyl alcohol (TBA) in accordance with the NMED May 7, 2021 letter (NMED 2021), as described in Sections 5.3.1, 5.3.2, and 5.3.3.

Wells that contain PSH at measured thicknesses of 0.03 feet or greater will not be sampled during any event. The required sample analytical parameters and sampling frequency for each well are summarized in Table 1.

5.3.1 1,4-Dioxane Analysis at Select Wells

In accordance with NMED's May 7, 2021, comments letter on the September 2019 report titled *Evaluation of Methyl Tert-Butyl Ether (MTBE) in Groundwater* (MTBE Groundwater Report [Wood 2019c]), groundwater samples collected from wells with any historical detection of chlorinated solvents since 2010 will be sampled for 1,4-dioxane by Method 8270 for two consecutive sampling events. For wells that are sampled on a semi-annual basis, the required 1,4-dioxane sampling events will be completed during the second semi-annual monitoring event of 2021 and the first semi-annual monitoring event of 2022. For wells that are sampled on an annual basis, the required 1,4-dioxane sampling events will be completed during the first semi-annual monitoring events of 2022 and 2023. For wells that are sampled on a biennial basis, the required 1,4-dioxane sampling events will be completed during the first semi-annual monitoring events of 2023 and 2025. No groundwater sample will be collected if PSH is present at a thickness of 0.03 feet or greater, and the required 1,4-dioxane sampling will be completed during subsequent monitoring events. Wells to be analyzed for 1,4-dioxane are listed below by the sampling frequency.

- Semi-annual (47 wells): KWB-2R, KWB-6, KWB-10R, KWB-11A, KWB-11B, MW-21, MW-23, MW-28, MW-29, MW-39, MW-43, MW-45, MW-49, MW-50, MW-54A, MW-60, MW-61, MW-62, MW-67, MW-90, MW-91, MW-92, MW-94, MW-101, MW-102, MW-104, MW-106, MW-108, MW-109, MW-110, MW-111, MW-113, MW-114, MW-117, MW-120, MW-126B, MW-127, MW-134, MW-135, MW-138, MW-139, NCL-31, NCL-49, NP-1, RA-4196, RA-4798, and TEL-4
- Annual (29 wells): MW-3, MW-4A, MW-6A, MW-22A, MW-40, MW-41, MW-42, MW-53, MW-71, MW-74, MW-76, MW-78, MW-93, MW-121, MW-122, MW-123, MW-128, OCD-3, OCD-6, RA-313, RW-1, RW-2, RW-8, RW-9, RW-10, RW-13, RW-16, RW-17, and UG-1
- Biennial (1 well): MW-54B

An evaluation of 1,4-dioxane results and recommendations for inclusion of 1,4-dioxane to the facility-wide groundwater monitoring program will be made in a future FWGMWP update, after completion of two required sampling events in all wells.

5.3.2 1,2-Dibromomethane (EDB) Analysis at Select Wells

In accordance with NMED's May 7, 2021, comments letter on the September 2019 MTBE Groundwater Report, groundwater samples collected from wells with any historical detection of 1,2-dichloroethane (EDC) since 2010 will be sampled for EDB by Method 8011 for two consecutive sampling events. For wells that are sampled on a semi-annual basis, the required EDB sampling events will be completed during the second semi-annual monitoring event of 2021 and the first semi-annual monitoring event of 2022. For wells that are sampled on an annual basis, the required EDB sampling events will be completed during the first semi-annual monitoring events of 2022 and 2023. No groundwater sample will be collected if PSH is present at a thickness of 0.03 feet or greater, and the required EDB sampling will be completed during subsequent monitoring events. Wells to be analyzed for EDB are listed below by the sampling frequency.

- Semi-annual (16 wells): KWB-6, KWB-11A, KWB-11B, MW-50, MW-60, MW-62, MW-102, MW-108, MW-111, MW-113, MW-114, MW-126B, MW-127, NP-1, RA-4196, and RA-4798
- Annual (4 wells): MW-71, RW-8, RW-9, and RW-13

An evaluation of EDB results and recommendations for inclusion of EDB to the facility-wide groundwater monitoring program will be made in a future FWGMWP update, after completion of two required sampling events in all wells.

5.3.3 Tert-Butyl Alcohol (TBA) Analysis

In accordance with NMED's May 7, 2021, comments letter on the September 2019 MTBE Groundwater Report, in response to the Refinery's planned pilot test to enhance biodegradation of hydrocarbon constituents under sulfate reducing conditions, groundwater samples collected from all wells where VOCs are currently analyzed will be sampled for TBA by Method 8260 for four consecutive sampling events. The analytical parameters and sampling frequency for each well in the groundwater monitoring program are summarized on Table 1.

For wells that are sampled on a semi-annual basis, the required TBA sampling events will be completed during the second semi-annual monitoring event of 2021, both semi-annual sampling events in 2022, and the first semi-annual monitoring event of 2023. For wells that are sampled on an annual basis, the required TBA sampling events will be completed during the first semi-annual monitoring events of 2022 to 2025. For wells that are sampled on a biennial basis, the required TBA sampling events will be completed during the first semi-annual monitoring events of 2023, 2025, 2027, and 2029. No groundwater sample will be collected if PSH is present at a thickness of 0.03 feet or greater, and the required TBA sampling will be completed during subsequent monitoring events.

6.0 Groundwater Monitoring Procedures

Monitoring activities will consist of the following tasks: field documentation, well inspection, well gauging, groundwater purging and sampling, handling of samples for laboratory analysis, QA/QC sampling, and managing IDW. The procedures that will be used to complete each task are described in detail below.

6.1 Field Documentation

Documentation of field activities associated with groundwater monitoring events will be recorded each day in a bound field logbook, on an electronic tablet, and/or associated field sampling forms. Each page of the logbook and field sampling forms will be signed by the person(s) making entries on that page. The following information will be collected during groundwater sampling activities:

- Sampling and oversight personnel identification
- Instrument calibrations
- Well conditions
- Monitoring well measurements including static water level depth and total well depth
- Depth to PSH, if present
- Weather conditions at the time of sample collection and throughout the sampling event
- Well purging procedures including equipment, purge volume, rate, and elapsed time
- Water quality parameters recorded during purging including appearance, odor, turbidity, pH, temperature, conductivity, TDS, oxidation-reduction potential (ORP), and dissolved oxygen (DO)
- Sample collection dates and times
- Reasons for deviating from the sampling and analysis plan (if applicable)

6.2 Well Inspection

During each gauging and sampling event, all monitoring and recovery wells will be inspected for well integrity. The information will be recorded on the groundwater gauging form. Each inspection will include:

- Identification of the well
- Inspection of the well pad for deterioration or damage
- Inspection of the protective casing and well casing for deterioration or damage
- Inspection of the presence or absence and condition of the padlock and well J-plug
- Measurement of the total depth of the well

6.3 Well Gauging

The depth to PSH, if present, and groundwater will be gauged at each monitoring well prior to sampling. The wells that are to be gauged are presented in Table 1 and well locations are depicted on Figure 2. Prior to gauging, each well cap will be removed to allow groundwater to equilibrate with atmospheric pressure. Fluid level measurements will be collected using an oil/water interface probe to an accuracy of 0.01 feet. Measurements will be made from a marked survey datum at the top of casing (TOC). Data will be recorded on a paper or electronic tablet field gauging form. The oil/water interface probe will be decontaminated before use and between wells following the procedures outlined in Section 6.8.

6.3.1 Fluid Level Gauging Procedures

The following procedure will be used to measure the depths to PSH and groundwater:

- The probe will be lowered into the well slowly until the probe alarm sounds or light illuminates, then the tape will be raised and lowered again slowly until the alarm is again audible or the light again illuminates. The depth to fluid on the tape will be recorded to within 0.01 feet. To ensure accuracy, the measurement will be repeated.
- Well identification, date, time, depth to water, depth to PSH (if applicable), and other pertinent observations will be recorded on the field gauging form.

6.3.2 Total Depth Gauging

Total well depth will be measured to detect the amount of silt accumulation in a well. This measurement will be collected during sampling events and well inspections. The following procedures will be followed to determine the total depth of the well:

- The oil/water interface probe will be slowly lowered until the bottom of the well is detected.
- The total well depth will be measured when the tape becomes slack for hard bottoms.
- The point of “pick-up” (where the weight of the probe is felt when reeling up the probe) will be used to determine the total depth in the case of soft sediment bottoms.
- The hardness of the bottom of the well will be documented in the field logbook.

6.4 Groundwater Sampling

Groundwater will be purged and sampled from monitoring and recovery wells using low-flow methods in accordance with the NMED Hazardous Waste Bureau (HWB) Position Paper “Use of Low-Flow and Other Non-Traditional Sampling Techniques for Compliance Groundwater Monitoring” (NMED 2001). Groundwater will be purged and sampled from irrigation wells using standard procedures described below. Data collected during the purging and sampling of each well will be recorded on a paper or electronic tablet groundwater sampling form.

Groundwater will be purged and sampled from monitoring and recovery wells using either a peristaltic pump (for sampling depths of approximately 25 feet bgs or less) or a dedicated, stainless steel

submersible pump (for sampling depth greater than 25 feet bgs). The locations of monitoring and recovery wells to be purged and sampled are provided on Figure 3. An oil/water interface probe will be lowered into the monitoring well to record the depth to water.

Groundwater will be purged and sampled from irrigation wells by attaching a decontaminated or dedicated hose barb to the available spigot. The spigot will be located at a point before the water supply is introduced into any storage tanks or treatment units. The groundwater will be purged from the spigot so that any stagnant water from the well casing and surface piping is removed.

A multi-parameter water quality meter with flow-through cell and hand-held turbidity meter will be used during the purging process to monitor for field water quality parameters (pH, temperature, conductivity, TDS, ORP, DO, and turbidity) and demonstrate stabilization. Water quality parameters will be recorded approximately every three minutes during purging. Water quality meters used to measure field parameters will be calibrated each day according to the manufacturer's specifications. The make, model, calibration fluids, and calibration results for the water quality meters will be recorded in the field logbook. The turbidity meter test cell will be triple rinsed with groundwater from the next sample aliquot prior to each reading. The water quality parameters and depth to water (in non-irrigation wells only) will be recorded on the Groundwater Sampling Form. A description of the water quality (e.g., turbidity, sheen, odor) will be recorded during the purging process.

The purging process will be considered complete and groundwater sampling will commence when at least four of the seven water quality parameters achieve stabilization within ten percent for three consecutive readings.

If the well goes dry during purging, a sample will be collected as soon after the water level recovers to a level from which a sample can be collected. The samples will be collected in clean, labeled laboratory-supplied containers prepared with the appropriate amount and type of preservative. The groundwater samples will be submitted for laboratory analysis following the schedule in Table 1.

Samples submitted for dissolved metals analysis will be filtered in the field using a new 0.45-micron filter. Filtering methods will be documented on the groundwater sampling form, field logbook, and chain-of-custody.

6.5 Handling of Samples for Laboratory Analysis

Neoprene or nitrile gloves will be worn during sample collection and while handling sample containers. New disposable gloves will be used to collect each sample. The sample containers will be labeled, secured with bubble wrap, placed in a resealable plastic bag, and immediately placed on ice in a cooler and stored below 4 degrees Celsius (° C). The sample labels will include the Permittee name (HFNR), site name (Artesia Refinery), unique sample identification, sample collection time and date, preservatives, and the name(s) of the sampler(s). The samples will be secured with packing material and kept below 4°C with wet ice in accordance with laboratory cooler shipping guidelines. The cooler will be secured with packing tape, and a signed and dated custody seal will be placed over the cooler lid and secured with tape. The samples and a completed chain-of-custody documentation will be shipped via priority overnight delivery to the analytical laboratory. The chain-of-custody forms are to be maintained as a record of sample collection, transfer, shipment, and receipt by the laboratory. At a minimum, all

samples will be submitted to the laboratory within 48 hours after collection. The laboratory will be informed that samples are being submitted for analysis and it will be confirmed that the samples were received the following day. If samples are shipped on Friday for Saturday delivery, the receiving laboratory will be contacted so provisions can be made for laboratory sample receipt.

6.6 Quality Assurance/Quality Control Sampling

Field QA/QC samples for groundwater will be collected as follows:

- Duplicates: Collected at a frequency of ten percent at the same time and from the same location as the original sample.
- Equipment blanks: Collected from non-dedicated, decontaminated equipment at a frequency of five percent by pouring distilled water over the equipment and collecting the sample in the appropriate laboratory containers.
- Trip blanks: One included in each cooler shipped to the laboratory that contains samples for VOC analyses. The trip blank consists of two 40-milliliter (mL) vials of reagent water provided by the laboratory that were stored in the sample cooler at all times.

Laboratory QA/QC samples will be performed according to test methodologies specified for each analytical method. The laboratory QA/QC samples may include reagent or method blanks, surrogates, matrix spike/matrix spike duplicates, blank spike/blank spike duplicates and/or laboratory duplicates, as appropriate for each method. The laboratory QA/QC samples will be run at the frequency specified by each method.

6.7 PSH Sample Collection

In the event that PSH is present in any of the monitoring or recovery wells that have not historically contained PSH, samples may be collected when sufficient volume (80 mL) is present for collection and analysis. The desired analyses for evaluation of PSH include paraffins, isoparaffins, aromatics, naphthenes, and olefins (PIANO) as well as specific gravity and simulated distillation. HFNR will notify the NMED within seven calendar days if PSH is present in wells where PSH has not previously be encountered, as required by the PCC Permit.

PSH samples will be collected using a disposable, non-dedicated hand bailer. The bailer will be lowered into the well slightly into the PSH and water column. The bailer will be slowly removed and groundwater decanted from the bottom of the bailer. The PSH remaining in the bailer will then be placed into the sample container, and the container will be sealed and properly labeled for shipment. Excess groundwater and PSH will be managed per methods discussed in Section 6.9.

6.8 Decontamination

The interface probe and other non-dedicated equipment coming into contact with groundwater will be decontaminated by the following procedures:

1. PSH, if present, will be removed with an absorbent pad.

2. Any solids will be removed to the degree possible with a brush and tap or distilled water.
3. Equipment will be washed with a brush, laboratory-grade non-phosphate detergent (e.g., Liquinox, Alconox), and potable tap water. Excess soap will be allowed to drain off the equipment when finished.
4. Equipment will be double rinsed with distilled water.

All decontamination fluids will be managed per methods discussed in Section 6.9.

6.9 Investigation-Derived Waste Disposal

The IDW (e.g., purge water, decontamination water) generated during monitoring activities will be collected and disposed of in the Refinery wastewater treatment system, upstream of the oil/water separator. Miscellaneous IDW (e.g., gloves, bailers) in contact with investigative material deemed to have no or de minimis contamination will be disposed of in a general refuse container. Any IDW deemed to have greater than de minimis contamination will be stored in labeled drums and disposed appropriately on a per case basis.

7.0 Annual Groundwater Monitoring Report

Groundwater monitoring from each calendar year will be documented in an *Annual Groundwater Monitoring Report*, in accordance with both the PCC Permit and the Discharge Permit. The *Annual Groundwater Monitoring Report* will follow the general report format provided in Appendix E of the PCC Permit and incorporate the requirements of Section 2.E of the Discharge Permit. At a minimum, the *Annual Groundwater Monitoring Report* will include the following:

- Description of groundwater monitoring and remediation activities conducted throughout the reporting period, including sample collection procedures, decontamination procedures, sample handling procedures, and management of wastes;
- Summary table of semi-annual groundwater and PSH gauging data, with corrected water table elevation for all wells containing PSH;
- Summary table of groundwater quality parameters recorded in the field (purge parameters);
- Summary of laboratory analytical data with comparison to screening levels;
- Summary of QA/QC data review and validation;
- Groundwater contour maps depicting the groundwater gradient for each semi-annual monitoring event of the reporting period, including site features and the direction and magnitude of the hydraulic gradient;
- PSH thickness isopleths maps for each semi-annual monitoring event during the reporting period;
- Isoconcentration maps for major constituents of concern (COCs);
- Plots of static water elevation versus time in key wells, specifically those that contain PSH;
- Plots of target COC groundwater concentrations versus time in wells that have historically exceeded screening levels;
- Tabulation of the monthly and cumulative volume of PSH removed from recovery wells or monitoring wells throughout the reporting period; and
- Recommendations, including any recommended changes to the groundwater monitoring program.

The *Annual Groundwater Monitoring Report* will be submitted to NMED by February 28 of the calendar year following sample collection and to OCD by June 15 of the calendar year following sample collection as part of the GW-028 Annual Discharge Report.

8.0 Schedule

The groundwater monitoring program is conducted on a semi-annual basis. The first semi-annual event is scheduled to occur no more than 30 days prior to the start of the pecan orchard flood irrigation season but no later than April 30 of each year. Typically, the first semi-annual event will occur in March or April of each calendar year. The second semi-annual event will occur no later than 30 days after the conclusion of the pecan orchard flood irrigation season or November 15 each year. Typically, the second semi-annual event will occur in October or November of each calendar year. Due to refinery turnaround scheduled in early October 2021, the second semi-annual event of 2021 may be conducted in September 2021.

The wells that are sampled on an annual basis will be sampled during the first semi-annual event of each calendar year. The wells that are sampled biennially will be sampled every other year. Biennial sampling at the Refinery began in the first semi-annual event of 2011. As such, these wells will be sampled during the first semi-annual event of each odd numbered year.

HFNR will notify both NMED and OCD prior to the initiation of each semi-annual sampling event.

The *Annual Groundwater Monitoring Report* will be submitted to NMED no later than February 28 of the calendar year following sample collection and to OCD no later than June 15 of the calendar year following sample collection as part of the GW-028 Annual Discharge Report.

9.0 References

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OCD 2019. GW-028 Permit Question, Email response to Roberts Combs of HFNR from Carl Chavez of OCD. August 30, 2019.

TRC 2020. 2020 Facility-Wide Groundwater Monitoring Work Plan. June 30, 2020.

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TRC 2021b. 2020 Annual Groundwater Monitoring Report. February 26, 2021.

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Wood 2019a. Stage 1 Abatement Plan for the Reverse Osmosis Reject Discharge Fields, Permit GW-028. March 21, 2019.

Wood 2019b. Amendment of the March 2019 Stage 1 Abatement Plan for the Reverse Osmosis Reject Discharge Fields. May 24, 2019.

Wood 2019c. Evaluation of Methyl Tert-Butyl Ether (MTBE) in Groundwater. September 13, 2019.

Wood 2019d. Well Installation Work Plan for SWMU / AOC Group 3. December 31, 2019

Wood 2020. Reverse Osmosis Reject Discharge Fields Stage 1 Abatement – Final Report. November 19, 2020.

Table

Table 1. 2021 Facility-Wide Groundwater Monitoring Program and Schedule

HollyFrontier Navajo Refining LLC - Artesia Refinery, Artesia, New Mexico

Well ID	Well Type	Associated Area	Well Construction [a]			Historic PSH? [b]	Gauging Frequency	Analytical Suite and Frequency [c, d]										
			Well Diameter (inch)	Screen Interval (ft bgs)	Water Bearing Zone			Purge Parameters	DRO	GRO	VOCs	SVOCs	Metals: As, Ba, Cr, Fe, Pb, Mn, Se	Metals: B, Cd, Co, Hg, Ni, U, Va	Cyanide	Cations/Anions	Nitrate / Nitrite as Nitrogen	Total Dissolved Solids
KWB-13	Monitoring	Cross-gradient	2		Shallow		SA	A	A	-	A	-	A	A	A	A	A	A
MW-136	Monitoring	Cross-gradient	2	10 to 25	Shallow		SA	SA	SA	SA	SA	-	SA	SA	SA	SA	SA	SA
NP-5	Monitoring	Cross-gradient	2	10.25 to 20	Shallow		SA	B	B	-	B	-	B	-	-	B	B	B
MW-1R	Monitoring	EP	2	8 to 23	Shallow		SA	A	A	-	A	-	A	-	-	A	A	A
MW-2A	Monitoring	EP	2		Shallow		SA	SA	SA	SA	A	-	SA	-	-	SA	SA	SA
MW-2B	Monitoring	EP	2	38.5 to 48	Valley Fill		SA	No samples to be collected										
MW-3	Monitoring	EP	2		Shallow		SA	SA	SA	SA	A	-	SA	-	-	SA	SA	SA
MW-4A	Monitoring	EP	4		Shallow		SA	SA	SA	SA	A	-	SA	-	-	SA	SA	SA
MW-4B	Monitoring	EP	4	60.25 to 70	Valley Fill		SA	B	B	B	B	-	B	-	-	B	B	B
MW-5A	Monitoring	EP	2		Shallow		SA	SA	SA	SA	A	-	SA	-	-	SA	SA	SA
MW-5B	Monitoring	EP	2	41.5 to 50.5	Valley Fill		SA	B	B	B	B	-	B	-	-	B	B	B
MW-5C	Monitoring	EP	2	59.25 to 68.75	Valley Fill		SA	B	B	B	B	-	B	-	-	B	B	B
MW-6A	Monitoring	EP	2		Shallow		SA	A	A	A	A	-	A	-	-	A	A	A
MW-6B	Monitoring	EP	2	39.5 to 49	Valley Fill		SA	B	B	B	B	-	B	-	-	B	B	B
MW-7A	Monitoring	EP	2		Shallow		SA	SA	SA	SA	SA	-	SA	-	-	SA	SA	SA
MW-7B	Monitoring	EP	4	39.5 to 49	Valley Fill		SA	B	B	B	B	-	B	-	-	B	B	B
MW-10	Monitoring	EP	2		Shallow		SA	SA	SA	SA	A	-	SA	-	-	SA	SA	SA
MW-11A	Monitoring	EP	4	5.5 to 20	Shallow		SA	A	A	A	A	-	A	-	-	SA	SA	SA
MW-11B	Monitoring	EP	2	35.5 to 45	Valley Fill		SA	B	B	B	B	-	B	-	-	B	B	B
MW-12	Monitoring	EP	4	6.5 to 16	Shallow		SA	No samples to be collected										
MW-13	Monitoring	EP	4	9.5 to 19	Shallow		SA	No samples to be collected										
MW-14	Monitoring	EP	4	5.5 to 20	Shallow		SA	No samples to be collected										
MW-15	Monitoring	EP	4	9 to 19	Shallow		SA	A	A	A	A	-	A	-	-	A	A	A
MW-18A	Monitoring	EP	4	10 to 20	Shallow		SA	SA	SA	-	A	-	SA	SA	SA	SA	SA	SA
MW-18B	Monitoring	EP	2	37 to 47	Valley Fill		SA	B	B	B	B	-	B	-	-	B	B	B
MW-18T	Monitoring	EP	4	37 to 47	Valley Fill		SA	No samples to be collected										
MW-22A	Monitoring	EP	4	5.5 to 20.5	Shallow		SA	SA	SA	SA	A	-	SA	-	-	SA	SA	SA
MW-22B	Monitoring	EP	2	42.3 to 52	Valley Fill		SA	B	B	B	B	-	B	-	-	B	B	B
MW-24	Monitoring	EP	6	15 to 20	Shallow		SA	No samples to be collected										
MW-69	Monitoring	EP	2	5 to 20	Shallow		SA	No samples to be collected										
MW-70	Monitoring	EP	4	5 to 20	Shallow		SA	SA	SA	SA	A	-	SA	-	-	A	A	A
MW-72	Monitoring	EP	4	2 to 12	Shallow		SA	A	A	A	A	-	A	-	-	A	A	A
MW-73	Monitoring	EP	4	2 to 17	Shallow		SA	A	A	A	A	-	A	-	-	A	A	A
MW-74	Monitoring	EP	4	2 to 17	Shallow		SA	SA	SA	SA	A	-	SA	-	-	SA	SA	SA
MW-75	Monitoring	EP	4	3 to 18	Shallow		SA	SA	SA	SA	A	-	SA	-	-	SA	SA	SA
MW-76	Monitoring	EP	4	3 to 18	Shallow		SA	SA	SA	SA	A	-	SA	-	-	SA	SA	SA
MW-77	Monitoring	EP	4	3 to 18	Shallow		SA	A	A	A	A	-	A	-	-	A	A	A
MW-78	Monitoring	EP	4	2 to 17	Shallow		SA	A	A	A	A	-	A	-	-	A	A	A
MW-79	Monitoring	EP	4	2 to 17	Shallow		SA	SA	SA	SA	A	-	SA	-	-	SA	SA	SA
MW-80	Monitoring	EP	4	2 to 17	Shallow		SA	A	A	A	A	-	A	-	-	A	A	A
MW-81	Monitoring	EP	4	2 to 17	Shallow		SA	A	A	A	A	-	A	-	-	A	A	A
MW-82	Monitoring	EP	4	2 to 17	Shallow		SA	A	A	A	A	-	A	-	-	A	A	A
MW-83	Monitoring	EP	4	2 to 17	Shallow		SA	SA	SA	SA	A	-	SA	-	-	SA	SA	SA
MW-84	Monitoring	EP	4	2 to 17	Shallow		SA	SA	SA	SA	A	-	SA	-	-	SA	SA	SA
MW-85	Monitoring	EP	4	3 to 18	Shallow	Y	SA	SA	SA	SA	SA	-	SA	-	-	SA	SA	SA
MW-86	Monitoring	EP	4	2 to 17	Shallow	Y	SA	SA	SA	SA	SA	-	SA	SA	SA	SA	SA	SA
MW-87	Monitoring	EP	4	2 to 17	Shallow		SA	SA	SA	SA	A	-	SA	-	-	A	A	A
MW-88	Monitoring	EP	4	3 to 18	Shallow		SA	SA	SA	SA	A	-	SA	-	-	A	A	A
MW-120	Monitoring	EP	2	10 to 25	Shallow		SA	SA	SA	SA	SA	-	SA	-	-	SA	SA	SA
MW-121	Monitoring	EP	2	10 to 25	Shallow		SA	SA	SA	SA	A	-	SA	-	-	SA	SA	SA
MW-122	Monitoring	EP	2	10 to 20	Shallow		SA	SA	SA	SA	A	-	SA	-	-	SA	SA	SA
MW-123	Monitoring	EP	2	10 to 25	Shallow		SA	SA	SA	SA	A	-	SA	-	-	SA	SA	SA
MW-124	Monitoring	EP	2	5 to 20	Shallow		SA	SA	SA	SA	A	-	SA	-	-	SA	SA	SA
OCD-1R	Monitoring	EP	2		Shallow		SA	SA	SA	SA	A	-	SA	-	-	SA	SA	SA
OCD-2A	Monitoring	EP	2	8.5 to 23.5	Shallow		SA	SA	SA	SA	A	-	SA	-	-	A	A	A
OCD-2B	Monitoring	EP	2	38.5 to 48	Valley Fill		SA	No samples to be collected										
OCD-3	Monitoring	EP	2	6.5 to 21.5	Shallow		SA	SA	SA	SA	A	-	SA	-	-	A	A	A
OCD-4	Monitoring	EP	2	6.5 to 21.5	Shallow		SA	SA	SA	SA	A	-	SA	-	-	A	A	A
OCD-5	Monitoring	EP	2		Shallow		SA	SA	SA	SA	A	-	SA	-	-	SA	SA	SA
OCD-6	Monitoring	EP	2	8 to 23	Shallow		SA	SA	SA	SA	A	-	SA	-	-	SA	SA	SA
OCD-7AR	Monitoring	EP	4	5.5 to 19.5	Shallow		SA	SA	SA	SA	A	-	SA	-	-	SA	SA	SA
OCD-7B	Monitoring	EP	2	43.5 to 52.5	Valley Fill		SA	B	B	B	B	-	B	-	-	B	B	B
OCD-7C	Monitoring	EP	2	60.25 to 69.75	Valley Fill		SA	No samples to be collected										
OCD-8A	Monitoring	EP	2	3 to 18	Shallow		SA	SA	SA	SA	A	-	SA	SA	SA	SA	SA	SA
OCD-8B	Monitoring	EP	2	43.5 to 53	Valley Fill		SA	B	B	B	B	-	B	-	-	B	B	B

Table 1. 2021 Facility-Wide Groundwater Monitoring Program and Schedule

HollyFrontier Navajo Refining LLC - Artesia Refinery, Artesia, New Mexico

Well ID	Well Type	Associated Area	Well Construction [a]			Historic PSH? [b]	Gauging Frequency	Analytical Suite and Frequency [c, d]										
			Well Diameter (inch)	Screen Interval (ft bgs)	Water Bearing Zone			Purge Parameters	DRO	GRO	VOCs	SVOCs	Metals: As, Ba, Cr, Fe, Pb, Mn, Se	Metals: B, Cd, Co, Hg, Ni, U, Va	Cyanide	Cations/Anions	Nitrate / Nitrite as Nitrogen	Total Dissolved Solids
KWB-1A	Monitoring	Field E of Refinery	2	18 to 32	Shallow	Y	SA	SA	SA	-	SA	-	SA	SA	SA	SA	SA	SA
KWB-1B	Monitoring	Field E of Refinery	4	18 to 32	Shallow		A	No samples to be collected										
KWB-1C	Monitoring	Field E of Refinery	4	30.5 to 49.5	Valley Fill		SA	B	B	-	B	-	B	-	-	B	B	B
KWB-3AR	Monitoring	Field E of Refinery	2	17 to 33	Shallow		SA [f]	SA [f]	SA [f]	-	SA [f]	-	SA [f]	SA [f]	SA [f]	SA [f]	SA [f]	SA [f]
KWB-5	Monitoring	Field E of Refinery	2	24.7 to 38.7	Shallow	Y	SA	SA	SA	-	SA	-	SA	-	-	SA	SA	SA
KWB-6	Monitoring	Field E of Refinery	2	17.5 to 36.5	Shallow	Y	SA	SA	SA	-	SA	-	SA	-	-	SA	SA	SA
KWB-7	Monitoring	Field E of Refinery	2	18 to 32	Shallow	Y	SA	SA	SA	-	SA	-	SA	SA	SA	SA	SA	SA
KWB-8	Monitoring	Field E of Refinery	2	15 to 34	Shallow	Y	SA	SA	SA	-	SA	-	SA	SA	SA	SA	SA	SA
KWB-9	Monitoring	Field E of Refinery	2	20 to 34	Shallow		SA [f]	A [f]	A [f]	-	A [f]	-	A [f]	A [f]	A [f]	A [f]	A [f]	A [f]
KWB-10R	Monitoring	Field E of Refinery	4	9 to 29	Shallow	Y	SA	SA	SA	-	SA	-	SA	-	-	SA	SA	SA
KWB-11A	Monitoring	Field E of Refinery	4	30 to 39.5	Shallow	Y	SA	SA	SA	SA	SA	-	SA	SA	SA	SA	SA	SA
KWB-11B	Monitoring	Field E of Refinery	4	50 to 69.5	Valley Fill		SA	SA	SA	SA	SA	-	SA	SA	SA	SA	SA	SA
KWB-12A	Monitoring	Field E of Refinery	4	15.5 to 24.5	Shallow		SA	SA	SA	SA	SA	-	SA	SA	SA	SA	SA	SA
KWB-12B	Monitoring	Field E of Refinery	4	25.5 to 39.5	Valley Fill		SA	SA	SA	SA	SA	-	SA	SA	SA	SA	SA	SA
KWB-P4	Monitoring	Field E of Refinery	2		Shallow		B	B	B	-	B	-	-	-	-	-	-	-
MW-57	Monitoring	Field E of Refinery	2	10 to 30	Shallow		SA	SA	SA	SA	SA	-	SA	-	-	SA	SA	SA
MW-58	Monitoring	Field E of Refinery	4	13 to 28	Shallow	Y	SA	SA	SA	-	SA	-	SA	SA	SA	SA	SA	SA
MW-111	Monitoring	Field E of Refinery	2	25 to 40	Shallow	Y	SA	SA	SA	SA	SA	-	SA	-	-	SA	SA	SA
MW-112	Monitoring	Field E of Refinery	2	25 to 35	Shallow	Y	SA	SA	SA	SA	SA	-	SA	-	-	SA	SA	SA
MW-113	Monitoring	Field E of Refinery	2	20 to 35	Shallow		SA	SA	SA	SA	SA	-	SA	-	-	SA	SA	SA
MW-125	Monitoring	Field E of Refinery	2	15 to 25	Shallow		SA	SA	SA	SA	SA	-	SA	-	-	SA	SA	SA
MW-126A	Monitoring	Field E of Refinery	2	19 to 34	Shallow	Y	SA	SA	SA	SA	SA	-	SA	-	-	SA	SA	SA
MW-126B	Monitoring	Field E of Refinery	2	40 to 50	Valley Fill		SA	SA	SA	SA	SA	-	SA	-	-	SA	SA	SA
MW-127	Monitoring	Field E of Refinery	2	20 to 50	Shallow	Y	SA	SA	SA	SA	SA	-	SA	-	-	SA	SA	SA
MW-128	Monitoring	Field E of Refinery	2	15 to 35	Shallow	Y	SA	SA	SA	SA	SA	-	SA	-	-	SA	SA	SA
MW-129	Monitoring	Field E of Refinery	2	20 to 50	Shallow	Y	SA	A	A	A	A	-	A	-	-	A	A	A
MW-131	Monitoring	Field E of Refinery	2	20 to 50	Shallow	Y	SA	SA	SA	SA	SA	-	SA	-	-	SA	SA	SA
MW-132	Monitoring	Field E of Refinery	2	15 to 40	Shallow	Y	SA	SA	SA	SA	SA	-	SA	-	-	SA	SA	SA
MW-133	Monitoring	Field E of Refinery	2	15 to 35	Shallow	Y	SA	SA	SA	SA	SA	-	SA	-	-	SA	SA	SA
MW-134	Monitoring	Field E of Refinery	2	20 to 30	Shallow		SA	SA	SA	SA	SA	-	SA	-	-	SA	SA	SA
MW-135	Monitoring	Field E of Refinery	2	35 to 65	Shallow		SA	SA	SA	SA	SA	-	SA	-	-	SA	SA	SA
MW-145	Monitoring	Field E of Refinery	2	9 to 29	Shallow		SA	SA	SA	SA	SA	-	SA	-	-	SA	-	SA
MW-146	Monitoring	Field E of Refinery	2	10 to 30	Shallow		SA	SA	SA	SA	SA	-	SA	-	-	SA	-	SA
MW-147	Monitoring	Field E of Refinery	2	20 to 40	Shallow		SA	SA	SA	SA	SA	-	SA	-	-	SA	-	SA
MW-148	Monitoring	Field E of Refinery	2	20 to 40	Shallow		SA	SA	SA	SA	SA	-	SA	-	-	SA	-	SA
RA-1227	Irrigation	Field E of Refinery	10 / 8	194 to 246	Artesian		NA	A [f]	-	-	A [f]	-	-	-	-	A [f]	A [f]	A [f]
RA-3156	Irrigation	Field E of Refinery	4	182 to ?	Artesian		NA	A	-	-	A	-	-	-	-	A	A	A
RA-4196	Irrigation	Field E of Refinery	8	280 to 292	Artesian		NA	SA	-	-	SA	-	-	-	-	SA	SA	SA
RA-4798	Irrigation	Field E of Refinery	7	840 to 850	Artesian		NA	SA	-	-	SA	-	-	-	-	SA	SA	SA
RW-11 [e]	Recovery	Field E of Refinery	36		Shallow		SA	A	A	-	A	-	A	-	-	A	A	A
RW-12R [g]	Recovery	Field E of Refinery	12	15 to 35	Shallow	Y	SA	A	A	-	A	-	A	-	-	A	A	A
RW-13R [g]	Recovery	Field E of Refinery	12	15 to 35	Shallow	Y	SA	A	A	-	A	-	A	-	-	A	A	A
RW-14R [g]	Recovery	Field E of Refinery	12	15 to 35	Shallow	Y	SA	A	A	-	A	-	A	-	-	A	A	A
RW-18 [e]	Recovery	Field E of Refinery	36		Shallow		SA	A	-	-	A	-	A	-	-	A	A	A
RW-20	Recovery	Field E of Refinery	4		Shallow	Y	SA	A	A	-	A	-	A	-	-	A	A	A
RW-22	Recovery	Field E of Refinery	12	11.5 to 39	Shallow	Y	SA	A	A	-	A	-	A	-	-	A	A	A
MW-23	Monitoring	N Refinery	6	15 to 20	Shallow	Y	SA	SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
MW-29	Monitoring	N Refinery	2	9.75 to 19.25	Shallow		SA	SA	SA	SA	SA	-	SA	-	-	SA	SA	SA
MW-30	Monitoring	N Refinery	8		Shallow		SA	No samples to be collected										
MW-39	Monitoring	N Refinery	2	14 to 24	Shallow	Y	SA	SA	SA	SA	SA	-	SA	-	-	SA	SA	SA
MW-40	Monitoring	N Refinery	2		Shallow	Y	SA	A	A	A	A	-	A	-	-	A	A	A
MW-41	Monitoring	N Refinery	2	14 to 19	Shallow		SA	A	A	A	A	-	A	-	-	A	A	A
MW-42	Monitoring	N Refinery	2		Shallow		SA	A	A	A	A	-	A	-	-	A	A	A
MW-43	Monitoring	N Refinery	6	15.5 to 20.5	Shallow	Y	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
MW-59	Monitoring	N Refinery	2	15 to 30	Shallow	Y	SA	A	A	A	A	-	A	-	-	A	A	A
MW-60	Monitoring	N Refinery	2	15 to 30	Shallow	Y	SA	SA	SA	SA	SA	-	SA	SA	SA	SA	SA	SA
MW-61	Monitoring	N Refinery	4	14 to 29	Shallow		SA	SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
MW-62	Monitoring	N Refinery	4	14 to 29	Shallow	Y	SA	SA	SA	SA	SA	SA	SA	-	-	SA	SA	SA
MW-62R	Monitoring	N Refinery	4	5 to 25	Shallow		SA	A	A	A	A	-	A	-	-	A	A	A
MW-67	Monitoring	N Refinery	4	12 to 27	Shallow	Y	SA	SA	SA	SA	SA	-	SA	SA	SA	SA	SA	SA
MW-90	Monitoring	N Refinery	4	5 to 20	Shallow		SA	SA	SA	SA	SA	-	SA	-	-	SA	SA	SA
MW-91	Monitoring	N Refinery	4	7 to 22	Shallow	Y	SA	SA	SA	SA	SA	-	SA	-	-	SA	SA	SA
MW-92	Monitoring	N Refinery	4	5 to 20	Shallow	Y	SA	SA	SA	SA	SA	-	SA	-	-	SA	SA	SA
MW-93	Monitoring	N Refinery	4	5 to 20	Shallow		SA	A	A	A	A	A	A	-	-	A	A	A
MW-94	Monitoring	N Refinery	4	5 to 20	Shallow	Y	SA	SA	SA	SA	SA	-	SA	-	-	SA	SA	SA

Table 1. 2021 Facility-Wide Groundwater Monitoring Program and Schedule

HollyFrontier Navajo Refining LLC - Artesia Refinery, Artesia, New Mexico

Well ID	Well Type	Associated Area	Well Construction [a]			Historic PSH? [b]	Gauging Frequency	Analytical Suite and Frequency [c, d]										
			Well Diameter (inch)	Screen Interval (ft bgs)	Water Bearing Zone			Purge Parameters	DRO	GRO	VOCs	SVOCs	Metals: As, Ba, Cr, Fe, Pb, Mn, Se	Metals: B, Cd, Co, Hg, Ni, U, Va	Cyanide	Cations/Anions	Nitrate / Nitrite as Nitrogen	Total Dissolved Solids
MW-95	Monitoring	N Refinery	4	7 to 22	Shallow	Y	SA	A	A	A	A	-	A	-	-	A	A	A
MW-96	Monitoring	N Refinery	4	7 to 22	Shallow	Y	SA	SA	SA	SA	SA	-	SA	-	-	SA	SA	SA
MW-97	Monitoring	N Refinery	4	8 to 23	Shallow	Y	SA	SA	SA	SA	SA	-	SA	-	-	SA	SA	SA
MW-98	Monitoring	N Refinery	4	13 to 23	Shallow		SA	SA	SA	SA	SA	-	SA	-	-	SA	SA	SA
MW-137	Monitoring	N Refinery	2	10 to 30	Shallow	Y	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
MW-137A	Monitoring	N Refinery	2	5.5 to 15.5	Shallow	Y	SA	A	A	A	A	-	A	A	A	A	A	A
MW-138	Monitoring	N Refinery	2	10 to 25	Shallow	Y	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA	SA
MW-138A	Monitoring	N Refinery	2	5.5 to 15.5	Shallow	Y	SA	A	A	A	A	-	A	A	A	A	A	A
RW-1R [g]	Recovery	N Refinery	12	15 to 35	Shallow	Y	SA	A	A	A	A	-	A	-	-	A	A	A
RW-2R [g]	Recovery	N Refinery	12	14.5 to 34.5	Shallow	Y	SA	A	A	A	A	-	A	-	-	A	A	A
RW-7R [g]	Recovery	N Refinery	12	14.5 to 34.5	Shallow	Y	SA	A	A	A	A	-	A	-	-	A	A	A
RW-8R [g]	Recovery	N Refinery	12	14.5 to 34.5	Shallow	Y	SA	A	A	-	A	-	A	-	-	A	A	A
RW-9	Recovery	N Refinery	36		Shallow		SA	A	A	A	A	-	A	-	-	A	A	A
RW-10	Recovery	N Refinery	36		Shallow		SA	A	A	A	A	-	A	-	-	A	A	A
RW-16 [e]	Recovery	N Refinery	36		Shallow		SA	A	A	-	A	-	A	-	-	A	A	A
RW-17 [e]	Recovery	N Refinery	36		Shallow		SA	A	A	A	A	-	A	-	-	A	A	A
MW-117	Monitoring	N RO Reject Field	2	10 to 25	Shallow		SA	SA	SA	SA	SA	-	SA	-	-	SA	SA	SA
MW-118	Monitoring	N RO Reject Field	2	10 to 25	Shallow		SA	SA	SA	SA	SA	-	SA	-	-	SA	SA	SA
MW-119	Monitoring	N RO Reject Field	2	10 to 25	Shallow		SA	SA	SA	SA	SA	-	SA	-	-	SA	SA	SA
MW-18	Monitoring	NCL	8	15 to 19	Shallow		SA	A	A	-	A	-	A	A	A	A	A	A
MW-19	Monitoring	NCL	2		Shallow		A	No samples to be collected										
MW-45	Monitoring	NCL	2	10.5 to 15.5	Shallow		SA	SA	SA	-	SA	-	SA	SA	SA	SA	SA	SA
MW-53R	Monitoring	NCL	2	14 to 24	Shallow		SA	A	A	-	A	-	A	-	-	A	A	A
MW-54A	Monitoring	NCL	2	12.7 to 27.7	Shallow		SA	SA	SA	-	SA	-	SA	-	-	SA	SA	SA
MW-54B	Monitoring	NCL	2	33.8 to 43.8	Valley Fill		SA	B	B	B	B	-	B	-	-	B	B	B
MW-55	Monitoring	NCL	2	13.7 to 23.7	Shallow		SA	SA	SA	SA	SA	-	SA	SA	SA	SA	SA	SA
MW-56	Monitoring	NCL	2	13.4 to 23.4	Shallow		SA	A	A	-	A	-	A	-	-	A	A	A
MW-108	Monitoring	NCL	4	9 to 24	Shallow		SA	SA	SA	-	SA	-	SA	-	-	SA	SA	SA
NCL-31	Monitoring	NCL	2	13 to 18	Shallow		SA	SA	SA	-	SA	-	SA	-	-	SA	SA	SA
NCL-32	Monitoring	NCL	2	17 to 22	Shallow		SA	SA	SA	-	SA	-	SA	-	-	SA	SA	SA
NCL-33	Monitoring	NCL	2	13 to 18	Shallow		SA	SA	SA	-	SA	-	SA	-	-	SA	SA	SA
NCL-34A	Monitoring	NCL	2	16 to 21	Shallow	Y	SA	SA	SA	-	SA	-	SA	-	-	SA	SA	SA
NCL-44	Monitoring	NCL	2		Shallow		SA	SA	SA	-	SA	-	SA	-	-	SA	SA	SA
NCL-49	Monitoring	NCL	2	16.8 to 17.8	Shallow		SA	SA	SA	-	SA	-	SA	-	-	SA	SA	SA
KWB-2R	Monitoring	S Refinery	2		Shallow	Y	SA	SA	SA	-	SA	-	SA	-	-	SA	SA	SA
KWB-4	Monitoring	S Refinery	2	20 to 39	Shallow	Y	SA	SA	SA	-	SA	-	SA	-	-	SA	SA	SA
MW-28	Monitoring	S Refinery	6	25 to 30	Shallow	Y	SA	SA	SA	SA	SA	-	SA	SA	SA	SA	SA	SA
MW-48	Monitoring	S Refinery	2	19 to 34	Shallow	Y	SA	SA	SA	SA	SA	-	SA	-	-	SA	SA	SA
MW-50	Monitoring	S Refinery	2	12 to 27	Shallow		SA	SA	SA	-	SA	-	SA	-	-	SA	SA	SA
MW-52	Monitoring	S Refinery	2	19 to 34	Shallow		SA	SA	SA	SA	SA	-	SA	SA	SA	SA	SA	SA
MW-64	Monitoring	S Refinery	4	15 to 30	Shallow	Y	SA	SA	SA	SA	SA	-	SA	-	-	SA	SA	SA
MW-65	Monitoring	S Refinery	4	14.5 to 29.5	Shallow	Y	SA	SA	SA	SA	SA	-	SA	-	-	SA	SA	SA
MW-66	Monitoring	S Refinery	4	14.6 to 29.6	Shallow		SA	SA	SA	SA	SA	-	SA	SA	SA	SA	SA	SA
MW-99	Monitoring	S Refinery	4	12 to 27	Shallow	Y	SA	SA	SA	SA	SA	-	SA	-	-	SA	SA	SA
MW-101	Monitoring	S Refinery	4	8 to 23	Shallow		SA	SA	SA	SA	SA	-	SA	-	-	SA	SA	SA
MW-102	Monitoring	S Refinery	4	12 to 27	Shallow	Y	SA	SA	SA	SA	SA	-	SA	-	-	SA	SA	SA
MW-103	Monitoring	S Refinery	4	7 to 22	Shallow		SA	A	A	A	A	-	A	-	-	A	A	A
MW-104	Monitoring	S Refinery	4	3 to 18	Shallow		SA	SA	SA	SA	SA	-	SA	-	-	SA	SA	SA
MW-105	Monitoring	S Refinery	4	8 to 18	Shallow	Y	SA	SA	SA	SA	SA	-	SA	-	-	SA	SA	SA
MW-106	Monitoring	S Refinery	4	11 to 26	Shallow		SA	SA	SA	SA	SA	-	SA	-	-	SA	SA	SA
MW-107	Monitoring	S Refinery	4	12 to 22	Shallow	Y	SA	A	A	A	A	-	A	-	-	A	A	A
MW-109	Monitoring	S Refinery	2	15 to 29.5	Shallow		SA	SA	SA	SA	SA	-	SA	-	-	SA	SA	SA
MW-110	Monitoring	S Refinery	2	15 to 29.5	Shallow		SA	SA	SA	SA	SA	-	SA	-	-	SA	SA	SA
MW-130	Monitoring	S Refinery	2	30 to 45	Shallow		SA	SA	SA	SA	SA	-	SA	-	-	SA	SA	SA
MW-139	Monitoring	S Refinery	2	10 to 30	Shallow		SA	SA	SA	SA	SA	-	SA	-	-	SA	SA	SA
RA-313	Irrigation	S Refinery	10	904 to 1157	Artesian		NA	A	-	-	A	-	-	-	-	A	A	A
RW-4R [g]	Recovery	S Refinery	12	14.5 to 34.5	Shallow	Y	SA	A	A	-	A	-	A	-	-	A	A	A
RW-5R [g]	Recovery	S Refinery	12	13 to 33	Shallow	Y	SA	A	A	-	A	-	A	-	-	A	A	A
RW-6R [g]	Recovery	S Refinery	12	14.5 to 34.5	Shallow	Y	SA	A	A	-	A	-	A	-	-	A	A	A
RW-15 [e]	Recovery	S Refinery	36		Shallow	Y	SA	A	A	-	A	-	A	-	-	A	A	A
RW-19	Recovery	S Refinery	12	11 to 46	Shallow	Y	SA	A	A	-	A	-	A	-	-	A	A	A
MW-114	Monitoring	S RO Reject Field	2	20 to 35	Shallow		SA	SA	SA	SA	SA	-	SA	-	-	SA	SA	SA
MW-115	Monitoring	S RO Reject Field	2	10 to 25	Shallow		SA	SA	SA	SA	SA	-	SA	-	-	SA	SA	SA
MW-116	Monitoring	S RO Reject Field	2	10 to 25	Shallow		SA	SA	SA	SA	SA	-	SA	-	-	SA	SA	SA
MW-49	Monitoring	TEL	2	19 to 34	Shallow		SA	SA	SA	SA	SA	-	SA	SA	SA	SA	SA	SA

Table 1. 2021 Facility-Wide Groundwater Monitoring Program and Schedule

HollyFrontier Navajo Refining LLC - Artesia Refinery, Artesia, New Mexico

Well ID	Well Type	Associated Area	Well Construction [a]			Historic PSH? [b]	Gauging Frequency	Analytical Suite and Frequency [c, d]										
			Well Diameter (inch)	Screen Interval (ft bgs)	Water Bearing Zone			Purge Parameters	DRO	GRO	VOCs	SVOCs	Metals: As, Ba, Cr, Fe, Pb, Mn, Se	Metals: B, Cd, Co, Hg, Ni, U, Va	Cyanide	Cations/Anions	Nitrate / Nitrite as Nitrogen	Total Dissolved Solids
TEL-1	Monitoring	TEL	2	13 to 23	Shallow	Y	SA	SA	SA	SA	SA	-	SA	-	-	SA	SA	SA
TEL-2	Monitoring	TEL	2	13 to 23	Shallow	Y	SA	SA	SA	SA	SA	-	SA	-	-	SA	SA	SA
TEL-3	Monitoring	TEL	2	13 to 23	Shallow	Y	SA	SA	SA	SA	SA	-	SA	-	-	SA	SA	SA
TEL-4	Monitoring	TEL	2	13 to 23	Shallow		SA	SA	SA	SA	SA	-	SA	-	-	SA	SA	SA
MW-8	Monitoring	TMD	2		Shallow		SA	A	A	A	A	-	A	-	-	A	A	A
MW-9	Monitoring	TMD	2		Shallow		SA	No samples to be collected										
MW-16	Monitoring	TMD	4	8.5 to 19	Shallow		SA	A	A	-	A	-	A	-	-	A	A	A
MW-20	Monitoring	TMD	4	9.5 to 23.5	Shallow		SA	A	A	-	A	-	A	-	-	A	A	A
MW-21	Monitoring	TMD	4	7.5 to 22	Shallow		SA	SA	SA	SA	SA	-	SA	-	-	SA	SA	SA
MW-25	Monitoring	TMD	2	15.75 to 25.25	Shallow		SA	A	A	-	A	-	A	-	-	A	A	A
MW-26	Monitoring	TMD	2	15.25 to 24.25	Shallow		SA	A	A	-	A	-	A	-	-	A	A	A
MW-27	Monitoring	TMD	2	18.25 to 27.75	Shallow		SA	A	A	-	A	-	A	-	-	A	A	A
MW-46R	Monitoring	TMD	2	3.5 to 18.5	Shallow		SA	SA	SA	-	SA	-	SA	-	-	SA	SA	SA
MW-68	Monitoring	TMD	2	14.75 to 24.5	Shallow		SA	A	A	-	A	-	A	-	-	A	A	A
MW-71	Monitoring	TMD	2	9.75 to 19.5	Shallow		SA	A	A	-	A	-	A	A	A	A	A	A
MW-89	Monitoring	TMD	4	2 to 17	Shallow		SA	A	A	-	A	-	A	-	-	A	A	A
NP-1	Monitoring	TMD	2	9.5 to 19	Shallow		SA	SA	-	-	SA	-	-	-	-	A	A	A
NP-2	Monitoring	TMD	2	9.5 to 18.5	Shallow		SA	No samples to be collected										
NP-3	Monitoring	TMD	2	9.5 to 18.5	Shallow		SA	No samples to be collected										
NP-4	Monitoring	TMD	2	24.5 to 33.5	Shallow		SA	No samples to be collected										
NP-6	Monitoring	TMD	2	8.75 to 18.75	Shallow		SA	B	-	-	B	-	-	-	-	-	-	-
NP-8	Monitoring	TMD	2		Shallow		SA	No samples to be collected										
NP-9	Monitoring	TMD	2		Shallow		SA	No samples to be collected										
UG-1	Monitoring	Up-gradient	4	8 to 23	Shallow		A	A	A	A	A	-	A	A	A	A	A	A
UG-2	Monitoring	Up-gradient	4	15 to 30	Shallow		A	A	A	A	A	-	A	A	A	A	A	A
UG-3R	Monitoring	Up-gradient	4	17 to 37	Shallow		A	A	A	A	A	-	A	A	A	A	A	A
UG-4	Monitoring	Up-gradient	2	19.5 to 39.5	Shallow		A	A	A	A	A	-	A	A	A	A	A	A

Note: Blank cells indicate that information is not available or applicable.

Abbreviations:

A = Annual (March/April event)
B = Biennial (March/April event in odd calendar years)
DRO = Diesal Range Organics
E = East
EP = Evaporation Ponds
ft bgs = feet below ground surface
ft btoc = feet below top of casing
ft MSL = feet Mean Sea Level
GRO = Gasoline Range Organics
N = North
NA = Not accessible
NCL = North Colony Landfarm
OCD = Oil Conservation District
S = South
SA = Semi-annual (March/April and September/October events)
TEL = Tetra Ethyl Lead Impoundment
TMD = Three Mile Ditch
TPH = Total Petroleum Hydrocarbons
VOCs = Volatile Organic Compounds
Y = Yes

Footnotes:

[a] Available well construction information provided.

[b] PSH was present during previous groundwater monitoring events or a recovery pump is in place. Recovery wells are gauged at least monthly.

[c] Analytical Suite to include the following:

1. Purge parameters pH, temperature, specific conductivity, dissolved oxygen, oxygen-reduction potential, and turbidity will be measured and recorded in the field.
2. Diesel Range Organics (DRO) by Method 8010Mod.
3. Gasoline Range Organics (GRO) by Method 8010Mod.
4. Volatile organic compounds (VOCs) by Method 8260, to include methyl tert butyl ether (MTBE), naphthalene, and tert-butyl alcohol (TBA).
5. Semi-volatile organic compounds (SVOCs) by Method 8270.
6. Total metals by Method 6010/6020 and/or 7470. Specific metals shown in table heading (symbols from periodic chart).
7. Dissolved metals - same list as total metals, but only analyzed during March/April event.
8. Cyanide by Method SM4500.
9. Cations/anions to include Calcium, Potassium, and Sodium by Method 6010 or 6020 and Chloride, Fluoride, and Sulfate by Method 300 or 9056.
10. Nitrates/Nitrites as Nitrogen by Method 300.
11. Total Dissolved Solids by Method 2540C.

"-" indicates parameter not required.

Note - *samples will not be collected from any well where PSH is measured to be 0.03 feet thick or greater.*

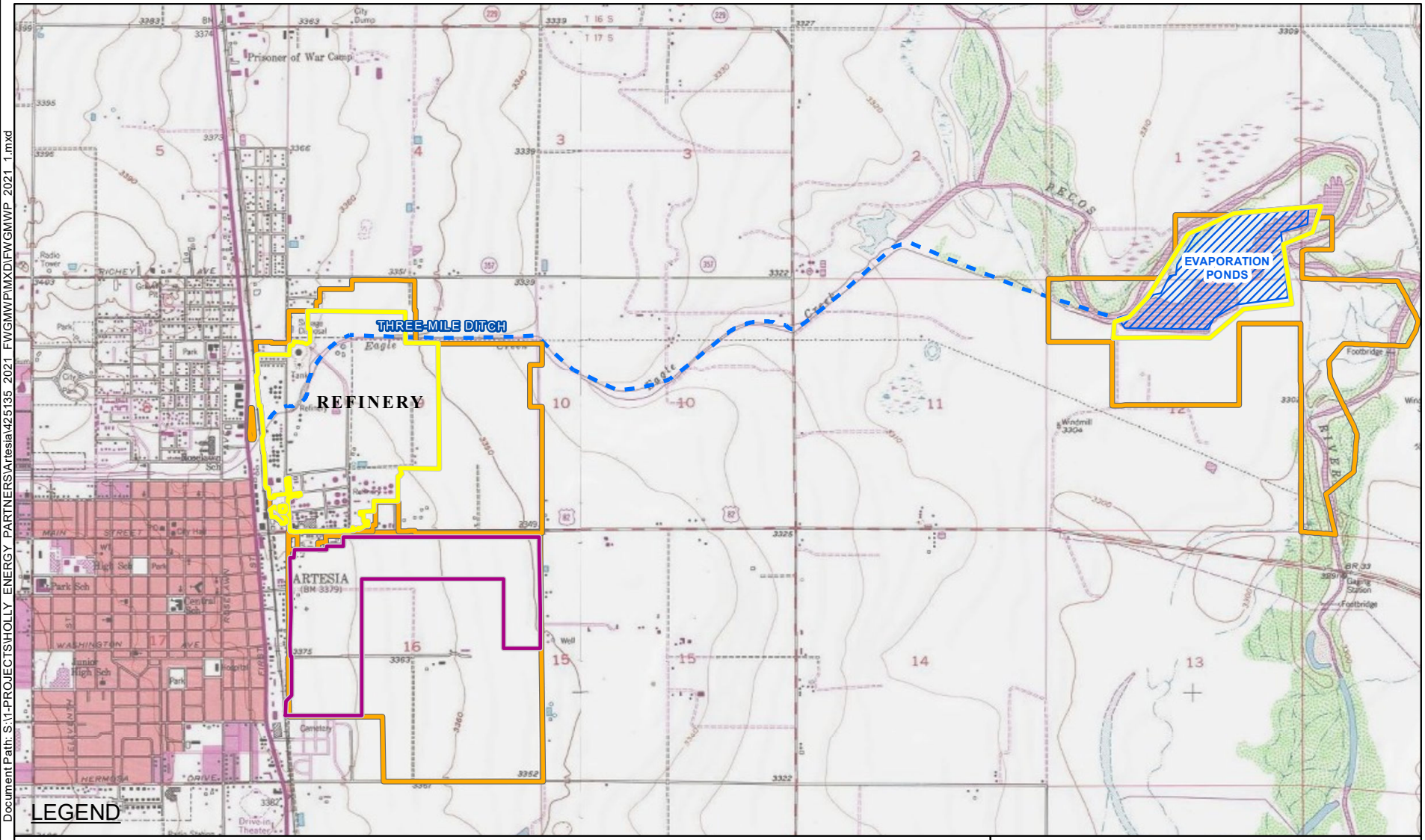
[d] Groundwater will be purged and sampled from wells as indicated using either a peristaltic pump (for sampling depths of approximately 25 feet bgs or less) or a dedicated, stainless steel submersible pump (for sampling depth greater than 25 feet bgs).

[e] Recovery trenches 11, 15, 16, 17, and 18 have multiple "wells". Gauging and sampling points are as follows: RW #11-0, RW #15C, RW #16B, RW #17A, and RW #18A.

[f] Wells will be gauged and/or sampled only if the landowner grants access.

[g] Recovery well RW-1, RW-2, RW-4, RW-5, RW-6, RW-7, RW-8, RW-12, RW-13, and RW-14 will be sampled instead if a recovery pump is installed in associated recovery well RW-1R, RW-2R, RW-4R, RW-5R, RW-6R, RW-7R, RW-8R, RW-12R, RW-13R, and RW-14R.

Figures



LEGEND

- FENCELINE
- HFNR PROPERTY BOUNDARY (FENCELINE SHOWN WHERE COINCIDENT)
- PROPOSED PTU FENCELINE
- THREE-MILE DITCH
- EVAPORATION PONDS

SOURCE: BASE MAP USGS 7.5 MINUTE SERIES QUADS, ARTESIA AND SPRINGLAKE QUADRANGLES, 1955, PHOTOREVISED 1983.

N

0 1,600 3,200
Feet

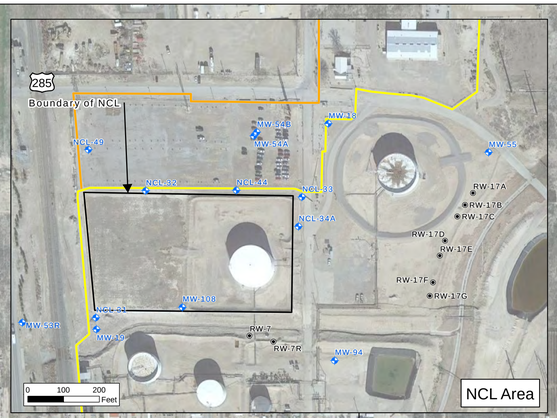
SITE LOCATION MAP

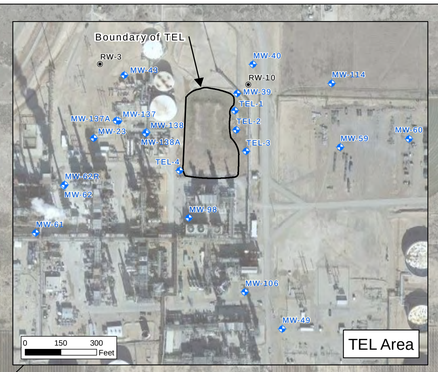
HOLLYFRONTIER NAVAJO REFINING LLC
ARTESIA REFINERY, EDDY COUNTY, NEW MEXICO

PROJECT NUMBER: 425135	FILE NAME: FWGMWP_2021_1
AUTHOR: MHORN	DATE: 6/23/2021

TRC
505 E. HUNTLAND DR.
SUITE 250
AUSTIN, TX 78752
PH:512-329-6080

FIGURE 1





LEGEND

- IRRIGATION WELL
- MONITORING WELL
- RECOVERY WELL
- FENCELINE
- HFNR PROPERTY BOUNDARY (FENCELINE SHOWN WHERE COINCIDENT)

N W E S

0 800 1,600 Feet

1 IN = 800 FT

NOTE:

1. THE FOLLOWING WELLS WERE INSTALLED IN SEPTEMBER 2020:
   MW-53R
   MW-62R
   MW-137A
   MW-138A
   MW-145
   MW-146
   MW-147
   MW-148

WELL LOCATION MAP

HOLLYFRONTIER NAVAJO REFINING LLC
ARTESIA REFINERY, EDDY COUNTY, NEW MEXICO

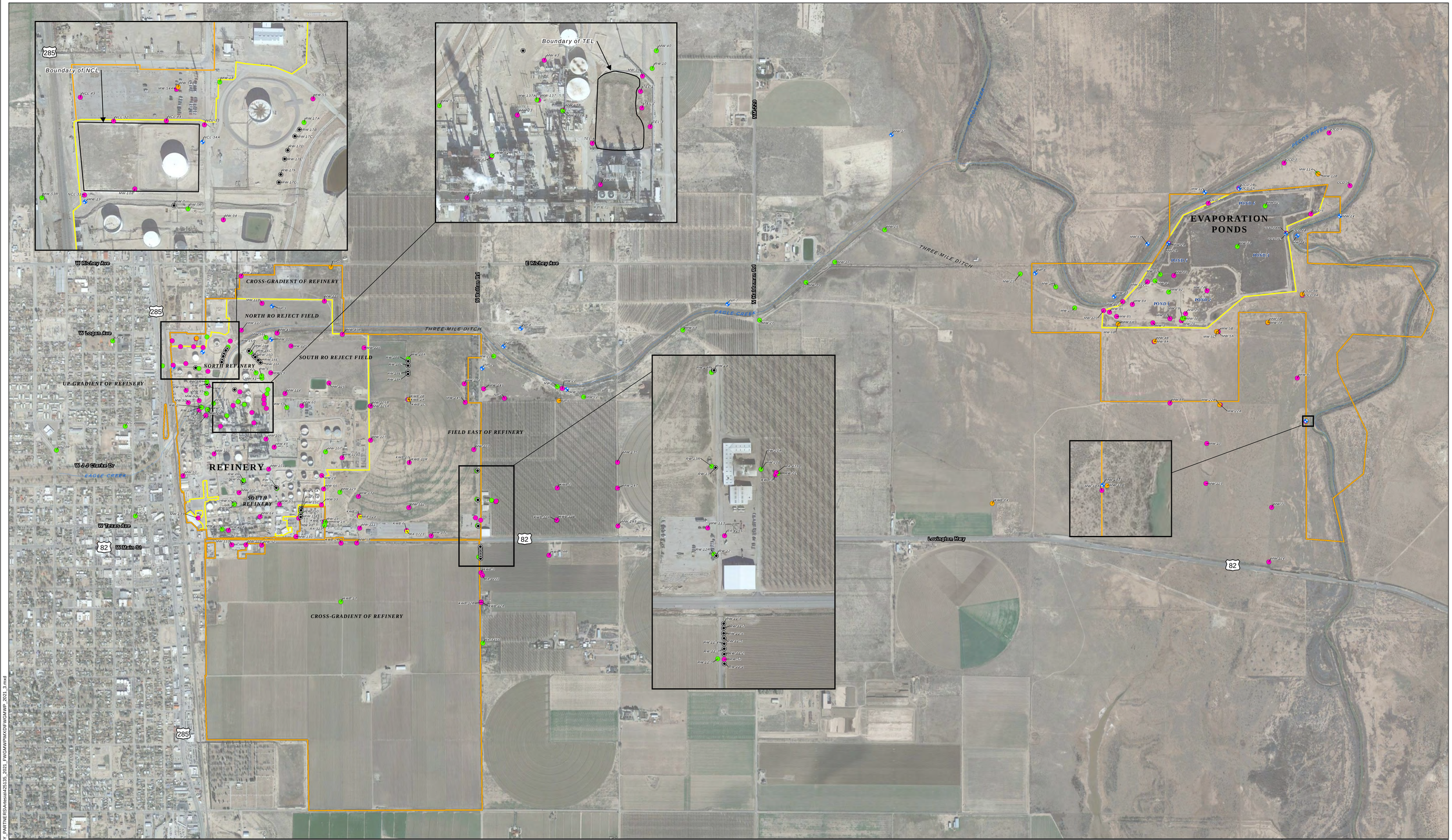
AUTHOR: MHORN	SAVED: 6/11/2021	MXD: FWGMWP_2021_2

TRC
505 E. HUNTLAND DR.
SUITE 250
AUSTIN, TX 78752
PH:512-329-6080

FIGURE 2

AERIAL IMAGERY SOURCE: GOOGLE EARTH PRO AND THEIR DATA PARTNERS, 12/29/2019.

Document Path: S:\1-PROJECTS\HOLLY_ENERGY_PARTNERS\Artesia\425135_2021_FWGMWP\MXD\FWGMWP_2021_2.mxd



LEGEND

- IRRIGATION WELL NOT INCLUDED IN SAMPLING PLAN
- MONITORING WELL NOT INCLUDED IN SAMPLING PLAN
- RECOVERY WELL NOT INCLUDED IN SAMPLING PLAN
- WELL TO BE SAMPLED ON A SEMI-ANNUAL BASIS
- WELL TO BE SAMPLED ON AN ANNUAL BASIS
- WELL TO BE SAMPLED ON A BIENNIAL BASIS
- HFNR PROPERTY BOUNDARY (FENCELINE SHOWN WHERE COINCIDENT)
- FENCELINE

N W E S

0 800 1,600
Feet

1 IN = 800 FT

NEW MEXICO

AERIAL IMAGERY SOURCE: GOOGLE EARTH PRO AND THEIR DATA PARTNERS, 12/29/2019.

Document Path: S:\1-PROJECTS\HOLLY_ENERGY_PARTNERS\Artesia\425135_2021_FWGMWP\MXD\FWGMWP_2021_3.mxd

FACILITY-WIDE GROUNDWATER SAMPLING PLAN

HOLLYFRONTIER NAVAJO REFINING LLC
ARTESIA REFINERY, EDDY COUNTY, NEW MEXICO

AUTHOR: MHORN	SAVED: 6/11/2021	MXD: FWGMWP_2021_3

TRC
505 E. HUNTLAND DR.
SUITE 250
AUSTIN, TX 78752
PH:512-329-6080

FIGURE 3

From:	Leik, Jason
To:	Cobrain, Dave, NMENV; Tsinnajinnie, Leona, NMENV; Chavez, Carl J, EMNRD; Wade, Gabriel, EMNRD; McDill, Teresa L, EMNRD
Cc:	Tupou, Kawika; Speer, Julie; Pearson, Christopher; Smith, Catriona V.; Dade, Randy
Subject:	[EXT] HollyFrontier Navajo Refining LLC, Artesia Refinery - Groundwater and Phase-Separated Hydrocarbon Recovery System Enhancements, Reinjection Pilot Test Status Report
Date:	Wednesday, May 19, 2021 12:06:17 PM
Attachments:	HFNR Artesia Pilot Test Status Rpt 01 FINAL 05182021.pdf

Mr. Cobrain and Ms. McDill,

Please find attached an electronic copy of the first status report for the groundwater reinjection pilot test at the HollyFrontier Navajo Refining LLC refinery in Artesia. A hard copy of this report is being sent to NMED to Mr. Pierard's attention. We will also upload this electronic version to the OCD portal.

Based on the gamma logging and baseline data collected to date, we believe the primary test locations selected in the Pilot Test Work Plan (MW-131 and RW-19) are suitable for testing and will provide representative data for design of the full scale system. As indicated in the status report, we would like to begin well installation for the additional monitoring and reinjection wells at these locations on or about the third week of June. If you would like to set up a call prior to that date to discuss the contents of this update report or the path forward, please let me know.

Please don't hesitate to contact me if you have any questions or need any additional information regarding this status report.

Respectfully,
Jason

Jason Leik, P.E.
Corporate Environmental Specialist - Remediation
HollyFrontier Corporation
2828 N Harwood St, Suite 1300
Dallas, TX 75201
Office 214-871-3408
Cell 214-970-8902

message or any attachments.Unless expressly stated, nothing contained in this message should be construed as a digital or electronic signature or a commitment to a binding agreement.

HollyFrontier Navajo Refining LLC
501 East Main, Artesia, New Mexico 88210
Tel: 575-748-3311
hollyfrontier.com

May 18, 2021

Mr. Kevin Pierard
Chief, Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87505

Ms. Teresa McDill
New Mexico Energy, Minerals & Natural Resources Department
Oil Conservation Division, Environmental Bureau
TeresaL.McDill@state.nm.us

Re: Status Report – Groundwater and Phase-Separated Hydrocarbon Recovery System Enhancements, Reinjection Pilot Test
HollyFrontier Navajo Refining LLC, Artesia Refinery
RCRA Permit No. NMD048918817
Discharge Permit GW-028

Dear Mr. Pierard and Ms. McDill:

Please find attached the first status report for the groundwater reinjection pilot test at the HollyFrontier Navajo Refining LLC (HFNR) refinery located in Artesia, New Mexico. The status report summarizes the gamma log survey and initial baseline groundwater monitoring event conducted in accordance with the *Revised Groundwater and Phase-Separated Hydrocarbon Recovery System Enhancements: Reinjection Pilot Test Work Plan* (Work Plan).

Results of the gamma log survey and initial baseline groundwater monitoring indicate that the primary pilot testing locations proposed in the Work Plan (near MW-131 and RW-19) are suitable for the pilot test. HFNR plans to proceed with the next steps of the Work Plan, which includes installation of recovery, injection, and monitoring wells at the primary locations proposed in the Work Plan, followed by aquifer testing, collection of additional baseline trend data, and installation of the reinjection and treatment system. The well installation is tentatively scheduled to commence the week of June 21, 2021. HFNR would be happy to set up a call to discuss any NMED or OCD questions or concerns regarding the data provided in the status report or the path forward, including the schedule, for the pilot test.

If you should have any questions or comments regarding this status report, please feel free to contact me at (575) 746-5487 or Jason Leik at (214) 970-8902.

Sincerely,

Kawika Tupou
Environmental Manager
HollyFrontier Navajo Refining LLC

cc: NMED: D. Cobrain, L. Tsinnajinnie
OCD: C. Chavez, G. Wade
HFC: J. Leik
TRC: J. Speer, C. Pearson, C. Smith

Status Report
Groundwater and PSH Recovery System Enhancements, Reinjection Pilot Test
HollyFrontier Navajo Refining LLC
Artesia Refinery
May 18, 2021

1.0 INTRODUCTION

This status report summarizes the gamma log survey and initial baseline groundwater monitoring event conducted at the HollyFrontier Navajo Refining LLC (HFNR) Artesia Refinery (refinery) as part of the groundwater reinjection pilot test detailed in the *Revised Groundwater and Phase-Separated Hydrocarbon Recovery System Enhancements: Reinjection Pilot Test Work Plan* (Work Plan). The gamma log survey and groundwater monitoring were conducted in accordance with the revised Work Plan dated December 2019 with updated replacement pages dated May 2020, for which the New Mexico Environment Department (NMED) provided notice to proceed in an email dated June 25, 2020. The planned pilot test will consist of extraction of affected groundwater, removal of phase-separated hydrocarbons (PSH), if present, and reinjection of the extracted water with amendments (terminal electron acceptors and nutrients) to enhance in situ anaerobic degradation of dissolved-phase hydrocarbons.

The gamma log survey summarized in this status report was conducted to evaluate the proposed pilot test locations and confirm they are appropriate and feasible for pilot testing, as well as confirm the current design is appropriate for the identified target zone. The initial baseline groundwater monitoring event was conducted to collect initial baseline trend data which will be used to further evaluate the existing groundwater quality and potentiometric surface prior to initiation of the pilot test.

2.0 GAMMA LOG SURVEY

Two primary locations (near MW-131 and RW-19) were proposed for pilot testing in the agriculture field located east of the refinery (East Field) based on the selection criteria described in Section 4.2 of the Work Plan. These proposed pilot test locations are shown on **Figure 1**. Based on the geologic, geophysical, and contaminant migration investigation results from previous investigation in the East Field, preliminary pilot test locations for injection, recovery, and monitoring were proposed with the intent of testing the effects of amendment and recovery in silty sand and gravel, both of which are prevalent in the observed preferential groundwater flow pathways in the East Field. Pilot test injection, monitoring, and recovery wells at each proposed test location will be oriented eastward (following groundwater flow direction) with the intent of having all test wells screened within the same, continuous coarse-grained lithologic zones (target zone), to the degree feasible. Each pilot test location will consist of one recovery well, one injection well, and at least five new monitoring wells, as shown in Figures 2a and 2b of the Work Plan and this status report. One pilot test area was proposed to target zones with more gravel (near RW-19) and the other pilot test area was proposed to target zones with more silty sand (near MW-131). A gamma log survey was completed to verify the presence, depth, thickness, and extent of the target lithologic interval and confirm the proposed locations are appropriate and feasible for pilot testing. The gamma log survey activities and results are summarized below.

2.1 GAMMA LOG SURVEY ACTIVITIES

Downhole gamma log surveys were completed in existing monitoring and recovery wells located within and surrounding the proposed primary pilot test locations. Collier Geophysics completed downhole gamma log surveys on December 22, 2020, in the following wells located in the immediate vicinity of the proposed pilot test locations: KWB-4, RW-19, and MW-131. TRC Environmental Corporation (TRC) completed downhole gamma log surveys on February 24-26, 2021, in the following wells located within, upgradient, crossgradient, and downgradient of the proposed primary pilot test locations: KWB-4, KWB-5, RW-19, MW-28, MW-58, MW-65, MW-66, MW-99, MW-111, MW-112, MW-128, MW-129, MW-130, and MW-131. Downhole gamma log surveys were also completed in wells MW-50 and MW-105 which are located near an alternate pilot test location identified in the Work Plan should the primary locations be determined to not be feasibly for pilot testing. A well location map is provided as **Figure 1**.

A gamma tool (9014 or 9512) manufactured by Century Geophysical, LLC was used to complete the gamma logging in December 2020. A gamma tool (2PGA-1000) manufactured by Mount Sopris Instruments Company, was used to complete the gamma logging in February 2021. These tools measure natural gamma rays using a sodium iodide crystal. In December 2020, one gamma log survey was completed in each well from the well total depth (less the length from the bottom of the tool to the gamma detector). In February 2021, two gamma log surveys were completed in each well – one from the ground surface to the well total depth (less the approximate 0.5-foot plug beneath the gamma detector at the bottom of the tool) and one from the well total depth to the ground surface. The tool was programmed to measure gamma approximately every 0.1 to 0.2 feet for each survey in each well. The gamma measurements were downloaded to a laptop computer immediately after each survey. The gamma tool was decontaminated between each well following the procedures outlined in Section 5.3.6 of the Work Plan.

2.2 GAMMA LOG SURVEY RESULTS

The gamma measurements were plotted relative to depth and elevation and compared to the existing soil boring log and well construction information, except for MW-50 for which there is no soil boring or well construction log available. The resulting logs are provided as **Attachment A**. The gamma log readings, shape, and relative deflection coupled with the observations noted on the soil boring logs indicate the following:

- The shallow subsurface lithology across the gamma log survey area in the southeastern portion of the refinery and the East Field is relatively consistent and primarily consists of finer grained material (silty clay to clayey silt) from the ground surface to an average approximate depth of 20 feet below ground surface (bgs), a coarser grained interval (target lithologic zone) from 20 feet bgs to an average approximate depth of 25 feet bgs, and an underlying confining unit (clay to silty clay). The subsurface lithology in the upgradient alternate proposed pilot test locations within the western portion of the refinery (near MW-50 and MW-105) is similar to the primary pilot test locations, but the target lithologic zone is present at a shallower depth of 7.5-14 feet bgs at MW-105 and 16-20 feet bgs at MW-50.

- The target zone at each well location consists of a silty sand (well graded or poorly sorted) overlying a sand to gravel (poorly graded or well sorted). This zone appears to be continuous across the East Field at a thickness ranging from approximately 5 to 9 feet, with the thickness generally increasing to the south. The top of the target zone in the East Field is present at an elevation ranging from approximately 3,337 feet above mean sea level (amsl) to 3,350 feet amsl, with the elevation decreasing eastward (in the same direction as groundwater flow). The target zone across the East Field is shown on simplified fence diagrams developed with the gamma logs that are provided as **Figures 3 through 5**.

- The clay to silty clay interval underlying the target zone does not have as strong of a gamma signature as the uppermost silty clay to clayey silt material indicating potassium has been leached or "washed out" from this interval. Observations noted on the soil boring logs indicate this interval is an apparent confining unit based on the noted lithology (clay to silty clay), lack of moisture, and lack of indications of hydrocarbon impacts (no odors, elevated photo ionization detector (PID) readings, or staining), compared to the overlying target zone.

The results of the gamma log survey indicate the proposed pilot test locations near MW-131 and RW-19 are feasible for pilot testing as the target groundwater reinjection zone (coarse-grained lithologic interval) was verified to be present at a relatively consistent depth and thickness at both these locations and in the surrounding areas. Even though the gamma logging results did not indicate there is an obvious relative difference in the amount of silty sand and gravel between the two proposed test locations, these locations will still allow for testing the effects of amendment and recovery in both of these predominant lithologies in the observed preferential groundwater flow pathways in the East Field.

3.0 INITIAL BASELINE GROUNDWATER MONITORING

Groundwater monitoring was completed at existing wells to collect initial baseline trend data which will be used to evaluate existing groundwater quality and potentiometric surface prior to startup of the pilot test extraction and reinjection systems. Results of baseline water quality testing will be used to (1) calculate the range of dosing of amendment(s) in the water treatment area and (2) determine baseline conditions to be used to evaluate the effectiveness of the sulfate and nitrogen amendment(s) in reducing dissolved-phase concentrations in the vicinity of the reinjection zone during the pilot test. Additionally, water level data recorded during the baseline period may be utilized to evaluate mounding and/or drawdown changes in groundwater levels observed during the pilot test. The baseline period will include data collected from this initial monitoring event through the forthcoming installation of the pilot test wells (injection, monitoring, and recovery) and completion of the subsequent baseline monitoring event which will include the new pilot test wells. The initial baseline groundwater monitoring activities and results are summarized below. A more detailed discussion of the monitoring activities and results will be provided in a subsequent progress report after completion of the baseline period, and in the Final Investigation Report after completion of the pilot test.

3.1 INITIAL BASELINE GROUNDWATER MONITORING ACTIVITIES

TRC conducted initial baseline groundwater monitoring on November 18-20, 2020 and December 14-15, 2020. The initial monitoring consisted of gauging and sampling the following existing wells located

within, upgradient, proximal and peripheral downgradient, and crossgradient of each proposed pilot test location: RW-15C, RW-19, KWB-4, KWB-5, MW-48, MW-66, MW-99, MW-111, MW-112, MW-129, and MW-131. These wells were all gauged in November and December 2020. Groundwater samples were collected from wells KWB-4, KWB-5, MW-48, MW-66, MW-111, and MW-131 in November 2020, and from wells RW-19, MW-99, MW-112, and MW-129 in December 2020. The monitoring was conducted in accordance with Sections 5.2.1 and 5.2.7 of the Work Plan with the following exception – groundwater samples were collected from wells with the presence of PSH at a measured thickness greater than or equal to 0.03 feet, per discussion with NMED via telephone call on November 18, 2020. A groundwater sample was not collected from RW-15C due to limited water column beneath the PSH.

3.2 INITIAL BASELINE GROUNDWATER MONITORING RESULTS

Initial baseline gauging results are summarized in **Table 1**. PSH was present in wells KWB-4, KWB-5, MW-48, MW-99. MW-111, MW-112, MW-129, MW-131, RW-15C, and RW-19, at apparent thicknesses ranging from 0.04 feet in MW-48 in December 2020 to 3.01 feet in MW-112 in December 2020. As described in the *2020 Annual Groundwater Monitoring Report* submitted to the NMED in February 2021, the increased occurrence and thickness of PSH in the East Field are attributed to reductions in groundwater elevations which have decreased across the refinery since 2018. Groundwater elevations in many wells in the East Field were at a historical minimum in 2020.

Initial baseline groundwater analytical results of dissolved-phase hydrocarbons are summarized in **Table 2** and monitored natural attenuations parameters are summarized in **Table 3**. Analytical reports and the data validation summary are provided as **Attachment B**. The initial baseline groundwater sampling results further indicate dissolved-phase hydrocarbons are being actively degraded under anaerobic conditions, and most likely via sulfate-reducing bacteria (SRBs) as follows:

- There is an inverse concentration correlation between sulfate and dissolved-phase hydrocarbon constituents in groundwater. Sulfate concentrations upgradient (west) of the refinery range from between 1,000 to 3,000 milligrams per liter (mg/L) as presented in the *2020 Annual Groundwater Monitoring Report*, while sulfate concentrations within the dissolved hydrocarbon plume below the East Field range from <0.594 mg/L to 337 mg/L.

- Qualitative SRB field screening (e.g., BART™ Hach Tests) results indicated dense anaerobic SRBs are present in groundwater at an approximate population of >115,000 colony forming units per milliliter (cfu/mL), which is an “aggressive” reaction as defined by the screening kit. This field screening does not account for the greater portion of the SRB population that is adhered to the soil matrix within the target zone.

- Oxidation reduction potential (ORP) within the East Field ranges from -61 millivolts (mV) to -375 mV indicating anaerobic conditions.

- There is preferential degradation of more readily degraded isomers in trimethylbenzene and xylenes isomer pairs. Under sulfate reducing conditions, o-xylenes are typically more degradable than m/p-xylenes, and 1,3,5-trimethylbenzene is more degradable than 1,2,4-trimethylbenzene. In some groundwater samples, o-xylenes were detected at concentrations

less than 1/10th the concentration of m/p-xylenes and 1,3,5-trimethylbenzene detected at concentrations less than 1/10th the concentration of 1,2,4-trimethylbenzene.

The initial baseline groundwater monitoring results for total Kjeldahl nitrogen (TKN) were less than 2 mg/L, indicating nitrogen in the form of ammonia should be added to the system with sulfate to amend the two most likely rate-limiting nutrients. Qualitative field screening results for acid-producing bacteria (APB) using BART™ Hach Tests indicated APB are not present above 2 cfu/mL ("not aggressive" as defined by the screening kit), and therefore, acidification of the groundwater is not occurring with hydrocarbon degradation.

A more thorough evaluation of the baseline groundwater monitoring results, including an estimation of the assimilative capacity of each terminal electron acceptor for biodegradation of the dissolved hydrocarbons (dissolved oxygen, nitrate, ferrous iron, manganese, sulfate and methane) will be provided at the end of the baseline period, following installation of the pilot test wells.

4.0 CONCLUSIONS AND PATH FORWARD

Results of the gamma log survey and initial baseline groundwater monitoring indicate that the two proposed pilot testing locations near MW-131 and RW-19 are both suitable for the pilot test and are consistent with the selection criteria specified in Section 4.1 of the Work Plan. Gamma log results at the primary locations (MW-131 and RW-19) were consistent with the gamma logs from the alternate locations, and the groundwater samples collected to date indicate the primary locations are impacted with dissolved phase constituents and PSH similar to the alternate locations. Thus, the primary locations will provide meaningful data for design of the full scale system.

Based on the data in this memo, HFNR plans to proceed with the next steps of the pilot test Work Plan, which includes installation of the injection, monitoring, and recovery wells at the primary locations proposed in the Work Plan. The wells will be installed in accordance Sections 5.2.2 and 5.3.1 of the Work Plan. Aquifer testing will be completed at the new wells as detailed in Section 5.2.3 of the Work Plan. Groundwater baseline trend data will continue to be collected from the existing wells (consistent with the initial baseline monitoring event) and the newly installed pilot test wells in accordance with Sections 5.2.1 and 5.2.7 of the Work Plan. HFNR would be happy to set up a call to discuss any NMED or OCD questions or concerns regarding this data.

Tables

Table 1. Initial Baseline Well Gauging Results

Status Report – Groundwater and PSH Recovery System Enhancements, Reinjection Pilot Test
HollyFrontier Navajo Refining LLC, Artesia Refinery

	Well Construction Details					Gauging Results				
Well ID	Land Surface Elevation (ft amsl)	TOC Elevation (ft amsl)	Top of Screen Elevation (ft amsl)	Screen Interval (ft bgs)	Well Diameter (inch)	Date Measured	Depth to LNAPL (ft btoc)	Depth to Water (ft btoc)	Corrected Groundwater Elevation (ft amsl)	LNAPL Thickness (ft)
KWB-4	3,368.36	3,370.25	3,348.36	20 to 39	4	11/18/2020	27.19	29.49	3,342.60	2.30
KWB-4	3,368.36	3,370.25	3,348.36	20 to 39	4	12/14/2020	27.05	30.00	3,342.61	2.95
KWB-5	3,362.60	3,364.72	3,337.90	24.7 to 38.7	2	11/18/2020	26.22	28.27	3,338.09	2.05
KWB-5	3,362.60	3,364.72	3,337.90	24.7 to 38.7	2	12/14/2020	26.38	28.37	3,337.94	1.99
MW-48	3,363.04	3,362.97	Unknown	Unknown	2	11/18/2020	21.60	21.75	3,341.34	0.15
MW-48	3,363.04	3,362.97	Unknown	Unknown	2	12/14/2020	21.73	21.77	3,341.23	0.04
MW-66	3,363.66	3,363.46	3,349.06	14.6 to 29.6	4	11/18/2020	--	20.30	3,343.16	--
MW-66	3,363.66	3,363.46	3,349.06	14.6 to 29.6	4	12/14/2020	--	20.43	3,343.03	--
MW-99	3,365.11	3,364.51	3,353.11	12 to 27	4	11/18/2020	20.95	22.57	3,343.24	1.62
MW-99	3,365.11	3,364.51	3,353.11	12 to 27	4	12/14/2020	20.77	22.66	3,343.36	1.89
MW-111	3,362.52	3,365.51	3,337.52	25 to 40	2	11/18/2020	27.42	28.73	3,337.83	1.31
MW-111	3,362.52	3,365.51	3,337.52	25 to 40	2	12/14/2020	27.53	28.88	3,337.71	1.35
MW-112	3,355.38	3,358.38	3,330.38	25 to 35	2	11/18/2020	23.60	25.90	3,334.32	2.30
MW-112	3,355.38	3,358.38	3,330.38	25 to 35	2	12/14/2020	23.82	26.83	3,333.96	3.01
MW-129	3,363.10	3,362.91	3,343.10	20 to 50	2	11/18/2020	23.89	25.05	3,338.79	1.16
MW-129	3,363.10	3,362.91	3,343.10	20 to 50	2	12/14/2020	24.03	25.25	3,338.63	1.22
MW-131	3,360.40	3,363.49	3,340.40	20 to 50	2	11/18/2020	26.16	27.92	3,336.98	1.76
MW-131	3,360.40	3,363.49	3,340.40	20 to 50	2	12/14/2020	26.30	28.18	3,336.81	1.88
RW-15C	3,362.65	3,361.41	Unknown	Unknown	36	11/18/2020	19.58	20.23	3,341.70	0.65
RW-15C	3,362.65	3,361.41	Unknown	Unknown	36	12/14/2020	19.70	>22.35	--	>2.65
RW-19	3,367.09	3,369.11	3,356.09	11 to 46	12	11/18/2020	28.10	28.18	3,340.99	0.08
RW-19	3,367.09	3,369.11	3,356.09	11 to 46	12	12/14/2020	26.90	27.00	3,342.19	0.10

ft amsl = feet above mean sea level
ft bgs = feet below ground surface
ft btoc = feet below top of casing
ft = feet

Table 2. Initial Baseline Groundwater Monitoring Results - Dissolved Hydrocarbons

Status Report – Groundwater and PSH Recovery System Enhancements, Reinjection Pilot Test
HollyFrontier Navajo Refining LLC, Artesia Refinery

	Analyte	TPH DRO	TPH GRO	1,2,4-TMB	1,3,5-TMB	Benzene	Toluene	Ethylbenzene	m,p-Xylene	o-Xylene	Xylenes, total	MTBE	Naphthalene
	Unit	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
	CGWSL	0.0858	0.0101	0.0560	0.0600	0.00500	1.00	0.700	0.193	0.193	0.620	0.100	0.0300
	CGWSL Source	NMED TPH	NMED TPH	USEPA TW	USEPA TW	WQCC HH	WQCC HH	WQCC HH	NMED TW	NMED TW	WQCC HH	WQCC Dom	WQCC HH
Well ID	Dup / Date												
KWB-4	11/20/2020	**9.20**	**15.7 B**	**0.254**	0.0455 J	**2.06**	0.0527 J	0.632	**0.440**	0.0469 J	0.487	**5.27**	**0.120 J**
KWB-5	11/20/2020	**4.16**	**24.8 B**	**0.764**	**0.148 J**	**2.27**	0.232	**1.26**	**2.28**	**0.315**	**2.60**	**8.21**	**0.270 J**
MW-48	11/19/2020	**4.97**	**5.08**	**0.115 J6**	0.0101	**0.946 V**	0.0544	0.131 J6	0.115	0.00748 J	0.122	**0.441 V**	**0.0332 J**
MW-66	11/18/2020	**3.93**	**3.11**	<0.000322	<0.000104	**1.35**	0.00741	0.00900	0.00894	0.00245	0.0114	**2.93**	**0.165 J**
MW-99	12/15/2020	**5.19**	**38.5 J3**	**0.548 V**	**0.110**	**3.43**	**2.87**	**1.42**	**2.15**	**0.913**	**3.06**	**2.97 V**	**0.197 J6**
MW-111	11/20/2020	**2.48**	**7.65**	**0.187**	0.0407	**1.05**	0.00976	0.515	**0.541**	0.0285	0.570	**1.33**	**0.0803**
MW-112	12/15/2020	**2.96**	**22.1**	**0.407**	**0.104**	**2.04**	0.228	**1.05**	**1.72**	**0.553**	**2.27**	**1.07**	**0.166**
MW-129	12/14/2020	**3.92**	**22.6**	**0.243**	0.0556	**1.18**	**1.88**	**0.793**	**1.14**	**0.353**	**1.49**	**4.17**	**0.0971**
MW-131	11/19/2020	**2.64**	**34.0**	**0.400**	**0.0876**	**5.09**	**5.38**	**0.860**	**1.72**	**0.736**	**2.46**	**3.61**	**0.0700 J**
MW-131	FD 11/19/2020	**2.41**	**31.9**	**0.479**	**0.114**	**5.60**	**5.84**	**0.945**	**2.04**	**0.834**	**2.87**	**4.86**	**0.0808**
RW-19	12/14/2020	**9.02**	**20.5**	**0.568**	0.0296 J	**2.06**	0.0457 J	**0.801**	**0.594**	0.0362 J	**0.630**	**4.58**	**0.193 J**
RW-19	FD 12/14/2020	**10.8**	**20.9**	**0.622**	0.0354 J	**2.22**	0.0505 J	**0.862**	**0.647**	0.0329 J	**0.680**	**5.02**	**0.215 J**

Definitions

X	Reported concentration, X, exceeds the CGWSL.
X	Analyte detected above the detection limit at a concentration equal to X.
<x	Analyte not detected at detection limit equal to x.
--	No applicable CGWSL.

Lab Qualifier

B	Analyte was also detected in the associated method blank.
J	Indicates an estimated value.
J3	The associated batch QC was outside the established quality control range for precision.
J6	The sample matrix interfered with the ability to make any accurate determination; spike value is low.
V	The sample concentration is too high to evaluate accurate spike recoveries.

Abbreviations

CGWSL	Critical Groundwater Screening Level
DRO	Diesel Range Organics
Dup	Duplicate Sample
FD	Field Duplicate
GRO	Gasoline Range Organics
mg/L	milligrams per liter
MTBE	Methyl Tert-Butyl Ether
NMED TPH	NMED Risk Assessment Guidance for Site Investigations and Remediation, February 2019, Rev 2 (6/19/19), Table 6-4 TPH Groundwater Screening Level
NMED TW	NMED Risk Assessment Guidance for Site Investigations and Remediation, February 2019, Rev 2 (6/19/19), Table A-1 Tap Water Screening Level
TMB	Trimethylbenzene
TPH	Total Petroleum Hydrocarbons
USEPA TW	United States Environmental Protection Agency Tap Water Screening Level, "Regional Screening Levels (RSL) Summary Table", November 2020
WQCC Dom	NMED Groundwater standard for domestic water supply, 20.6.2.3103.B NMAC
WQCC HH	NMED Groundwater standard for human health exposure, 20.6.2.3103.A NMAC

Table 3. Initial Baseline Groundwater Monitoring Results - Monitored Natural Attenuation Parameters

Status Report – Groundwater and PSH Recovery System Enhancements, Reinjection Pilot Test

HollyFrontier Navajo Refining LLC, Artesia Refinery

			Laboratory Analysis								Field Screening			
		Analyte	Alkalinity, total	Bromide	Ferrous Iron (Fe^{2+})	Magnesium	Sulfate	Sulfide	TKN	TOC	ORP	Dissolved Oxygen	SRB (1)	APB (1)
		Unit	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mV	mg/L	cfu/mL	cfu/mL
		CGWSL	--	--	1.00	--	600	--	--	--	--	--	--	--
		CGWSL Source	--	--	WQCC Dom	--	WQCC Dom	--	--	--	--	--	--	--
Well ID	**Dup**	**Date**												
KWB-4		11/20/2020	797	3.93	**4.68 T8**	117	230	<0.0250	0.521	13.4	-61	2.96	500,000	<2
KWB-5		11/20/2020	745	5.19	**3.85 T8**	134	60.0	<0.0250	0.344	11.9	-143	0.54	115,000	<2
MW-48		11/19/2020	878	1.62	0.130 T8	121 V	250	0.102 J5	1.20	20.5	-318	0.72	115,000	<2
MW-66		11/18/2020	713	1.47	0.556 T8	86.0	0.687 J	<0.0250	0.665	11.4	-115	0.67	115,000	<2
MW-99		12/15/2020	772	1.11	0.250 T8	92.9	52.4	1.83 J6	0.957 J6	10.3	-373	1.37	500,000	<2
MW-111		11/20/2020	790	1.75	**5.92 T8**	147	337	<0.0250	0.305	11.0	-76	0.39	115,000	<2
MW-112		12/15/2020	720	6.12	**4.44 T8**	174	<0.594	<0.0250	<0.140	5.99	-130	0.62	115,000	<2
MW-129		12/14/2020	740	1.23	**5.89 T8**	117	90.7	<0.0250	<0.140	10.2	-240	0.89	500,000	<2
MW-131		11/19/2020	745	1.91	**1.14 T8**	116	12.0	<0.0250	0.319	6.78	-177	0.45	500,000	<2
MW-131	FD	11/19/2020	757	1.89	**1.23 T8**	115	14.3	<0.0250	0.352	6.65	--	--	--	--
RW-19		12/14/2020	930	2.84	0.914 T8	144	118	0.0450 J	0.315	14.1	-375	1.00	500,000	<2
RW-19	FD	12/14/2020	917	3.42	0.936 T8	145	118	0.0330 J	0.365	14.8	--	--	--	--

Definitions

X	Reported concentration, X, exceeds the CGWSL.
X	Analyte detected above the detection limit at a concentration equal to X.
<x	Analyte not detected at detection limit equal to x.
--	No applicable CGWSL.

Lab Qualifier

J	Indicates an estimated value.
J5	The sample matrix interfered with the ability to make accurate determination; spike value is high.
J6	The sample matrix interfered with the ability to make accurate determination; spike value is low.
T8	Sample received past/too close to holding time expiration.
V	The sample concentration is too high to evaluate accurate spike recoveries.

Abbreviations

APB	Acid Producing Bacteria
cfu/mL	colony forming units per milliliter, approximate value
CGWSL	Critical Groundwater Screening Level
Dup	Duplicate Sample
FD	Field Duplicate
mg/L	milligrams per liter
mV	millivolts
ORP	Oxidation Reduction Potential
SRB	Sulfate Reducing Bacteria
TKN	Total Kjeldahl Nitrogen
TOC	Total Organic Carbon
WQCC Dom	NMED Groundwater standard for domestic water supply, 20.6.2.3103.B NMAC

Notes

(1) Sulfate Reducing Bacteria and Acid Producing Bacteria potential population results qualitatively measured using Hach BART™ Test Kits. The kit samples were observed daily for at least 8 days and the number of days for a reaction correlates with the approximate bacteria population provided. There was no APB reaction observed in any of the wells for 8 days, indicating the approximate APB population is not aggressive at less than 2 cfu/mL. The SRB results were based on the following reaction key:

Approximate SRB Population, days to reaction

1 days - 2,200,000 cfu/mL (Aggressive)	6 days - 1,400 cfu/mL (Moderate)
2 days - 500,000 cfu/mL (Aggressive)	7 days - 325 cfu/mL (Moderate)
3 days - 115,000 cfu/mL (Aggressive)	8 days - 75 cfu/mL (Moderate)
4 days - 27,000 cfu/mL (Aggressive)	9 days - 20 cfu/mL (Not Aggressive)
5 days - 6,000 cfu/mL (Aggressive)	10 days - 5 cfu/mL (Not Aggressive)

Figures

LEGEND

- REFINERY FENCELINE
- FACILITY PROPERTY BOUNDARY (FENCELINE SHOWN WHERE COINCIDENT)
- PROPOSED PILOT TEST LOCATION
- MONITORING WELL
- RECOVERY WELL
- IRRIGATION WELL

SOURCE: BASEMAP FROM GOOGLE EARTH 2021, IMAGE DATE: 12/29/2019.

N W E S

0 350 700 Feet

1 " = 350 '

1:4,200

PROJECT:

HOLLYFRONTIER NAVAJO REFINING LLC
ARTESIA REFINERY, EDDY COUNTY, NEW MEXICO

TITLE:

STATUS REPORT - GROUNDWATER AND PHASE-SEPARATED HYDROCARBON RECOVERY SYSTEM ENHANCEMENTS, REINJECTION PILOT TEST

DRAWN BY:	M. HORN	PROJ. NO.:	435741
CHECKED BY:	J. SPEER		
APPROVED BY:	J. SPEER		
DATE:	MAY 2021		

FIGURE 1
WELL LOCATION

TRC
505 East Huntland Drive
Suite #250
Austin, TX 78752
Phone: 512.329.6080

FILE NO.: 435741_1_well_loc.mxd

Plot Date: 5/7/2021, 14:08:56 PM by MHORN -- LAYOUT: ANSI B(11"x17")
Path: S:\1-PROJECTS\HOLLY_ENERGY_PARTNERS\Artesia\435741_PilotTest\435741_1_well_loc.mxd
Coordinate System: NAD 1983 2011 StatePlane New Mexico East FIPS 3001 Ft US (Foot US)
Map Rotation: 0

TRC - GIS

TRC
505 E. HUNTLAND DR.
SUITE 250
AUSTIN, TX 78752
PH:512-329-6080

N

Due to this map being projected in the WGS84 EPSG:3857 one cannot accurately scale distances or areas from it. This map should be used for reference purposes only.

LEGEND

- Monitoring Well
- Recovery Well
- Irrigation Well
- Tanks
- Proposed Injection Well
- Proposed Monitoring Well
- Proposed Recovery Well

Note: Proposed well locations subject to change based on field testing (gamma logging, soil borings, etc.) and presence of underground and aboveground utilities.

0 160 320
Approximate Scale in Feet

Figure 2a - Proposed Recovery, Injection, and Monitoring Locations near RW-19

Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
Projection: Mercator Auxiliary Sphere
Datum: WGS 1984
False Easting: 0.0000
False Northing: 0.0000
Central Meridian: 0.0000
Standard Parallel 1: 0.0000
Auxiliary Sphere Type: 0.0000
Units: Meter

Document Path: C:\Users\trc\AppData\Local\Temp\c489bbcd69bd421ebf448cbe9fd6c44550.mxd

Path: D:\Users\SRay\Desktop\GWReinjectionPilotTestWP.mxd

TRC
505 East Huntland Drive, Suite 250
Austin, TX 78752
Phone: 512.329.6080
www.trcsolutions.com

LEGEND

- Proposed Injection Well
- Proposed Monitoring Well
- Proposed Recovery Well
- Irrigation Well
- Monitoring Well
- Recovery Well
- Tanks

NOTE: PROPOSED WELL LOCATIONS ARE SUBJECT TO CHANGE BASED ON FIELD TESTING (GAMMA LOGGING, SOIL BORINGS, ETC.) AND PRESENCE OF UNDERGROUND AND ABOVEGROUND UTILITIES.

SOURCE: BASEMAP FROM GOOGLE AND THEIR DATA PARTNERS (2018).

N

0 190 380 Feet

FIGURE 2B - PROPOSED RECOVERY, INJECTION, AND MONITORING LOCATIONS NEAR MW-131

ARTESIA REFINERY - ARTESIA, NEW MEXICO
HOLLYFRONTIER NAVAJO REFINING LLC

FIGURE 3 – GAMMA LOG FENCE DIAGRAM THROUGH KWB-4, RW-19, AND MW-111

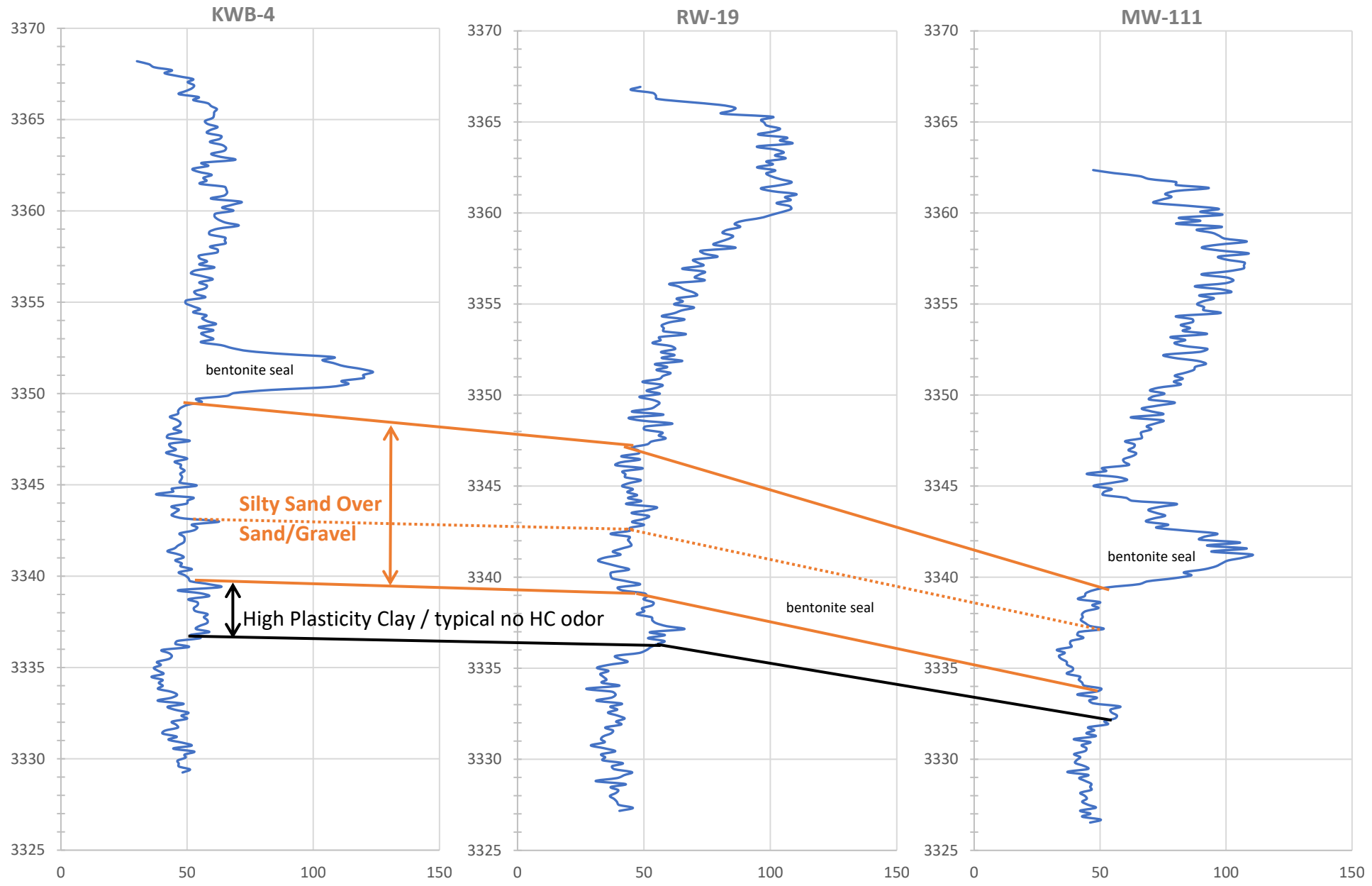


FIGURE 4 – GAMMA LOG FENCE DIAGRAM THROUGH MW-66, MW-129, MW-131, AND MW-112

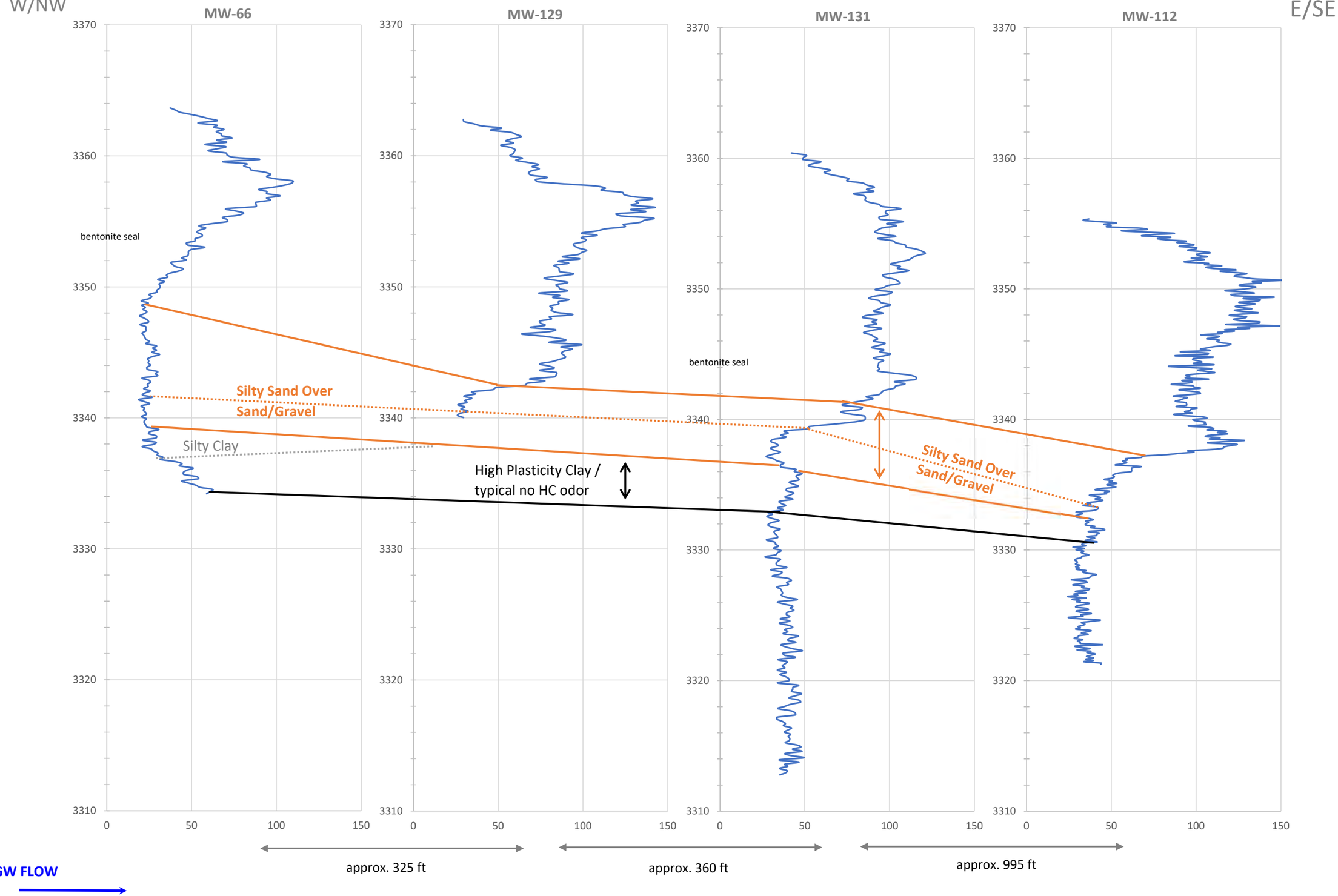
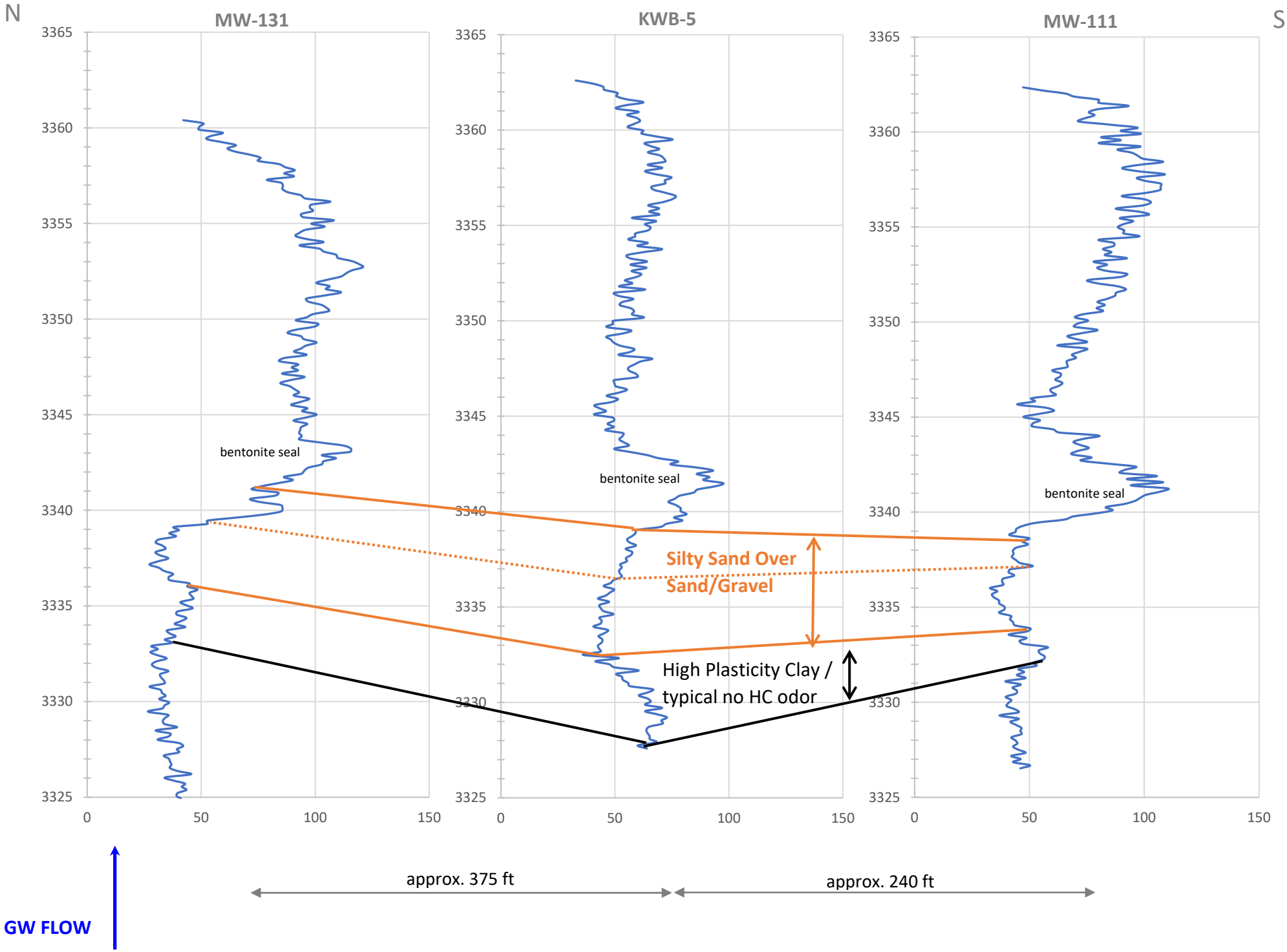
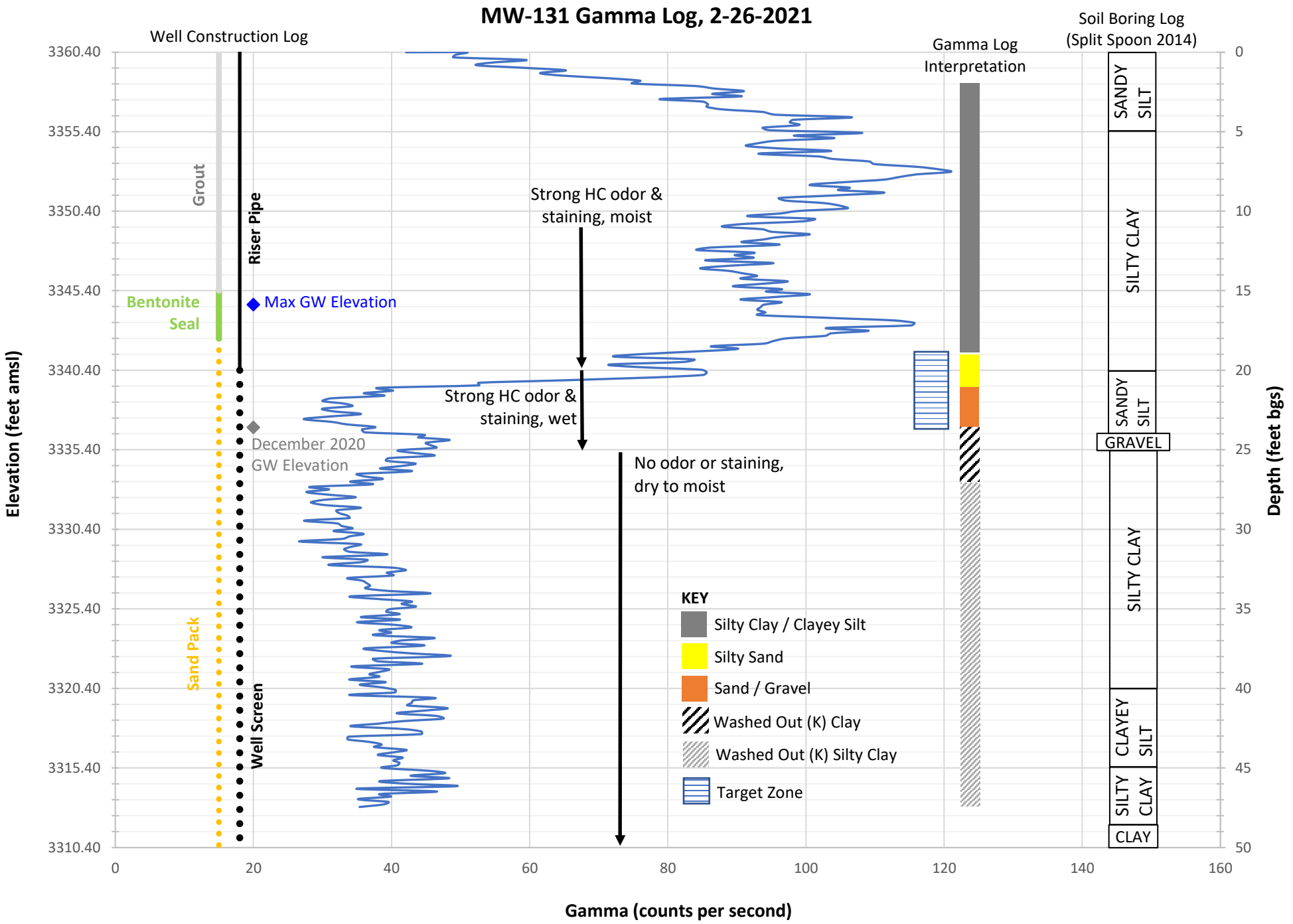
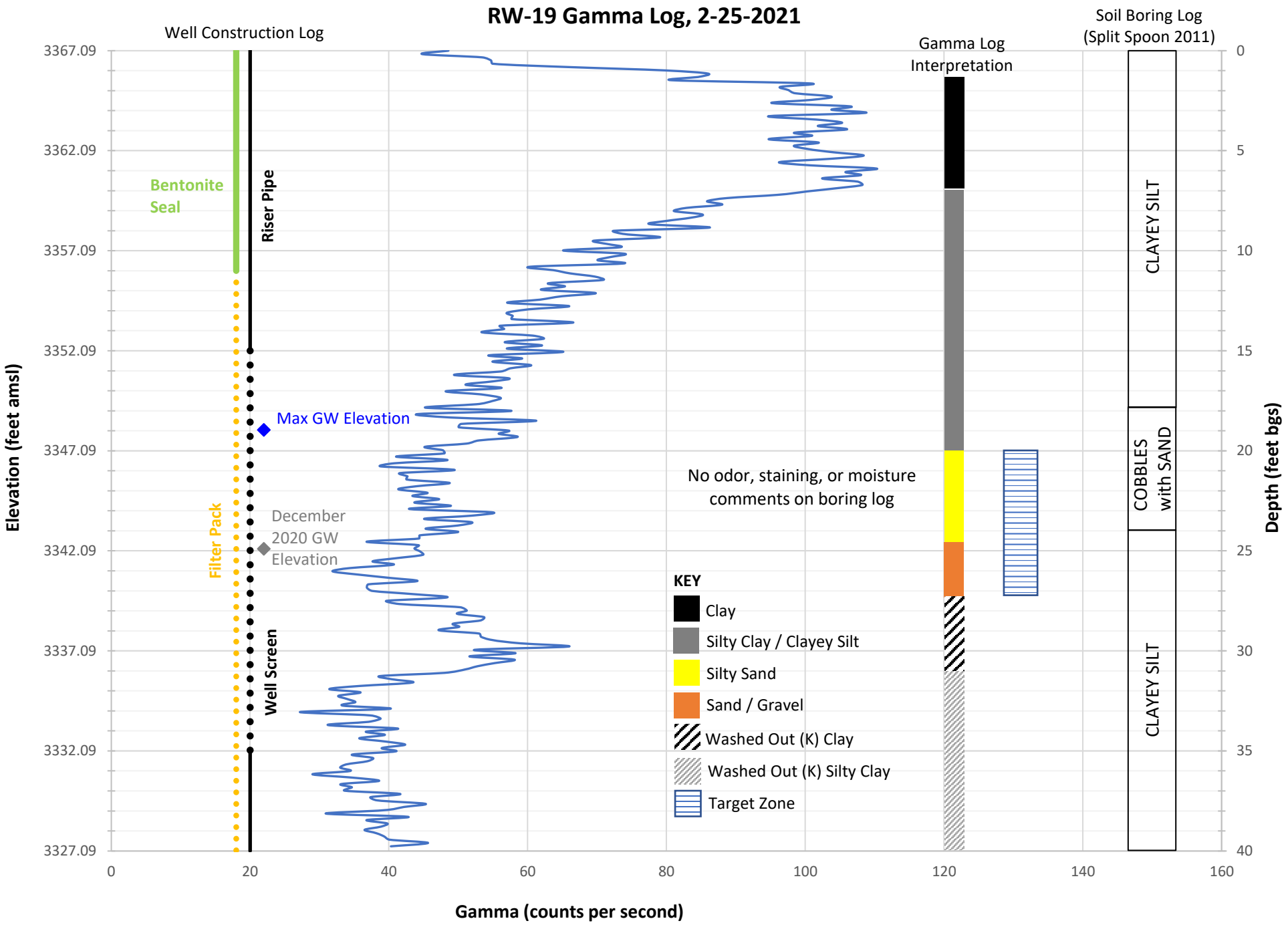


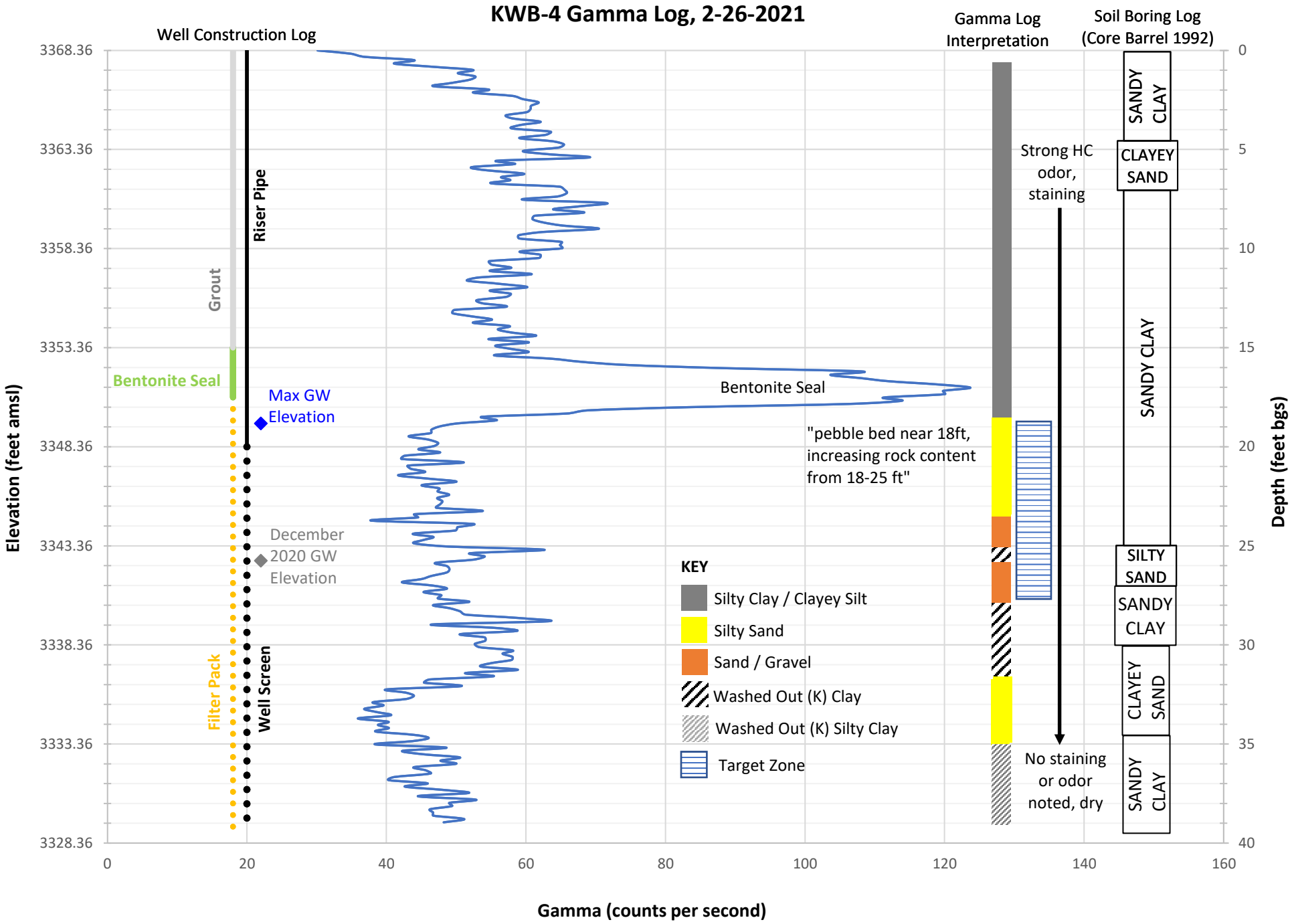
FIGURE 5 – GAMMA LOG FENCE DIAGRAM THROUGH MW-131, KWB-5, AND MW-111

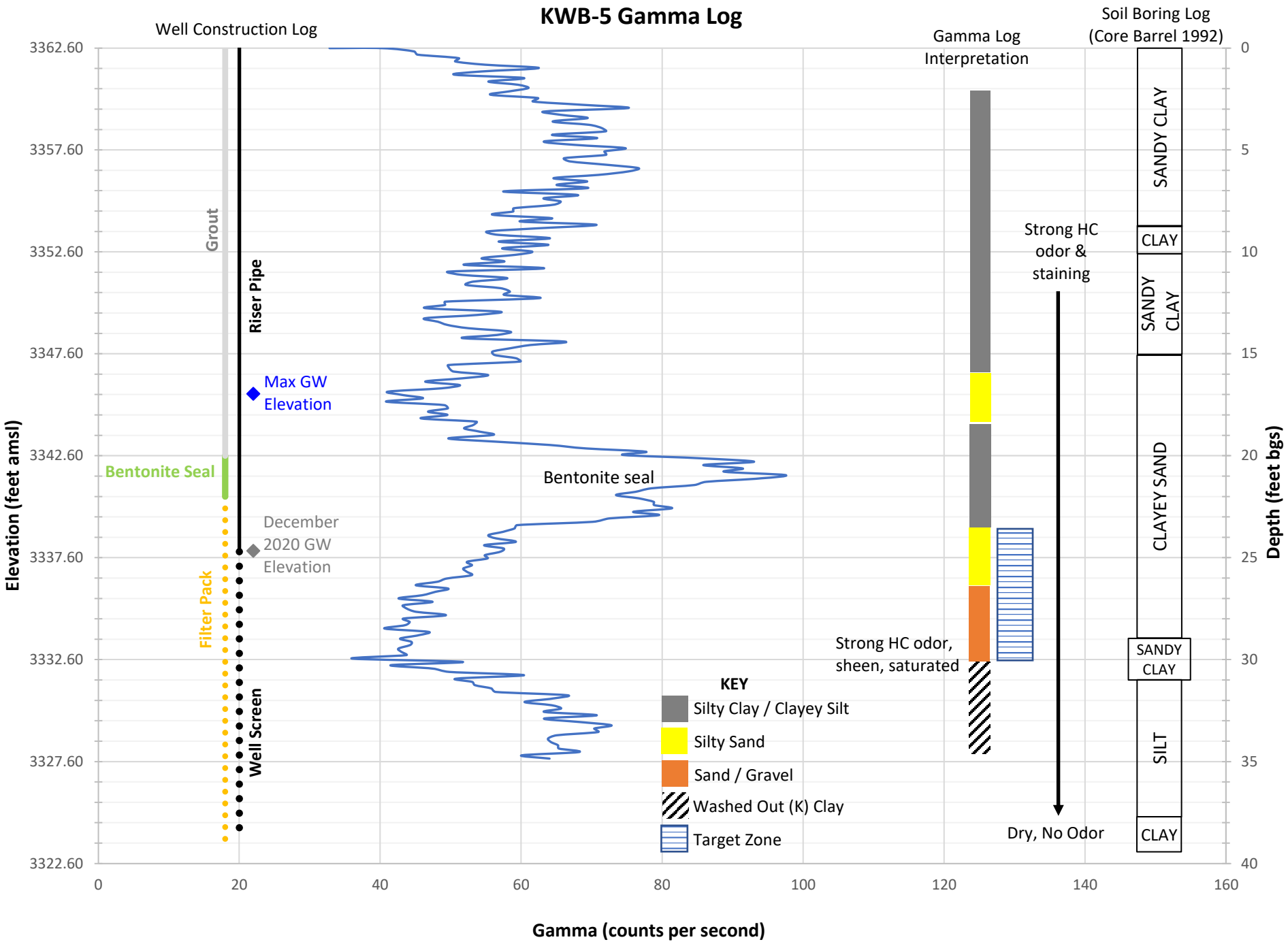


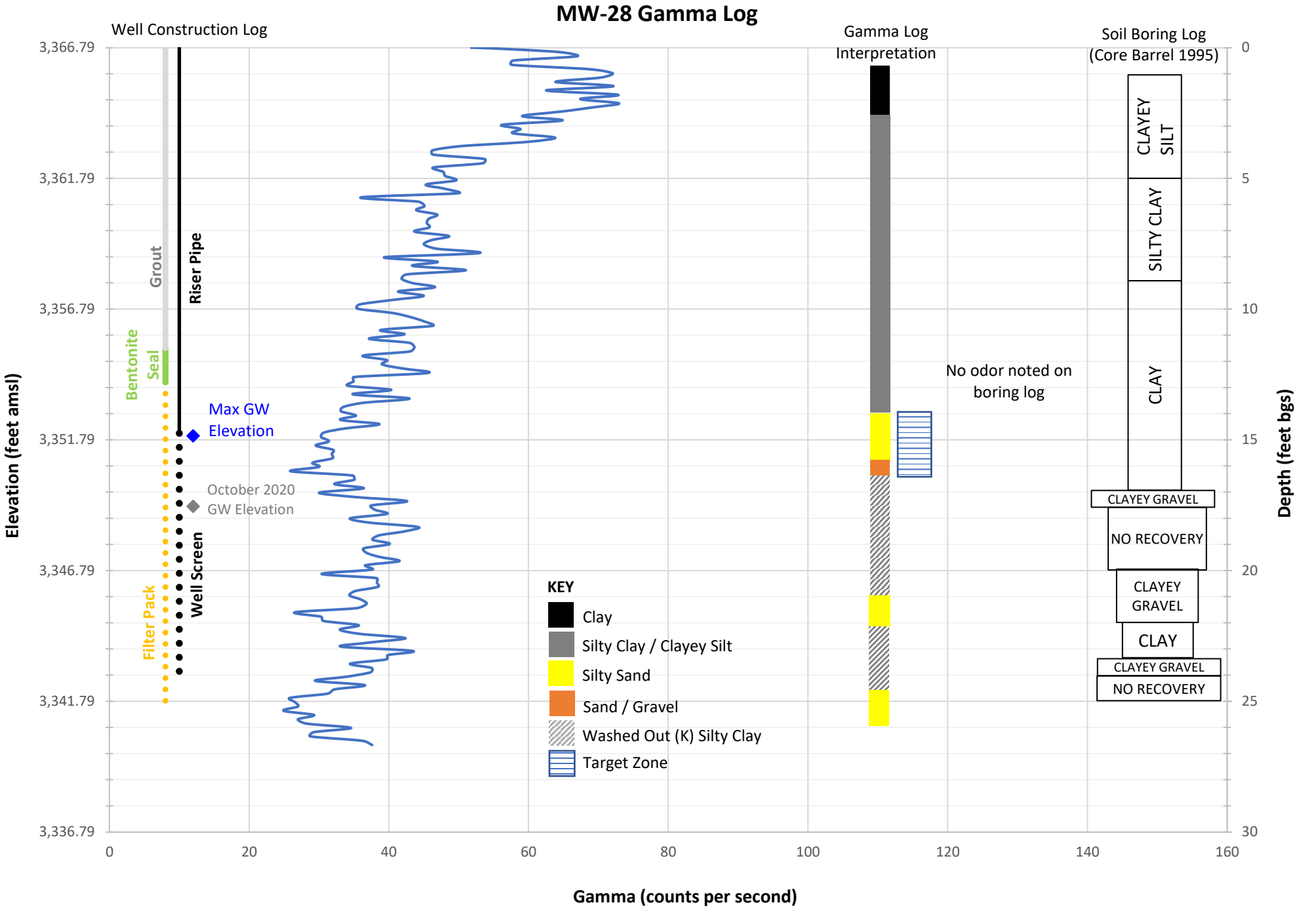
Attachment A. Gamma Log Plots

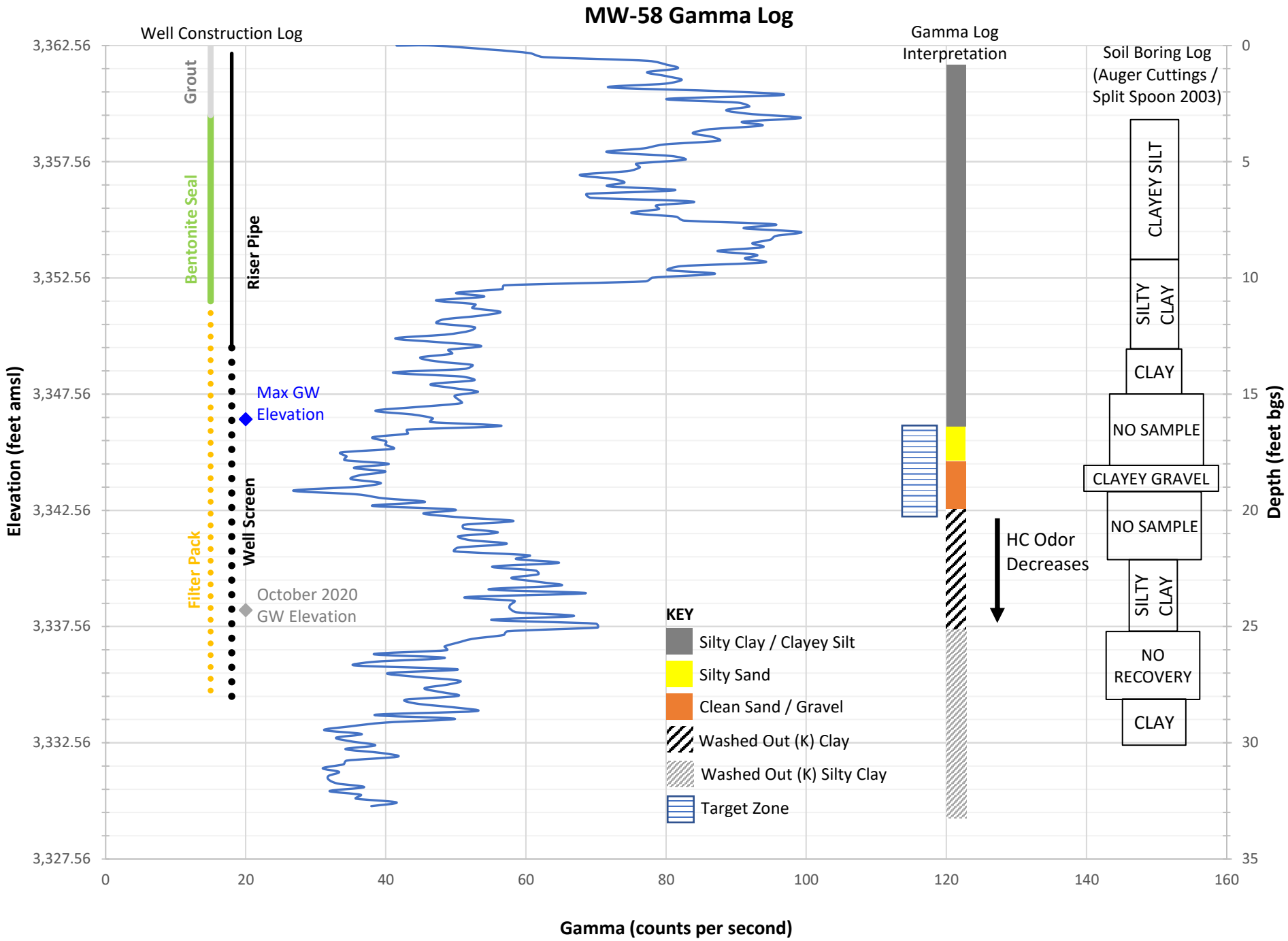

MW-131 Gamma Log, 2-26-2021
Well Construction Log
Gamma Log Interpretation
Soil Boring Log (Split Spoon 2014)
Grout
Riser Pipe
Bentonite Seal
Max GW Elevation
December 2020 GW Elevation
Sand Pack
Well Screen
Strong HC odor & staining, moist
Strong HC odor & staining, wet
No odor or staining, dry to moist
KEY
Silty Clay / Clayey Silt
Silty Sand
Sand / Gravel
Washed Out (K) Clay
Washed Out (K) Silty Clay
Target Zone
SANDY SILT
SILTY CLAY
SANDY SILT
GRAVEL
SILTY CLAY
CLAYEY SILT
SILTY CLAY
CLAY
Elevation (feet amsl)
Depth (feet bgs)
Gamma (counts per second)
3360.40
3355.40
3350.40
3345.40
3340.40
3335.40
3330.40
3325.40
3320.40
3315.40
3310.40
0
5
10
15
20
25
30
35
40
45
50
0
20
40
60
80
100
120
140
160

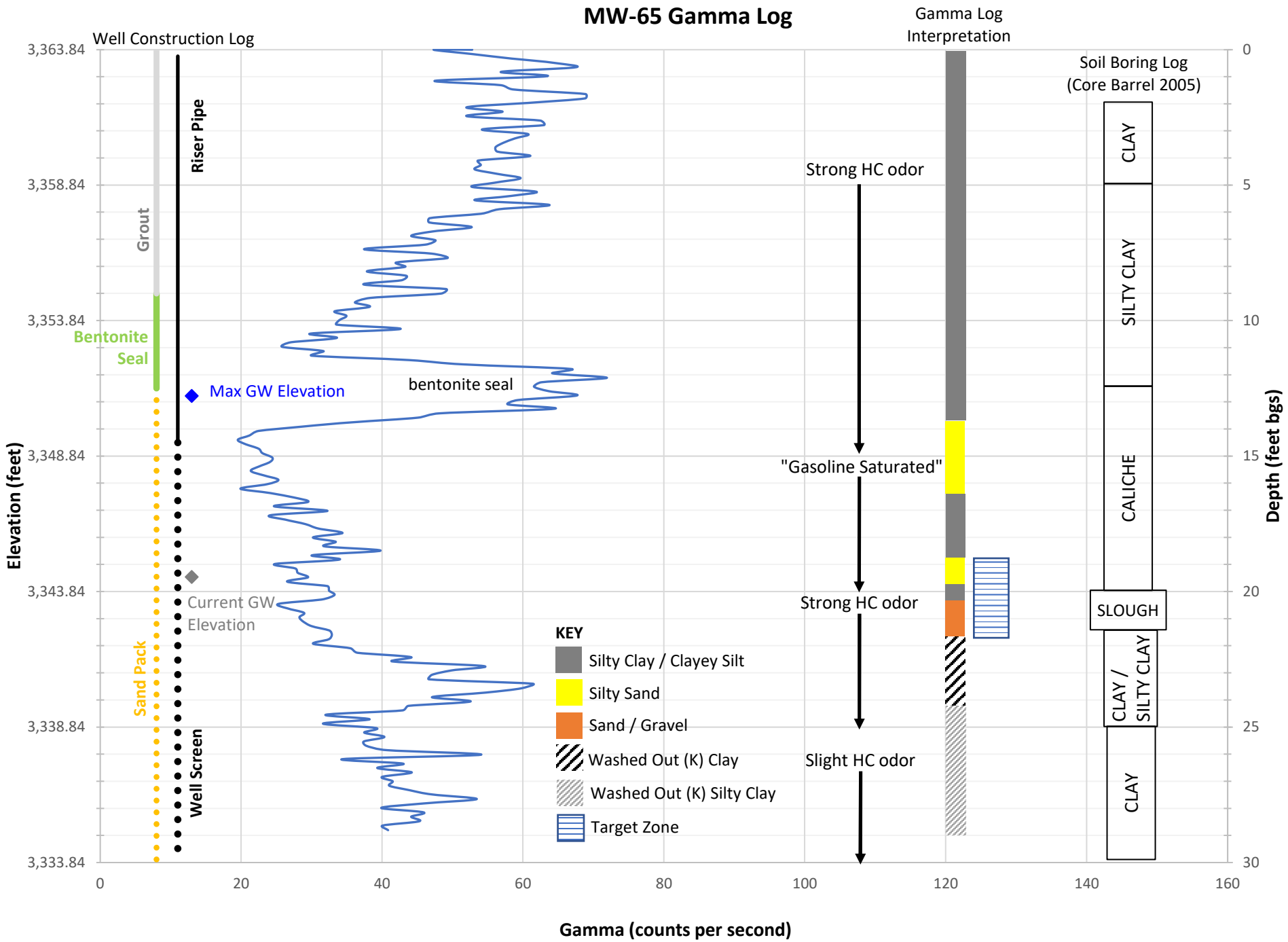

RW-19 Gamma Log, 2-25-2021
Well Construction Log
Gamma Log Interpretation
Soil Boring Log (Split Spoon 2011)
Bentonite Seal
Riser Pipe
Filter Pack
Well Screen
Max GW Elevation
December 2020 GW Elevation
No odor, staining, or moisture comments on boring log
KEY
Clay
Silty Clay / Clayey Silt
Silty Sand
Sand / Gravel
Washed Out (K) Clay
Washed Out (K) Silty Clay
Target Zone
CLAYEY SILT
COBBLES with SAND
CLAYEY SILT
Elevation (feet amsl)
Depth (feet bgs)
Gamma (counts per second)
3367.09
3362.09
3357.09
3352.09
3347.09
3342.09
3337.09
3332.09
3327.09
0
5
10
15
20
25
30
35
40
0
20
40
60
80
100
120
140
160

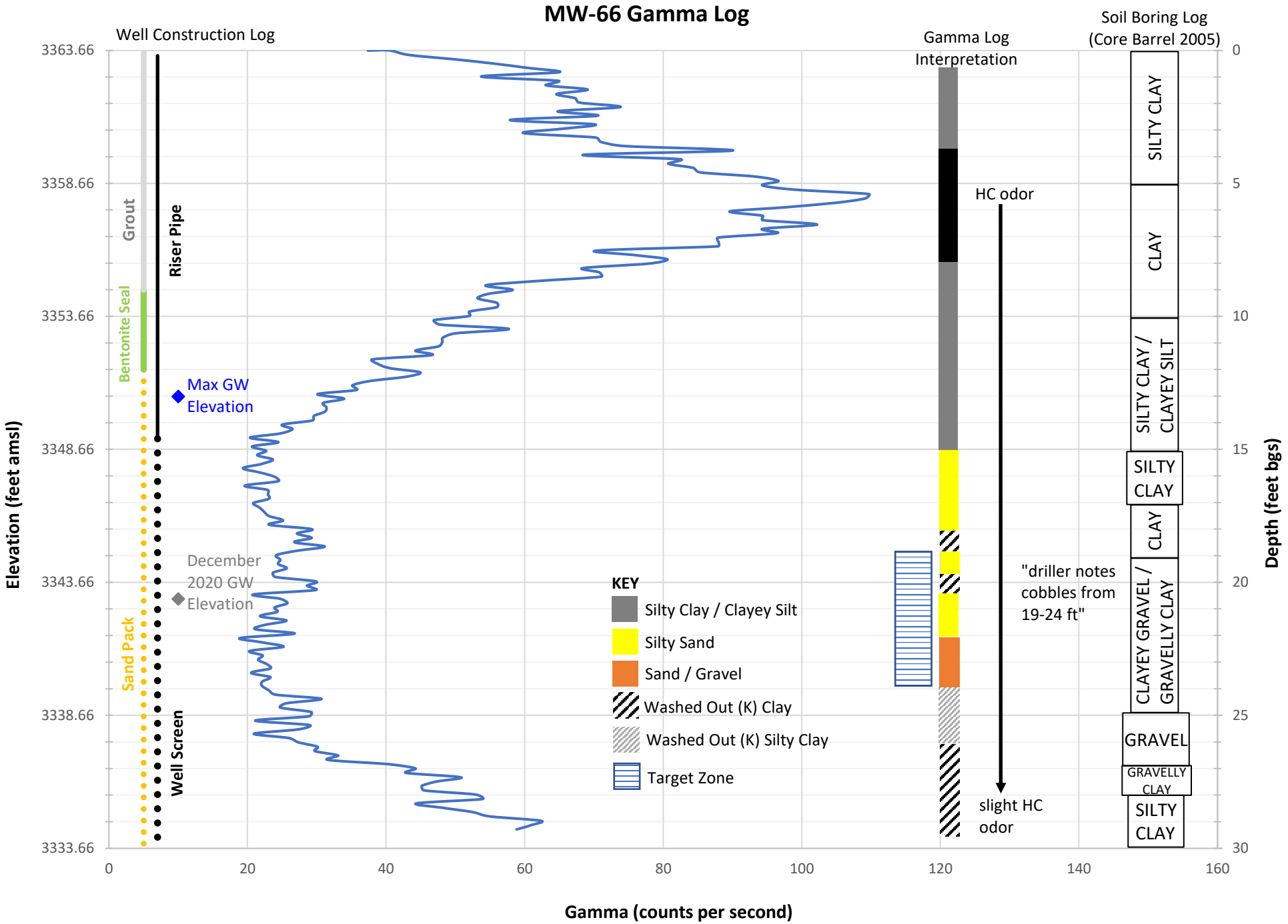

KWB-4 Gamma Log, 2-26-2021
Well Construction Log
Gamma Log Interpretation
Soil Boring Log (Core Barrel 1992)
Riser Pipe
Grout
Bentonite Seal
Max GW Elevation
December 2020 GW Elevation
Filter Pack
Well Screen
Bentonite Seal
"pebble bed near 18ft, increasing rock content from 18-25 ft"
Strong HC odor, staining
No staining or odor noted, dry
KEY
Silty Clay / Clayey Silt
Silty Sand
Sand / Gravel
Washed Out (K) Clay
Washed Out (K) Silty Clay
Target Zone
SANDY CLAY
CLAYEY SAND
SANDY CLAY
SILTY SAND
SANDY CLAY
CLAYEY SAND
SANDY CLAY
Elevation (feet amsl)
3368.36
3363.36
3358.36
3353.36
3348.36
3343.36
3338.36
3333.36
3328.36
Depth (feet bgs)
0
5
10
15
20
25
30
35
40
Gamma (counts per second)
0
20
40
60
80
100
120
140
160

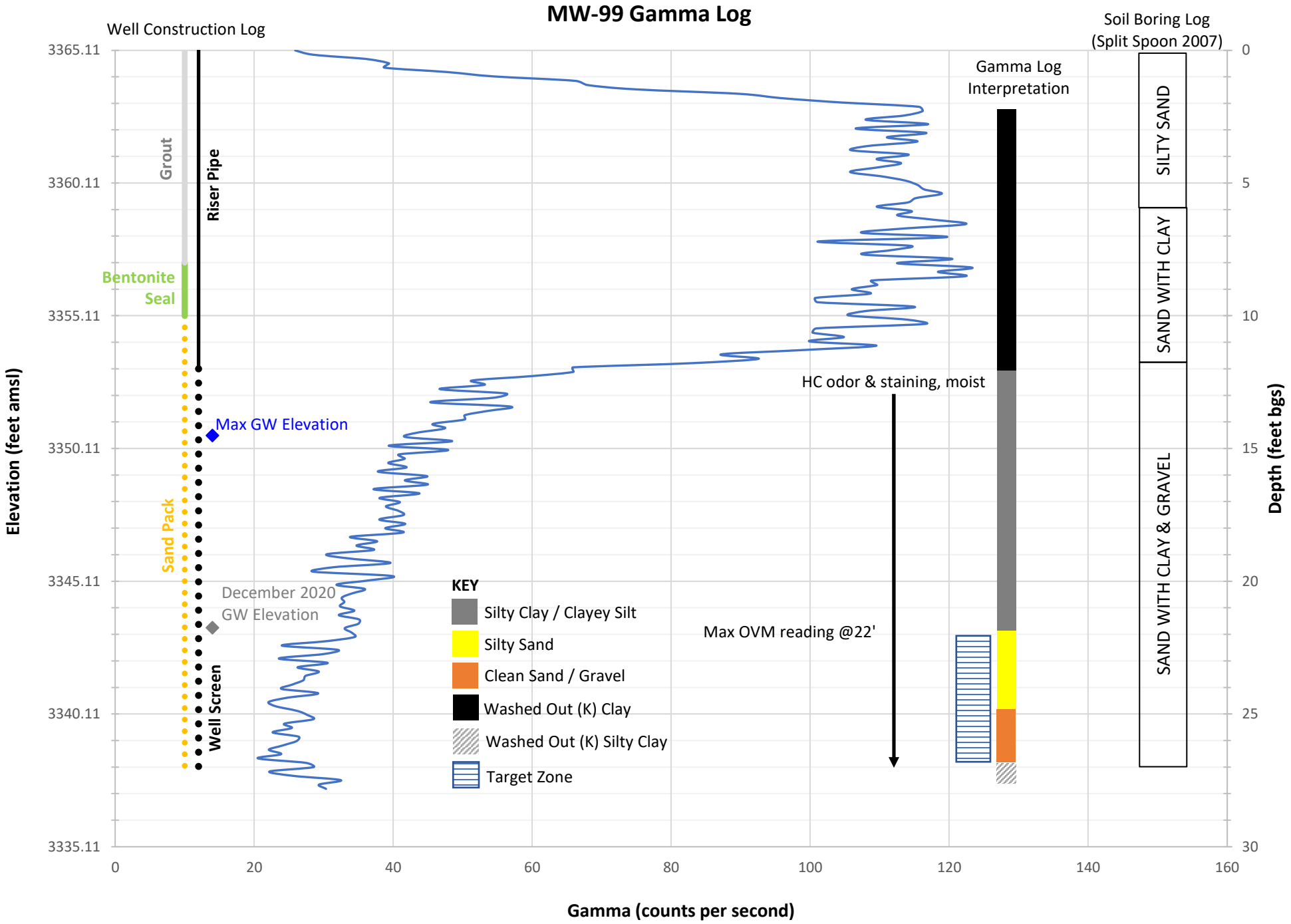

KWB-5 Gamma Log
Well Construction Log
Gamma Log Interpretation
Soil Boring Log (Core Barrel 1992)
Grout
Riser Pipe
Max GW Elevation
Bentonite Seal
December 2020 GW Elevation
Filter Pack
Well Screen
Bentonite seal
Strong HC odor & staining
Strong HC odor, sheen, saturated
Dry, No Odor
KEY
Silty Clay / Clayey Silt
Silty Sand
Sand / Gravel
Washed Out (K) Clay
Target Zone
SANDY CLAY
CLAY
SANDY CLAY
CLAYEY SAND
SANDY CLAY
SILT
CLAY
Elevation (feet amsl)
Depth (feet bgs)
Gamma (counts per second)
3362.60
3357.60
3352.60
3347.60
3342.60
3337.60
3332.60
3327.60
3322.60
0
5
10
15
20
25
30
35
40
0
20
40
60
80
100
120
140
160

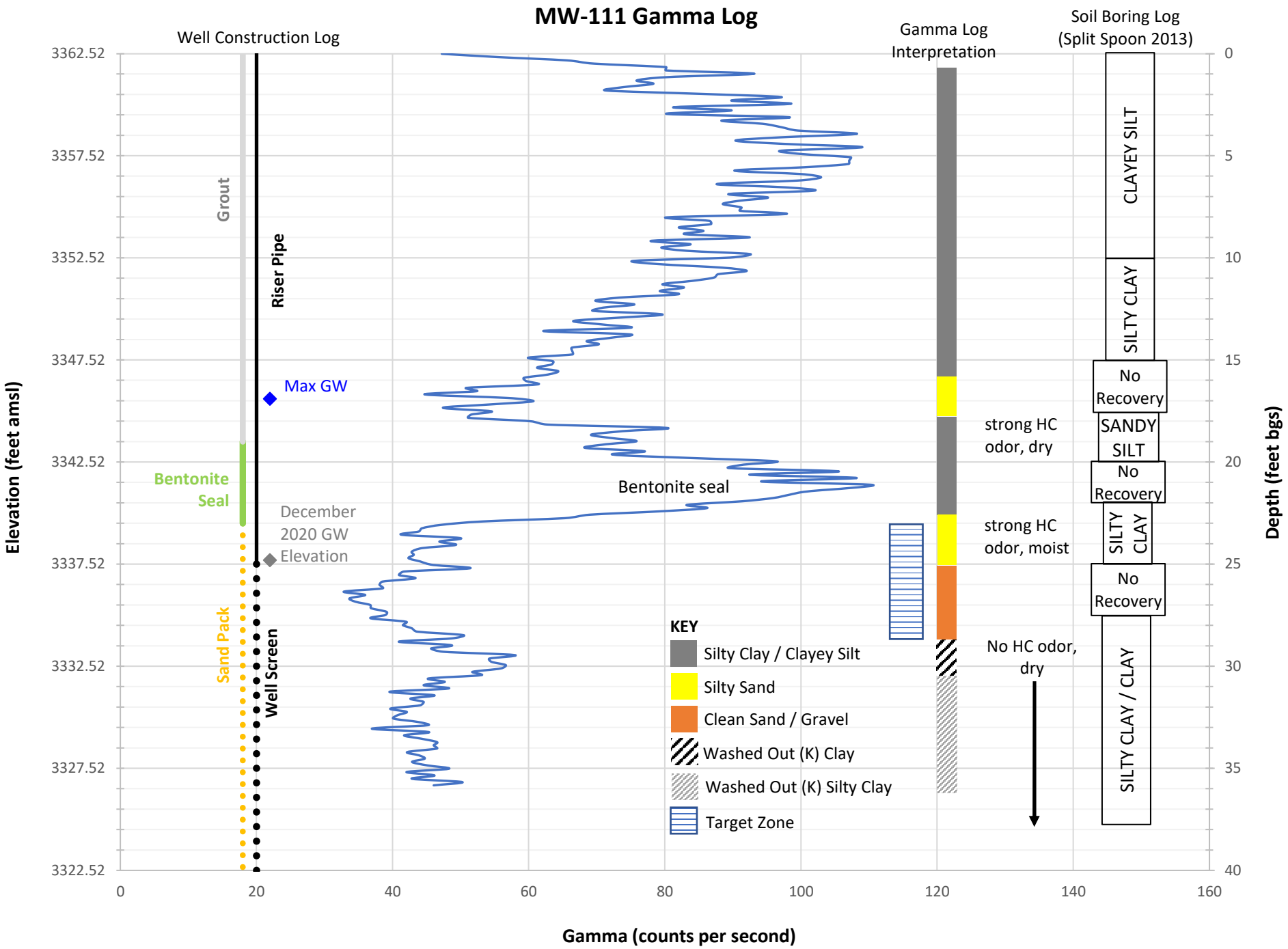

MW-28 Gamma Log
Well Construction Log
Gamma Log Interpretation
Soil Boring Log (Core Barrel 1995)
Elevation (feet amsl)
Depth (feet bgs)
Gamma (counts per second)
3,366.79
3,361.79
3,356.79
3,351.79
3,346.79
3,341.79
3,336.79
0
5
10
15
20
25
30
0
20
40
60
80
100
120
140
160
Grout
Riser Pipe
Bentonite Seal
Max GW Elevation
October 2020 GW Elevation
Filter Pack
Well Screen
No odor noted on boring log
CLAYEY SILT
SILTY CLAY
CLAY
CLAYEY GRAVEL
NO RECOVERY
CLAYEY GRAVEL
CLAY
CLAYEY GRAVEL
NO RECOVERY
KEY
Clay
Silty Clay / Clayey Silt
Silty Sand
Sand / Gravel
Washed Out (K) Silty Clay
Target Zone

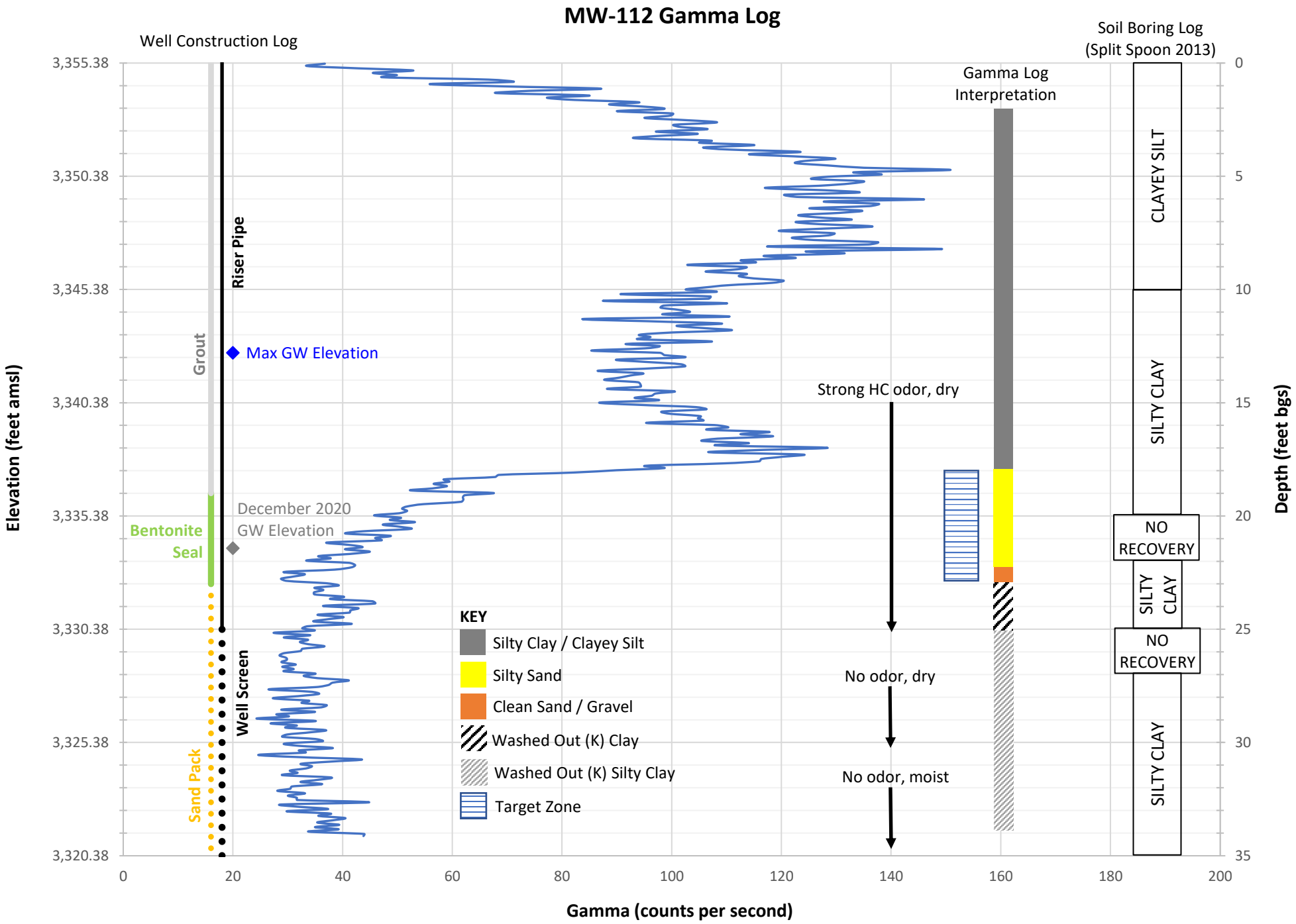

MW-58 Gamma Log
Well Construction Log
Gamma Log Interpretation
Soil Boring Log (Auger Cuttings / Split Spoon 2003)
Grout
Bentonite Seal
Riser Pipe
Well Screen
Filter Pack
Max GW Elevation
October 2020 GW Elevation
HC Odor Decreases
KEY
Silty Clay / Clayey Silt
Silty Sand
Clean Sand / Gravel
Washed Out (K) Clay
Washed Out (K) Silty Clay
Target Zone
CLAYEY SILT
SILTY CLAY
CLAY
NO SAMPLE
CLAYEY GRAVEL
NO SAMPLE
SILTY CLAY
NO RECOVERY
CLAY
Elevation (feet amsl)
3,362.56
3,357.56
3,352.56
3,347.56
3,342.56
3,337.56
3,332.56
3,327.56
Depth (feet bgs)
0
5
10
15
20
25
30
35
0
20
40
60
80
100
120
140
160
Gamma (counts per second)

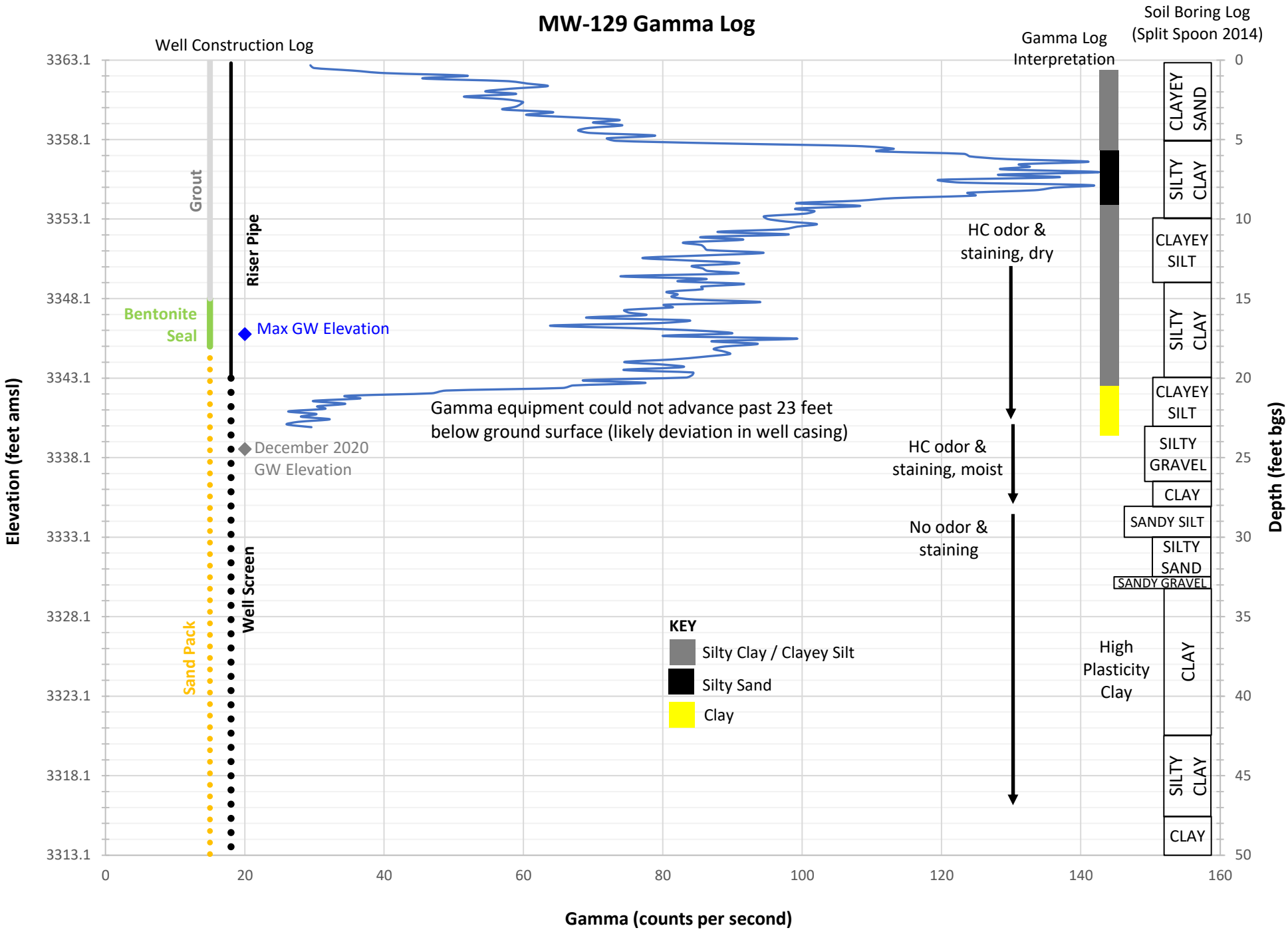

MW-65 Gamma Log
Well Construction Log
Gamma Log Interpretation
Soil Boring Log (Core Barrel 2005)
Riser Pipe
Grout
Bentonite Seal
Sand Pack
Well Screen
Max GW Elevation
Current GW Elevation
bentonite seal
Strong HC odor
"Gasoline Saturated"
Strong HC odor
Slight HC odor
KEY
Silty Clay / Clayey Silt
Silty Sand
Sand / Gravel
Washed Out (K) Clay
Washed Out (K) Silty Clay
Target Zone
CLAY
SILTY CLAY
CALICHE
SLOUGH
CLAY / SILTY CLAY
CLAY
Elevation (feet)
3,363.84
3,358.84
3,353.84
3,348.84
3,343.84
3,338.84
3,333.84
Depth (feet bgs)
0
5
10
15
20
25
30
Gamma (counts per second)
0
20
40
60
80
100
120
140
160

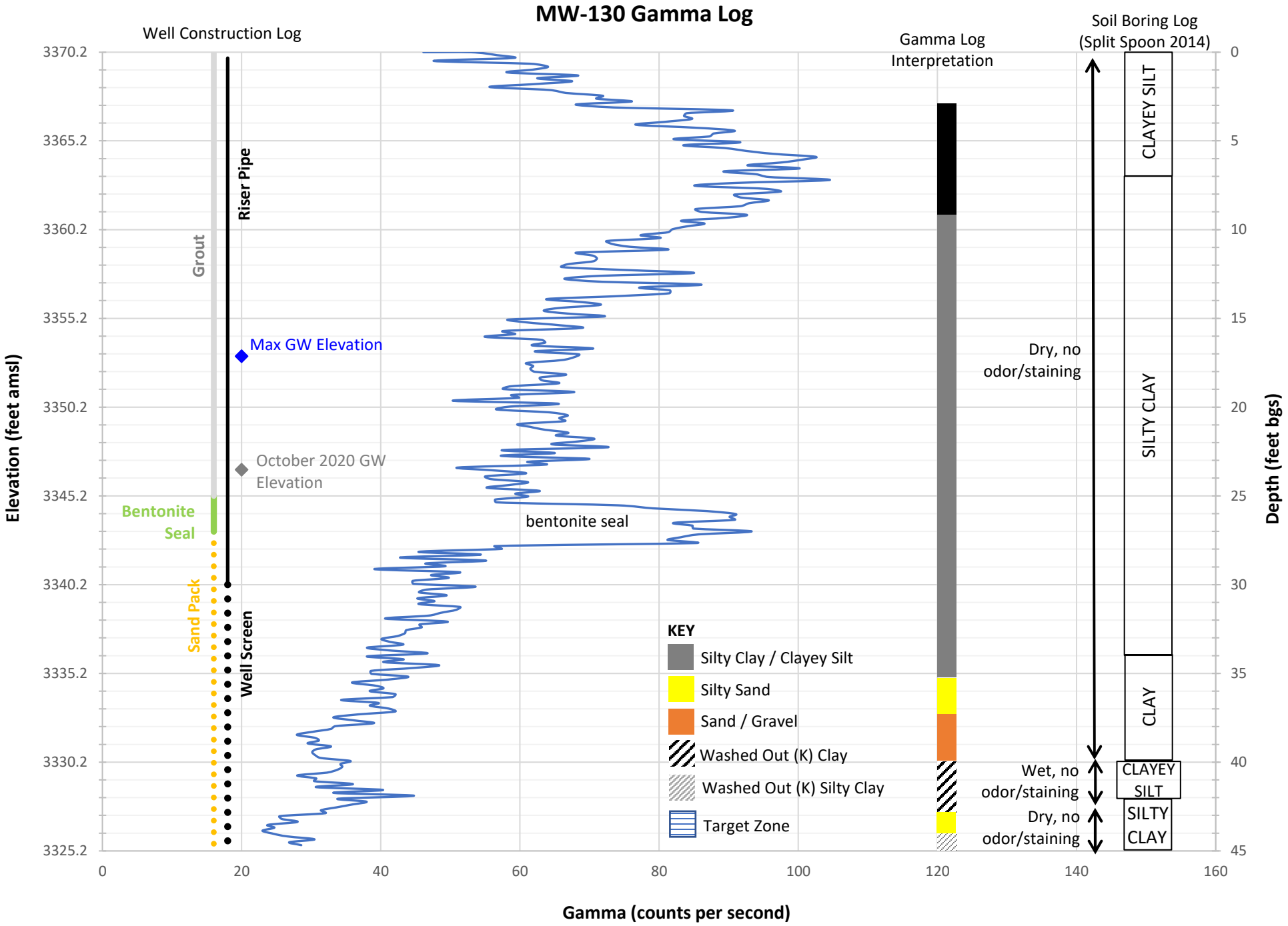

MW-66 Gamma Log
Well Construction Log
Gamma Log Interpretation
Soil Boring Log (Core Barrel 2005)
Grout
Bentonite Seal
Sand Pack
Riser Pipe
Well Screen
Max GW Elevation
December 2020 GW Elevation
HC odor
slight HC odor
"driller notes cobbles from 19-24 ft"
KEY
Silty Clay / Clayey Silt
Silty Sand
Sand / Gravel
Washed Out (K) Clay
Washed Out (K) Silty Clay
Target Zone
SILTY CLAY
CLAY
SILTY CLAY / CLAYEY SILT
SILTY CLAY
CLAY
CLAYEY GRAVEL / GRAVELLY CLAY
GRAVEL
GRAVELLY CLAY
SILTY CLAY
Elevation (feet amsl)
Depth (feet bgs)
Gamma (counts per second)
3363.66
3358.66
3353.66
3348.66
3343.66
3338.66
3333.66
0
5
10
15
20
25
30
0
20
40
60
80
100
120
140
160

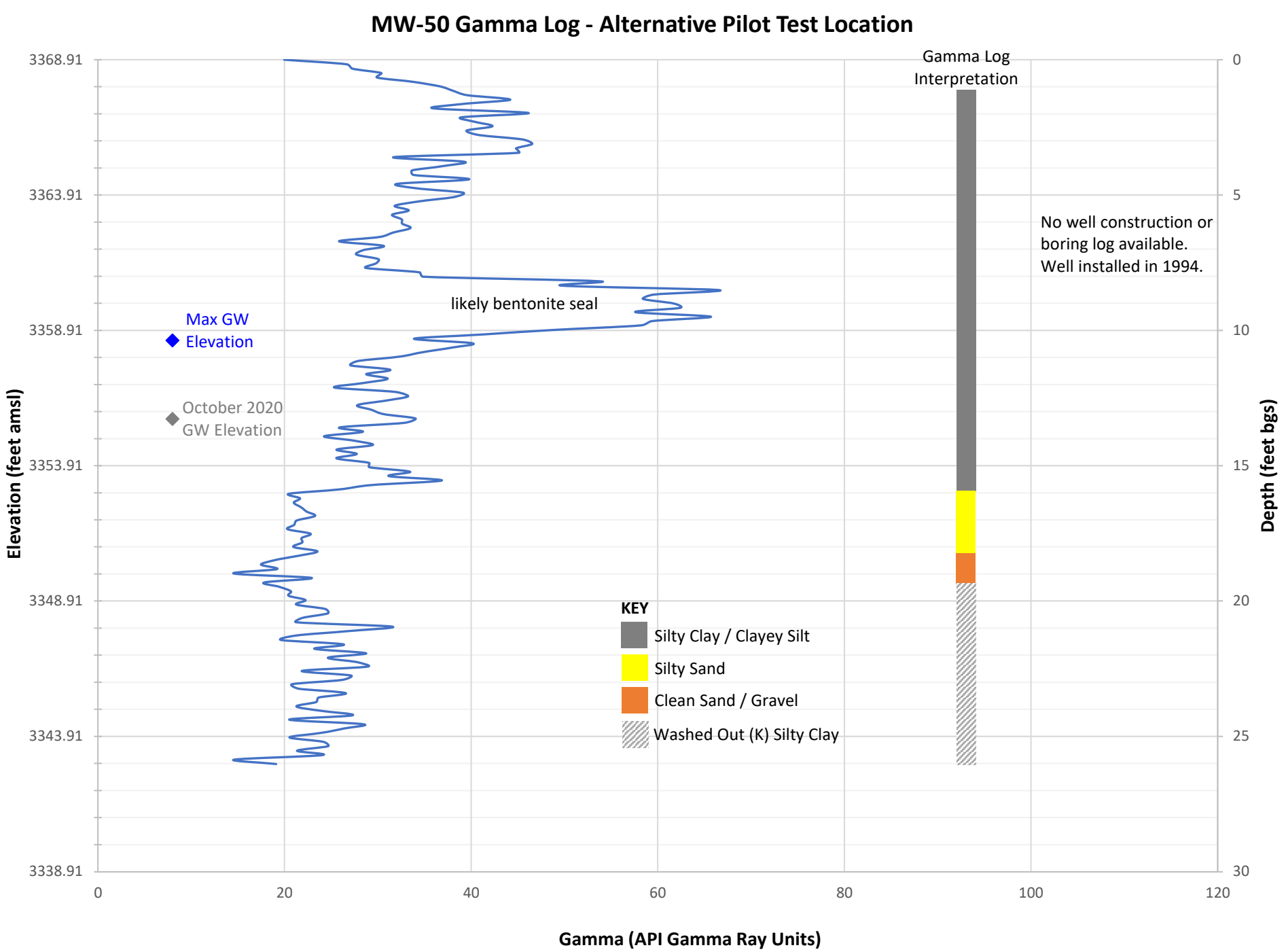

MW-99 Gamma Log
Well Construction Log
Soil Boring Log
(Split Spoon 2007)
Gamma Log
Interpretation
Grout
Riser Pipe
Bentonite
Seal
Sand Pack
Well Screen
Max GW Elevation
December 2020
GW Elevation
HC odor & staining, moist
Max OVM reading @22'
KEY
Silty Clay / Clayey Silt
Silty Sand
Clean Sand / Gravel
Washed Out (K) Clay
Washed Out (K) Silty Clay
Target Zone
SILTY SAND
SAND WITH CLAY
SAND WITH CLAY & GRAVEL
Elevation (feet amsl)
Depth (feet bgs)
Gamma (counts per second)
3365.11
3360.11
3355.11
3350.11
3345.11
3340.11
3335.11
0
5
10
15
20
25
30
0
20
40
60
80
100
120
140
160

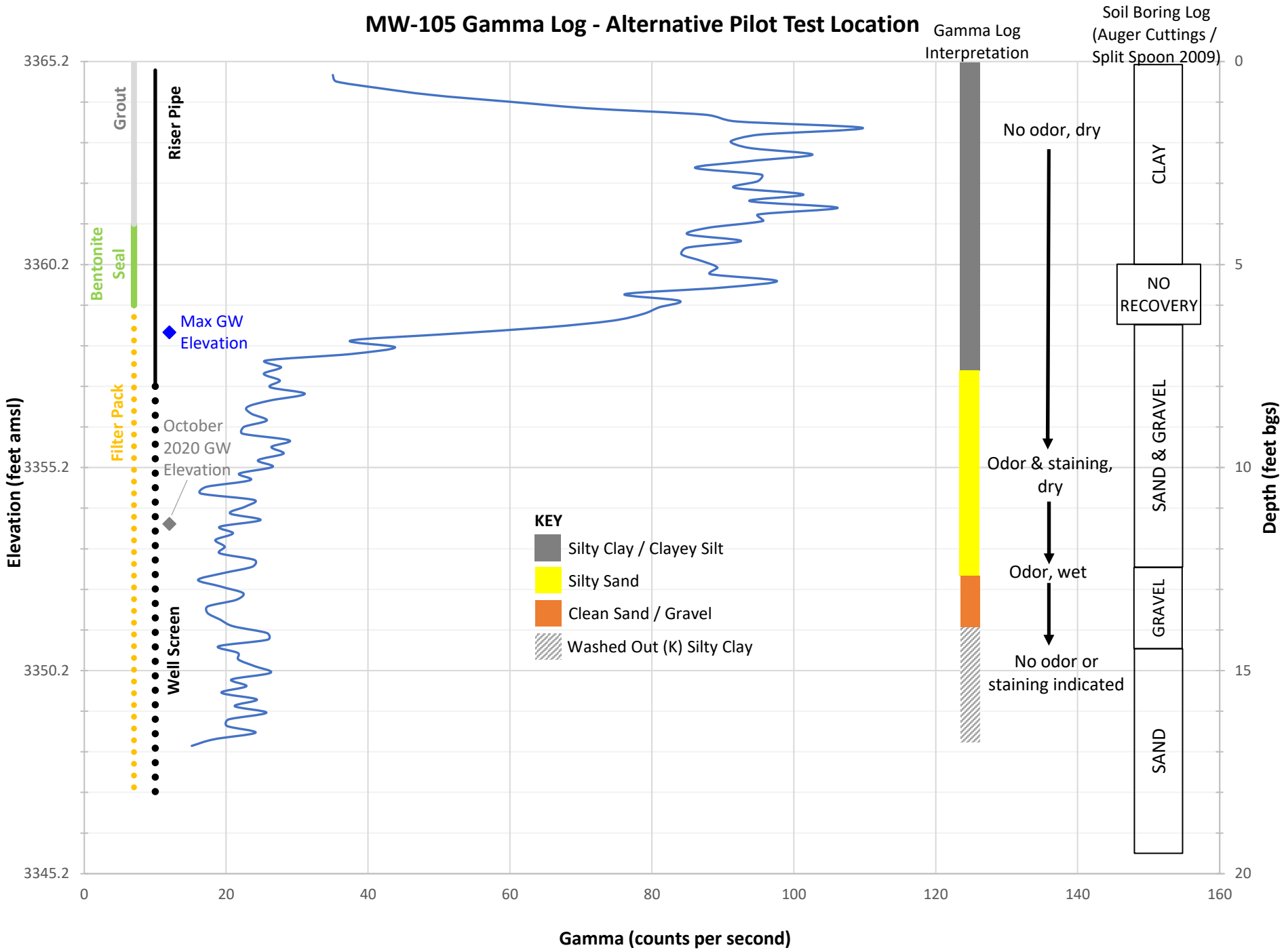

MW-111 Gamma Log
Well Construction Log
Gamma Log Interpretation
Soil Boring Log (Split Spoon 2013)
Elevation (feet amsl)
Depth (feet bgs)
Gamma (counts per second)
3362.52
3357.52
3352.52
3347.52
3342.52
3337.52
3332.52
3327.52
3322.52
0
5
10
15
20
25
30
35
40
0
20
40
60
80
100
120
140
160
Grout
Riser Pipe
Max GW
Bentonite Seal
December 2020 GW Elevation
Sand Pack
Well Screen
Bentonite seal
strong HC odor, dry
strong HC odor, moist
No HC odor, dry
CLAYEY SILT
SILTY CLAY
No Recovery
SANDY SILT
No Recovery
SILTY CLAY
No Recovery
SILTY CLAY / CLAY
KEY
Silty Clay / Clayey Silt
Silty Sand
Clean Sand / Gravel
Washed Out (K) Clay
Washed Out (K) Silty Clay
Target Zone


MW-112 Gamma Log
Well Construction Log
Soil Boring Log
(Split Spoon 2013)
Gamma Log
Interpretation
Riser Pipe
Grout
Max GW Elevation
December 2020
GW Elevation
Bentonite
Seal
Sand Pack
Well Screen
Strong HC odor, dry
No odor, dry
No odor, moist
KEY
Silty Clay / Clayey Silt
Silty Sand
Clean Sand / Gravel
Washed Out (K) Clay
Washed Out (K) Silty Clay
Target Zone
CLAYEY SILT
SILTY CLAY
NO
RECOVERY
SILTY
CLAY
NO
RECOVERY
SILTY CLAY
Elevation (feet amsl)
3,355.38
3,350.38
3,345.38
3,340.38
3,335.38
3,330.38
3,325.38
3,320.38
Depth (feet bgs)
0
5
10
15
20
25
30
35
0
20
40
60
80
100
120
140
160
180
200
Gamma (counts per second)


MW-129 Gamma Log
Well Construction Log
Gamma Log Interpretation
Soil Boring Log (Split Spoon 2014)
Grout
Riser Pipe
Bentonite Seal
Max GW Elevation
December 2020 GW Elevation
Well Screen
Sand Pack
Gamma equipment could not advance past 23 feet below ground surface (likely deviation in well casing)
HC odor & staining, dry
HC odor & staining, moist
No odor & staining
KEY
Silty Clay / Clayey Silt
Silty Sand
Clay
High Plasticity Clay
CLAYEY SAND
SILTY CLAY
CLAYEY SILT
SILTY CLAY
CLAYEY SILT
SILTY GRAVEL
CLAY
SANDY SILT
SILTY SAND
SANDY GRAVEL
CLAY
SILTY CLAY
CLAY
Elevation (feet amsl)
Depth (feet bgs)
Gamma (counts per second)
3363.1
3358.1
3353.1
3348.1
3343.1
3338.1
3333.1
3328.1
3323.1
3318.1
3313.1
0
5
10
15
20
25
30
35
40
45
50
0
20
40
60
80
100
120
140
160


MW-130 Gamma Log
Well Construction Log
Gamma Log Interpretation
Soil Boring Log (Split Spoon 2014)
Riser Pipe
Grout
Max GW Elevation
October 2020 GW Elevation
Bentonite Seal
Sand Pack
Well Screen
bentonite seal
KEY
Silty Clay / Clayey Silt
Silty Sand
Sand / Gravel
Washed Out (K) Clay
Washed Out (K) Silty Clay
Target Zone
Dry, no odor/staining
Wet, no odor/staining
Dry, no odor/staining
CLAYEY SILT
SILTY CLAY
CLAY
CLAYEY SILT
SILTY CLAY
Elevation (feet amsl)
Depth (feet bgs)
Gamma (counts per second)
3370.2
3365.2
3360.2
3355.2
3350.2
3345.2
3340.2
3335.2
3330.2
3325.2
0
5
10
15
20
25
30
35
40
45
0
20
40
60
80
100
120
140
160


MW-50 Gamma Log - Alternative Pilot Test Location
Elevation (feet amsl)
3368.91
3363.91
3358.91
3353.91
3348.91
3343.91
3338.91
Depth (feet bgs)
0
5
10
15
20
25
30
0
20
40
60
80
100
120
Gamma (API Gamma Ray Units)
Gamma Log Interpretation
No well construction or boring log available.
Well installed in 1994.
likely bentonite seal
Max GW Elevation
October 2020 GW Elevation
KEY
Silty Clay / Clayey Silt
Silty Sand
Clean Sand / Gravel
Washed Out (K) Silty Clay


MW-105 Gamma Log - Alternative Pilot Test Location
Gamma Log Interpretation
Soil Boring Log (Auger Cuttings / Split Spoon 2009)
Grout
Riser Pipe
Bentonite Seal
Filter Pack
Well Screen
Max GW Elevation
October 2020 GW Elevation
KEY
Silty Clay / Clayey Silt
Silty Sand
Clean Sand / Gravel
Washed Out (K) Silty Clay
No odor, dry
Odor & staining, dry
Odor, wet
No odor or staining indicated
CLAY
NO RECOVERY
SAND & GRAVEL
GRAVEL
SAND
Elevation (feet amsl)
Depth (feet bgs)
Gamma (counts per second)
3365.2
3360.2
3355.2
3350.2
3345.2
0
5
10
15
20
0
20
40
60
80
100
120
140
160

Attachment B. Analytical Reports and Data Review Summary

Pace Analytical®
National Center for Testing & Innovation

ANALYTICAL REPORT

December 08, 2020

TRC Solutions - Austin, TX

Sample Delivery Group:	L1288818
Samples Received:	11/21/2020
Project Number:	387820.0000.0000 000
Description:	PilotTest Baseline GWM
Site:	ARTESIA REFINERY
Report To:	Julie Speer 505 E. Huntland Dr, Ste 250 Austin, TX 78752

Entire Report Reviewed By:

Chris McCord
Project Manager

TABLE OF CONTENTS

KWB-4 L1288818-01 GW

Collected by: Cullen Kane | Collected date/time: 11/20/20 09:18 | Received date/time: 11/21/20 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Wet Chemistry by Method 2320 B-2011	WG1585961	1	12/03/20 19:23	12/03/20 19:23	SL	Mt. Juliet, TN
Wet Chemistry by Method 3500Fe B-2011	WG1582803	10	11/26/20 20:55	11/26/20 20:55	BJD	Mt. Juliet, TN
Wet Chemistry by Method 351.2	WG1583567	1	11/28/20 12:14	12/03/20 19:25	JER	Mt. Juliet, TN
Wet Chemistry by Method 4500S2 D-2011	WG1582136	1	11/24/20 21:11	11/24/20 21:11	LRP	Mt. Juliet, TN
Wet Chemistry by Method 9056A	WG1586285	1	12/05/20 00:31	12/05/20 00:31	ELN	Mt. Juliet, TN
Wet Chemistry by Method 9056A	WG1586285	10	12/05/20 00:44	12/05/20 00:44	ELN	Mt. Juliet, TN
Wet Chemistry by Method 9060A	WG1583432	1	11/28/20 23:32	11/28/20 23:32	MJA	Mt. Juliet, TN
Metals (ICPMS) by Method 6020	WG1583391	1	11/28/20 11:10	11/29/20 22:01	LD	Mt. Juliet, TN
Volatile Organic Compounds (GC) by Method 8015D/GRO	WG1584306	100	12/01/20 20:24	12/01/20 20:24	ACG	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1583947	100	11/30/20 05:42	11/30/20 05:42	GLN	Mt. Juliet, TN
Semi-Volatile Organic Compounds (GC) by Method 3511/8015	WG1585215	1	12/02/20 13:12	12/04/20 01:28	WCR	Mt. Juliet, TN

KWB-5 L1288818-02 GW

Collected by: Cullen Kane | Collected date/time: 11/20/20 13:44 | Received date/time: 11/21/20 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Wet Chemistry by Method 2320 B-2011	WG1585961	1	12/03/20 19:37	12/03/20 19:37	SL	Mt. Juliet, TN
Wet Chemistry by Method 3500Fe B-2011	WG1582803	10	11/26/20 20:56	11/26/20 20:56	BJD	Mt. Juliet, TN
Wet Chemistry by Method 351.2	WG1583567	1	11/28/20 12:14	12/03/20 16:52	JER	Mt. Juliet, TN
Wet Chemistry by Method 4500S2 D-2011	WG1582136	1	11/24/20 21:12	11/24/20 21:12	LRP	Mt. Juliet, TN
Wet Chemistry by Method 9056A	WG1586285	1	12/05/20 00:57	12/05/20 00:57	ELN	Mt. Juliet, TN
Wet Chemistry by Method 9060A	WG1583432	1	11/29/20 00:25	11/29/20 00:25	MJA	Mt. Juliet, TN
Metals (ICPMS) by Method 6020	WG1583391	1	11/28/20 11:10	11/29/20 22:05	LD	Mt. Juliet, TN
Volatile Organic Compounds (GC) by Method 8015D/GRO	WG1584306	200	12/01/20 20:46	12/01/20 20:46	ACG	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1583947	200	11/30/20 06:02	11/30/20 06:02	GLN	Mt. Juliet, TN
Semi-Volatile Organic Compounds (GC) by Method 3511/8015	WG1585215	1	12/02/20 13:12	12/04/20 01:48	WCR	Mt. Juliet, TN

MW-48 L1288818-03 GW

Collected by: Cullen Kane | Collected date/time: 11/19/20 09:33 | Received date/time: 11/21/20 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Wet Chemistry by Method 2320 B-2011	WG1584350	1	12/03/20 15:43	12/03/20 15:43	SL	Mt. Juliet, TN
Wet Chemistry by Method 3500Fe B-2011	WG1582803	1	11/26/20 20:57	11/26/20 20:57	BJD	Mt. Juliet, TN
Wet Chemistry by Method 351.2	WG1583567	1	11/28/20 12:14	12/03/20 16:55	JER	Mt. Juliet, TN
Wet Chemistry by Method 4500S2 D-2011	WG1582136	1	11/24/20 21:12	11/24/20 21:12	LRP	Mt. Juliet, TN
Wet Chemistry by Method 9056A	WG1586285	1	12/05/20 02:41	12/05/20 02:41	ELN	Mt. Juliet, TN
Wet Chemistry by Method 9056A	WG1586285	10	12/05/20 03:21	12/05/20 03:21	ELN	Mt. Juliet, TN
Wet Chemistry by Method 9060A	WG1583432	1	11/29/20 00:51	11/29/20 00:51	MJA	Mt. Juliet, TN
Metals (ICPMS) by Method 6020	WG1583391	1	11/28/20 11:10	11/29/20 19:07	LD	Mt. Juliet, TN
Volatile Organic Compounds (GC) by Method 8015D/GRO	WG1584306	10	12/01/20 21:09	12/01/20 21:09	ACG	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1583947	10	11/30/20 05:21	11/30/20 05:21	GLN	Mt. Juliet, TN
Semi-Volatile Organic Compounds (GC) by Method 3511/8015	WG1584733	1	12/02/20 07:30	12/03/20 01:04	WCR	Mt. Juliet, TN

MW-66 L1288818-04 GW

Collected by: Cullen Kane | Collected date/time: 11/18/20 16:44 | Received date/time: 11/21/20 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Wet Chemistry by Method 2320 B-2011	WG1584345	1	12/02/20 05:34	12/02/20 05:34	KAB	Mt. Juliet, TN
Wet Chemistry by Method 3500Fe B-2011	WG1582803	1	11/26/20 20:57	11/26/20 20:57	BJD	Mt. Juliet, TN
Wet Chemistry by Method 351.2	WG1583567	1	11/28/20 12:14	12/03/20 17:02	JER	Mt. Juliet, TN
Wet Chemistry by Method 4500S2 D-2011	WG1582136	1	11/24/20 21:13	11/24/20 21:13	LRP	Mt. Juliet, TN
Wet Chemistry by Method 9056A	WG1586285	1	12/05/20 01:49	12/05/20 01:49	ELN	Mt. Juliet, TN
Wet Chemistry by Method 9060A	WG1583432	1	11/29/20 02:11	11/29/20 02:11	MJA	Mt. Juliet, TN

1 Cp
2 Tc
3 Ss
4 Cn
5 Tr
6 Sr
7 Qc
8 Gl
9 Al
10 Sc

MW-66 L1288818-04 GW

Collected by: Cullen Kane | Collected date/time: 11/18/20 16:44 | Received date/time: 11/21/20 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Metals (ICPMS) by Method 6020	WG1583915	1	11/30/20 23:53	12/01/20 22:39	LD	Mt. Juliet, TN
Volatile Organic Compounds (GC) by Method 8015D/GRO	WG1584306	1	12/01/20 17:24	12/01/20 17:24	ACG	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1583947	1	11/30/20 03:18	11/30/20 03:18	GLN	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1584924	50	12/02/20 01:11	12/02/20 01:11	GLN	Mt. Juliet, TN
Semi-Volatile Organic Compounds (GC) by Method 3511/8015	WG1584733	1	12/02/20 07:30	12/03/20 02:05	WCR	Mt. Juliet, TN

MW-111 L1288818-05 GW

Collected by: Cullen Kane | Collected date/time: 11/20/20 12:01 | Received date/time: 11/21/20 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Wet Chemistry by Method 2320 B-2011	WG1585961	1	12/03/20 19:43	12/03/20 19:43	SL	Mt. Juliet, TN
Wet Chemistry by Method 3500Fe B-2011	WG1582803	10	11/26/20 20:58	11/26/20 20:58	BJD	Mt. Juliet, TN
Wet Chemistry by Method 351.2	WG1583567	1	11/28/20 12:14	12/03/20 17:03	JER	Mt. Juliet, TN
Wet Chemistry by Method 4500S2 D-2011	WG1582136	1	11/24/20 21:13	11/24/20 21:13	LRP	Mt. Juliet, TN
Wet Chemistry by Method 9056A	WG1586285	1	12/05/20 03:34	12/05/20 03:34	ELN	Mt. Juliet, TN
Wet Chemistry by Method 9056A	WG1586285	10	12/05/20 03:47	12/05/20 03:47	ELN	Mt. Juliet, TN
Wet Chemistry by Method 9060A	WG1583432	1	11/29/20 04:39	11/29/20 04:39	MJA	Mt. Juliet, TN
Metals (ICPMS) by Method 6020	WG1583915	1	11/30/20 23:53	12/02/20 02:26	LAT	Mt. Juliet, TN
Volatile Organic Compounds (GC) by Method 8015D/GRO	WG1584306	1	12/01/20 17:46	12/01/20 17:46	ACG	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1583947	1	11/30/20 03:38	11/30/20 03:38	GLN	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1584924	25	12/02/20 01:32	12/02/20 01:32	GLN	Mt. Juliet, TN
Semi-Volatile Organic Compounds (GC) by Method 3511/8015	WG1585215	1	12/02/20 13:12	12/04/20 02:08	WCR	Mt. Juliet, TN

MW-131 L1288818-06 GW

Collected by: Cullen Kane | Collected date/time: 11/19/20 12:41 | Received date/time: 11/21/20 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Wet Chemistry by Method 2320 B-2011	WG1584350	1	12/03/20 15:58	12/03/20 15:58	SL	Mt. Juliet, TN
Wet Chemistry by Method 3500Fe B-2011	WG1583622	1	11/28/20 20:45	11/28/20 20:45	BJD	Mt. Juliet, TN
Wet Chemistry by Method 351.2	WG1583567	1	11/28/20 12:14	12/03/20 17:04	JER	Mt. Juliet, TN
Wet Chemistry by Method 4500S2 D-2011	WG1582136	1	11/24/20 21:14	11/24/20 21:14	LRP	Mt. Juliet, TN
Wet Chemistry by Method 9056A	WG1586285	1	12/05/20 04:00	12/05/20 04:00	ELN	Mt. Juliet, TN
Wet Chemistry by Method 9060A	WG1583432	1	11/29/20 05:06	11/29/20 05:06	MJA	Mt. Juliet, TN
Metals (ICPMS) by Method 6020	WG1583915	1	11/30/20 23:53	12/02/20 02:29	LAT	Mt. Juliet, TN
Volatile Organic Compounds (GC) by Method 8015D/GRO	WG1584306	20	12/01/20 21:31	12/01/20 21:31	ACG	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1583947	20	11/30/20 06:23	11/30/20 06:23	GLN	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1584924	250	12/02/20 01:52	12/02/20 01:52	GLN	Mt. Juliet, TN
Semi-Volatile Organic Compounds (GC) by Method 3511/8015	WG1584733	1	12/02/20 07:30	12/03/20 02:25	WCR	Mt. Juliet, TN

DUP-01 L1288818-07 GW

Collected by: Cullen Kane | Collected date/time: 11/19/20 00:00 | Received date/time: 11/21/20 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Wet Chemistry by Method 2320 B-2011	WG1584350	1	12/03/20 16:05	12/03/20 16:05	SL	Mt. Juliet, TN
Wet Chemistry by Method 3500Fe B-2011	WG1583622	1	11/28/20 20:46	11/28/20 20:46	BJD	Mt. Juliet, TN
Wet Chemistry by Method 351.2	WG1583567	1	11/28/20 12:14	12/03/20 17:06	JER	Mt. Juliet, TN
Wet Chemistry by Method 4500S2 D-2011	WG1582136	1	11/24/20 21:14	11/24/20 21:14	LRP	Mt. Juliet, TN
Wet Chemistry by Method 9056A	WG1586285	1	12/05/20 04:26	12/05/20 04:26	ELN	Mt. Juliet, TN
Wet Chemistry by Method 9060A	WG1583432	1	11/29/20 05:33	11/29/20 05:33	MJA	Mt. Juliet, TN
Metals (ICPMS) by Method 6020	WG1583915	1	11/30/20 23:53	12/02/20 02:32	LAT	Mt. Juliet, TN
Volatile Organic Compounds (GC) by Method 8015D/GRO	WG1585269	25	12/02/20 16:15	12/02/20 16:15	DWR	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1583947	1	11/30/20 03:59	11/30/20 03:59	GLN	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1584924	100	12/02/20 02:13	12/02/20 02:13	GLN	Mt. Juliet, TN

1 Cp
2 Tc
3 Ss
4 Cn
5 Tr
6 Sr
7 Qc
8 Gl
9 Al
10 Sc

DUP-01 L1288818-07 GW

Collected by: Cullen Kane | Collected date/time: 11/19/20 00:00 | Received date/time: 11/21/20 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Semi-Volatile Organic Compounds (GC) by Method 3511/8015	WG1584733	1	12/02/20 07:30	12/03/20 02:45	WCR	Mt. Juliet, TN

TRIP BLANK 1 L1288818-08 GW

Collected by: Cullen Kane | Collected date/time: 11/18/20 00:00 | Received date/time: 11/21/20 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1583891	1	11/29/20 22:02	11/29/20 22:02	GLN	Mt. Juliet, TN

TRIP BLANK 2 L1288818-09 GW

Collected by: Cullen Kane | Collected date/time: 11/20/20 00:00 | Received date/time: 11/21/20 09:00

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1583891	1	11/29/20 22:23	11/29/20 22:23	GLN	Mt. Juliet, TN

All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times, unless qualified or notated within the report. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.

Chris McCord
Project Manager

Sample Delivery Group (SDG) Narrative

pH outside of method requirement.

Lab Sample ID	Project Sample ID	Method
L1288818-01	KWB-4	3511/8015
L1288818-02	KWB-5	8260B, 3511/8015
L1288818-03	MW-48	3511/8015
L1288818-04	MW-66	8260B, 3511/8015
L1288818-05	MW-111	3511/8015
L1288818-06	MW-131	3511/8015
L1288818-07	DUP-01	3511/8015

This data package consists of this signature page, the laboratory review checklist, and the following reportable data as applicable:

R1 - Field chain-of-custody documentation;

R2 - Sample identification cross-reference;

R3 - Test reports (analytical data sheets) for each environmental sample that includes:

a. Items consistent with NELAC Chapter 5,

b. dilution factors,

c. preparation methods,

d. cleanup methods, and

e. if required for the project, tentatively identified compounds (TICs).

R4 - Surrogate recovery data including:

a. Calculated recovery (%R), and

b. The laboratory's surrogate QC limits.

R5 - Test reports/summary forms for blank samples;

R6 - Test reports/summary forms for laboratory control samples (LCSs) including:

a. LCS spiking amounts,

b. Calculated %R for each analyte, and

c. The laboratory's LCS QC limits.

R7 - Test reports for project matrix spike/matrix spike duplicates (MS/MSDs) including:

a. Samples associated with the MS/MSD clearly identified,

b. MS/MSD spiking amounts,

c. Concentration of each MS/MSD analyte measured in the parent and spiked samples,

d. Calculated %Rs and relative percent differences (RPDs), and

e. The laboratory's MS/MSD QC limits

R8 - Laboratory analytical duplicate (if applicable) recovery and precision:

a. The amount of analyte measured in the duplicate,

b. The calculated RPD, and

c. The laboratory's QC limits for analytical duplicates.

R9 - List of method quantitation limits (MQLs) and detectability check sample results for each analyte for each method and matrix.

R10 - Other problems or anomalies.

Release Statement: I am responsible for the release of this laboratory data package. This laboratory is NELAC accredited under the Texas Laboratory Accreditation Program for all the methods, analytes, and matrices reported in this data package except as noted in the Exception Reports. The data have been reviewed and are technically compliant with the requirements of the methods used, except where noted by the laboratory in the Exception Reports. By my signature below, I affirm to the best of my knowledge all problems/anomalies observed by the laboratory have been identified in the Laboratory Review Checklist, and no information affecting the quality of the data has been knowingly withheld.

Chris McCord
Project Manager

Laboratory Review Checklist: Reportable Data

Laboratory Name: Pace Analytical National	LRC Date: 12/08/2020 17:42
Project Name: PilotTest Baseline GWM	Laboratory Job Number: L1288818-01, 02, 03, 04, 05, 06, 07, 08 and 09
Reviewer Name: Chris McCord	Prep Batch Number(s): WG1582136, WG1582803, WG1583622, WG1583391, WG1583432, WG1583891, WG1584306, WG1583947, WG1583915, WG1584345, WG1584924, WG1585269, WG1584733, WG1584350, WG1583567, WG1585961, WG1585215 and WG1586285

#[1]	A[2]	Description	Yes	No	NA[3]	NR[4]	ER#[5]
R1	OI	Chain-of-custody (C-O-C)					
		Did samples meet the laboratory's standard conditions of sample acceptability upon receipt?	X				
		Were all departures from standard conditions described in an exception report?			X		
R2	OI	Sample and quality control (QC) identification					
		Are all field sample ID numbers cross-referenced to the laboratory ID numbers?	X				
		Are all laboratory ID numbers cross-referenced to the corresponding QC data?	X				
R3	OI	Test reports					
		Were all samples prepared and analyzed within holding times?		X			1
		Other than those results < MQL, were all other raw values bracketed by calibration standards?		X			2
		Were calculations checked by a peer or supervisor?	X				
		Were all analyte identifications checked by a peer or supervisor?	X				
		Were sample detection limits reported for all analytes not detected?	X				
		Were all results for soil and sediment samples reported on a dry weight basis?	X				
		Were % moisture (or solids) reported for all soil and sediment samples?			X		
		Were bulk soils/solids samples for volatile analysis extracted with methanol per SW846 Method 5035?			X		
		If required for the project, are TICs reported?			X		
R4	O	Surrogate recovery data					
		Were surrogates added prior to extraction?	X				
		Were surrogate percent recoveries in all samples within the laboratory QC limits?		X			3
R5	OI	Test reports/summary forms for blank samples					
		Were appropriate type(s) of blanks analyzed?	X				
		Were blanks analyzed at the appropriate frequency?	X				
		Were method blanks taken through the entire analytical process, including preparation and, if applicable, cleanup procedures?	X				
		Were blank concentrations < MQL?	X				
R6	OI	Laboratory control samples (LCS):					
		Were all COCs included in the LCS?	X				
		Was each LCS taken through the entire analytical procedure, including prep and cleanup steps?	X				
		Were LCSs analyzed at the required frequency?	X				
		Were LCS (and LCSD, if applicable) %Rs within the laboratory QC limits?	X				
		Does the detectability check sample data document the laboratory's capability to detect the COCs at the MDL used to calculate the SDLs?	X				
		Was the LCSD RPD within QC limits?	X				
R7	OI	Matrix spike (MS) and matrix spike duplicate (MSD) data					
		Were the project/method specified analytes included in the MS and MSD?	X				
		Were MS/MSD analyzed at the appropriate frequency?	X				
		Were MS (and MSD, if applicable) %Rs within the laboratory QC limits?		X			4
		Were MS/MSD RPDs within laboratory QC limits?	X				
R8	OI	Analytical duplicate data					
		Were appropriate analytical duplicates analyzed for each matrix?	X				
		Were analytical duplicates analyzed at the appropriate frequency?	X				
		Were RPDs or relative standard deviations within the laboratory QC limits?	X				
R9	OI	Method quantitation limits (MQLs):					
		Are the MQLs for each method analyte included in the laboratory data package?	X				
		Do the MQLs correspond to the concentration of the lowest non-zero calibration standard?	X				
		Are unadjusted MQLs and DCSs included in the laboratory data package?	X				
R10	OI	Other problems/anomalies					
		Are all known problems/anomalies/special conditions noted in this LRC and ER?		X			5
		Was applicable and available technology used to lower the SDL to minimize the matrix interference effects on the sample results?	X				
		Is the laboratory NELAC-accredited under the Texas Laboratory Accreditation Program for the analytes, matrices and methods associated with this laboratory data package?	X				

1. Items identified by the letter "R" must be included in the laboratory data package submitted in the TRRP-required report(s). Items identified by the letter "S" should be retained and made available upon request for the appropriate retention period.
2. O = organic analyses; I = inorganic analyses (and general chemistry, when applicable);
3. NA = Not applicable;
4. NR = Not reviewed;
5. ER# = Exception Report identification number (an Exception Report should be completed for an item if "NR" or "No" is checked).

Laboratory Review Checklist: Supporting Data

Laboratory Name: Pace Analytical National	LRC Date: 12/08/2020 17:42
Project Name: PilotTest Baseline GWM	Laboratory Job Number: L1288818-01, 02, 03, 04, 05, 06, 07, 08 and 09
Reviewer Name: Chris McCord	Prep Batch Number(s): WG1582136, WG1582803, WG1583622, WG1583391, WG1583432, WG1583891, WG1584306, WG1583947, WG1583915, WG1584345, WG1584924, WG1585269, WG1584733, WG1584350, WG1583567, WG1585961, WG1585215 and WG1586285

#[1]	A[2]	Description	Yes	No	NA[3]	NR[4]	ER#[5]
S1	OI	Initial calibration (ICAL)					
		Were response factors and/or relative response factors for each analyte within QC limits?	X				
		Were percent RSDs or correlation coefficient criteria met?	X				
		Was the number of standards recommended in the method used for all analytes?	X				
		Were all points generated between the lowest and highest standard used to calculate the curve?	X				
		Are ICAL data available for all instruments used?	X				
		Has the initial calibration curve been verified using an appropriate second source standard?	X				
S2	OI	Initial and continuing calibration verification (ICCV and CCV) and continuing calibration blank (CCB):					
		Was the CCV analyzed at the method-required frequency?	X				
		Were percent differences for each analyte within the method-required QC limits?	X				
		Was the ICAL curve verified for each analyte?	X				
		Was the absolute value of the analyte concentration in the inorganic CCB < MDL?	X				
S3	O	Mass spectral tuning					
		Was the appropriate compound for the method used for tuning?	X				
		Were ion abundance data within the method-required QC limits?	X				
S4	O	Internal standards (IS)					
		Were IS area counts and retention times within the method-required QC limits?	X				
S5	OI	Raw data (NELAC Section 5.5.10)					
		Were the raw data (for example, chromatograms, spectral data) reviewed by an analyst?	X				
		Were data associated with manual integrations flagged on the raw data?	X				
S6	O	Dual column confirmation					
		Did dual column confirmation results meet the method-required QC?			X		
S7	O	Tentatively identified compounds (TICs)					
		If TICs were requested, were the mass spectra and TIC data subject to appropriate checks?			X		
S8	I	Interference Check Sample (ICS) results					
		Were percent recoveries within method QC limits?	X				
S9	I	Serial dilutions, post digestion spikes, and method of standard additions					
		Were percent differences, recoveries, and the linearity within the QC limits specified in the method?	X				
S10	OI	Method detection limit (MDL) studies					
		Was a MDL study performed for each reported analyte?	X				
		Is the MDL either adjusted or supported by the analysis of DCSs?	X				
S11	OI	Proficiency test reports					
		Was the laboratory's performance acceptable on the applicable proficiency tests or evaluation studies?	X				
S12	OI	Standards documentation					
		Are all standards used in the analyses NIST-traceable or obtained from other appropriate sources?	X				
S13	OI	Compound/analyte identification procedures					
		Are the procedures for compound/analyte identification documented?	X				
S14	OI	Demonstration of analyst competency (DOC)					
		Was DOC conducted consistent with NELAC Chapter 5?	X				
		Is documentation of the analyst's competency up-to-date and on file?	X				
S15	OI	Verification/validation documentation for methods (NELAC Chapter 5)					
		Are all the methods used to generate the data documented, verified, and validated, where applicable?	X				
S16	OI	Laboratory standard operating procedures (SOPs)					
		Are laboratory SOPs current and on file for each method performed	X				

1. Items identified by the letter "R" must be included in the laboratory data package submitted in the TRRP-required report(s). Items identified by the letter "S" should be retained and made available upon request for the appropriate retention period.
2. O = organic analyses; I = inorganic analyses (and general chemistry, when applicable);
3. NA = Not applicable;
4. NR = Not reviewed;
5. ER# = Exception Report identification number (an Exception Report should be completed for an item if "NR" or "No" is checked).

Laboratory Review Checklist: Exception Reports

Laboratory Name: Pace Analytical National	LRC Date: 12/08/2020 17:42
Project Name: PilotTest Baseline GWM	Laboratory Job Number: L1288818-01, 02, 03, 04, 05, 06, 07, 08 and 09
Reviewer Name: Chris McCord	Prep Batch Number(s): WG1582136, WG1582803, WG1583622, WG1583391, WG1583432, WG1583891, WG1584306, WG1583947, WG1583915, WG1584345, WG1584924, WG1585269, WG1584733, WG1584350, WG1583567, WG1585961, WG1585215 and WG1586285

ER #[1]	Description
1	3500Fe B-2011 WG1582803 L1288818-01, 02, 03, 04 and 05: Prepared and/or analyzed past holding time as defined in the method. Concentrations should be considered minimum values. 3500Fe B-2011 WG1583622 L1288818-06 and 07: Prepared and/or analyzed past holding time as defined in the method. Concentrations should be considered minimum values.
2	9056A WG1586285 R3600785-5 and 6: The analyte concentration exceeds the upper limit of the calibration range of the instrument established by the initial calibration (ICAL).
3	8260B WG1583947 Toluene-d8 L1288818-07: Percent Recovery is outside of established control limits.
4	6020 WG1583391 Magnesium,Dissolved: Percent Recovery is outside of established control limits. 8260B WG1583947 Benzene, Methyl tert-butyl ether: Percent Recovery is outside of established control limits. 3500Fe B-2011 WG1582136 Sulfide: Percent Recovery is outside of established control limits. 8260B WG1583947 Ethylbenzene, 1,2,4-Trimethylbenzene: Percent Recovery is outside of established control limits.
5	3511/8015 WG1584733 L1288818-03, 04, 06 and 07: pH outside of method requirement. 3511/8015 WG1585215 L1288818-01, 02 and 05: pH outside of method requirement. 8260B WG1583947 L1288818-02 and 04: pH outside of method requirement.

1. Items identified by the letter "R" must be included in the laboratory data package submitted in the TRRP-required report(s). Items identified by the letter "S" should be retained and made available upon request for the appropriate retention period.
2. O = organic analyses; I = inorganic analyses (and general chemistry, when applicable);
3. NA = Not applicable;
4. NR = Not reviewed;
5. ER# = Exception Report identification number (an Exception Report should be completed for an item if "NR" or "No" is checked).

Wet Chemistry by Method 2320 B-2011

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
Alkalinity	797		8.45	20.0	20.0	1	12/03/2020 19:23	WG1585961

Sample Narrative:
L1288818-01 WG1585961: Endpoint pH 4.5

Wet Chemistry by Method 3500Fe B-2011

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
Ferrous Iron	4.68	T8	0.150	0.0500	0.500	10	11/26/2020 20:55	WG1582803

Wet Chemistry by Method 351.2

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
Kjeldahl Nitrogen, TKN	0.521		0.140	0.250	0.250	1	12/03/2020 19:25	WG1583567

Wet Chemistry by Method 4500S2 D-2011

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
Sulfide	U		0.0250	0.0500	0.0500	1	11/24/2020 21:11	WG1582136

Wet Chemistry by Method 9056A

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
Bromide	3.93		0.353	1.00	1.00	1	12/05/2020 00:31	WG1586285
Sulfate	230		5.94	5.00	50.0	10	12/05/2020 00:44	WG1586285

Wet Chemistry by Method 9060A

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
TOC (Total Organic Carbon)	13.4		0.102	1.00	1.00	1	11/28/2020 23:32	WG1583432

Metals (ICPMS) by Method 6020

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
Magnesium,Dissolved	117		0.0735	1.00	1.00	1	11/29/2020 22:01	WG1583391

Volatile Organic Compounds (GC) by Method 8015D/GRO

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
TPH (GC/FID) Low Fraction	15.7	B	3.14	0.100	10.0	100	12/01/2020 20:24	WG1584306
(S) a,a,a-Trifluorotoluene(FID)	*97.4*				*78.0-120*		*12/01/2020 20:24*	WG1584306

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
Benzene	2.06		0.00941	0.00100	0.100	100	11/30/2020 05:42	WG1583947
Ethylbenzene	0.632		0.0137	0.00100	0.100	100	11/30/2020 05:42	WG1583947
Methyl tert-butyl ether	5.27		0.0101	0.00100	0.100	100	11/30/2020 05:42	WG1583947
Naphthalene	0.120	J	0.100	0.00500	0.500	100	11/30/2020 05:42	WG1583947
Toluene	0.0527	J	0.0278	0.00100	0.100	100	11/30/2020 05:42	WG1583947
1,2,4-Trimethylbenzene	0.254		0.0322	0.00100	0.100	100	11/30/2020 05:42	WG1583947
1,3,5-Trimethylbenzene	0.0455	J	0.0104	0.00100	0.100	100	11/30/2020 05:42	WG1583947

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
o-Xylene	0.0469	J	0.0174	0.00100	0.100	100	11/30/2020 05:42	WG1583947
m&p-Xylene	0.440		0.0430	0.00200	0.200	100	11/30/2020 05:42	WG1583947
Xylenes, Total	0.487		0.0174	0.00300	0.300	100	11/30/2020 05:42	WG1583947
(S) Toluene-d8	*107*				*80.0-120*		*11/30/2020 05:42*	WG1583947
(S) 4-Bromofluorobenzene	*93.6*				*77.0-126*		*11/30/2020 05:42*	WG1583947
(S) 1,2-Dichloroethane-d4	*97.6*				*70.0-130*		*11/30/2020 05:42*	WG1583947

Semi-Volatile Organic Compounds (GC) by Method 3511/8015

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
TPH (GC/FID) High Fraction	9.20		0.0247	0.100	0.100	1	12/04/2020 01:28	WG1585215
(S) o-Terphenyl	*113*				*31.0-160*		*12/04/2020 01:28*	WG1585215

Wet Chemistry by Method 2320 B-2011

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Alkalinity	745		8.45	20.0	20.0	1	12/03/2020 19:37	WG1585961

Sample Narrative:
L1288818-02 WG1585961: Endpoint pH 4.5

Wet Chemistry by Method 3500Fe B-2011

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Ferrous Iron	3.85	T8	0.150	0.0500	0.500	10	11/26/2020 20:56	WG1582803

Wet Chemistry by Method 351.2

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Kjeldahl Nitrogen, TKN	0.344		0.140	0.250	0.250	1	12/03/2020 16:52	WG1583567

Wet Chemistry by Method 4500S2 D-2011

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Sulfide	U		0.0250	0.0500	0.0500	1	11/24/2020 21:12	WG1582136

Wet Chemistry by Method 9056A

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Bromide	5.19		0.353	1.00	1.00	1	12/05/2020 00:57	WG1586285
Sulfate	60.0		0.594	5.00	5.00	1	12/05/2020 00:57	WG1586285

Wet Chemistry by Method 9060A

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
TOC (Total Organic Carbon)	11.9		0.102	1.00	1.00	1	11/29/2020 00:25	WG1583432

Metals (ICPMS) by Method 6020

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Magnesium,Dissolved	134		0.0735	1.00	1.00	1	11/29/2020 22:05	WG1583391

Volatile Organic Compounds (GC) by Method 8015D/GRO

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
TPH (GC/FID) Low Fraction	24.8	B	6.28	0.100	20.0	200	12/01/2020 20:46	WG1584306
(S) a,a,a-Trifluorotoluene(FID)	*97.3*				*78.0-120*		*12/01/2020 20:46*	WG1584306

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Benzene	2.27		0.0188	0.00100	0.200	200	11/30/2020 06:02	WG1583947
Ethylbenzene	1.26		0.0274	0.00100	0.200	200	11/30/2020 06:02	WG1583947
Methyl tert-butyl ether	8.21		0.0202	0.00100	0.200	200	11/30/2020 06:02	WG1583947
Naphthalene	0.270	J	0.200	0.00500	1.00	200	11/30/2020 06:02	WG1583947
Toluene	0.232		0.0556	0.00100	0.200	200	11/30/2020 06:02	WG1583947
1,2,4-Trimethylbenzene	0.764		0.0644	0.00100	0.200	200	11/30/2020 06:02	WG1583947
1,3,5-Trimethylbenzene	0.148	J	0.0208	0.00100	0.200	200	11/30/2020 06:02	WG1583947

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
o-Xylene	0.315		0.0348	0.00100	0.200	200	11/30/2020 06:02	WG1583947
m&p-Xylene	2.28		0.0860	0.00200	0.400	200	11/30/2020 06:02	WG1583947
Xylenes, Total	2.60		0.0348	0.00300	0.600	200	11/30/2020 06:02	WG1583947
(S) Toluene-d8	*104*				*80.0-120*		*11/30/2020 06:02*	WG1583947
(S) 4-Bromofluorobenzene	*93.8*				*77.0-126*		*11/30/2020 06:02*	WG1583947
(S) 1,2-Dichloroethane-d4	*93.4*				*70.0-130*		*11/30/2020 06:02*	WG1583947

Semi-Volatile Organic Compounds (GC) by Method 3511/8015

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
TPH (GC/FID) High Fraction	4.16		0.0247	0.100	0.100	1	12/04/2020 01:48	WG1585215
(S) o-Terphenyl	*105*				*31.0-160*		*12/04/2020 01:48*	WG1585215

Wet Chemistry by Method 2320 B-2011

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
Alkalinity	878		8.45	20.0	20.0	1	12/03/2020 15:43	WG1584350

Sample Narrative:
L1288818-03 WG1584350: Endpoint pH 4.5

Wet Chemistry by Method 3500Fe B-2011

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
Ferrous Iron	0.130	T8	0.0150	0.0500	0.0500	1	11/26/2020 20:57	WG1582803

Wet Chemistry by Method 351.2

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
Kjeldahl Nitrogen, TKN	1.20		0.140	0.250	0.250	1	12/03/2020 16:55	WG1583567

Wet Chemistry by Method 4500S2 D-2011

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
Sulfide	0.102	J5	0.0250	0.0500	0.0500	1	11/24/2020 21:12	WG1582136

Wet Chemistry by Method 9056A

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
Bromide	1.62		0.353	1.00	1.00	1	12/05/2020 02:41	WG1586285
Sulfate	250		5.94	5.00	50.0	10	12/05/2020 03:21	WG1586285

Wet Chemistry by Method 9060A

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
TOC (Total Organic Carbon)	20.5		0.102	1.00	1.00	1	11/29/2020 00:51	WG1583432

Metals (ICPMS) by Method 6020

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
Magnesium,Dissolved	121	V	0.0735	1.00	1.00	1	11/29/2020 19:07	WG1583391

Volatile Organic Compounds (GC) by Method 8015D/GRO

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
TPH (GC/FID) Low Fraction	5.08		0.314	0.100	1.00	10	12/01/2020 21:09	WG1584306
(S) a,a,a-Trifluorotoluene(FID)	*96.9*				*78.0-120*		*12/01/2020 21:09*	WG1584306

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
Benzene	0.946	V	0.000941	0.00100	0.0100	10	11/30/2020 05:21	WG1583947
Ethylbenzene	0.131	J6	0.00137	0.00100	0.0100	10	11/30/2020 05:21	WG1583947
Methyl tert-butyl ether	0.441	V	0.00101	0.00100	0.0100	10	11/30/2020 05:21	WG1583947
Naphthalene	0.0332	J	0.0100	0.00500	0.0500	10	11/30/2020 05:21	WG1583947
Toluene	0.0544		0.00278	0.00100	0.0100	10	11/30/2020 05:21	WG1583947
1,2,4-Trimethylbenzene	0.115	J6	0.00322	0.00100	0.0100	10	11/30/2020 05:21	WG1583947
1,3,5-Trimethylbenzene	0.0101		0.00104	0.00100	0.0100	10	11/30/2020 05:21	WG1583947

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
o-Xylene	0.00748	J	0.00174	0.00100	0.0100	10	11/30/2020 05:21	WG1583947
m&p-Xylene	0.115		0.00430	0.00200	0.0200	10	11/30/2020 05:21	WG1583947
Xylenes, Total	0.122		0.00174	0.00300	0.0300	10	11/30/2020 05:21	WG1583947
(S) Toluene-d8	*105*				*80.0-120*		*11/30/2020 05:21*	WG1583947
(S) 4-Bromofluorobenzene	*97.6*				*77.0-126*		*11/30/2020 05:21*	WG1583947
(S) 1,2-Dichloroethane-d4	*98.3*				*70.0-130*		*11/30/2020 05:21*	WG1583947

Semi-Volatile Organic Compounds (GC) by Method 3511/8015

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
TPH (GC/FID) High Fraction	4.97		0.0247	0.100	0.100	1	12/03/2020 01:04	WG1584733
(S) o-Terphenyl	*108*				*31.0-160*		*12/03/2020 01:04*	WG1584733

Wet Chemistry by Method 2320 B-2011

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Alkalinity	713		8.45	20.0	20.0	1	12/02/2020 05:34	WG1584345

Sample Narrative:
L1288818-04 WG1584345: Endpoint pH 4.5

Wet Chemistry by Method 3500Fe B-2011

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Ferrous Iron	0.556	T8	0.0150	0.0500	0.0500	1	11/26/2020 20:57	WG1582803

Wet Chemistry by Method 351.2

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Kjeldahl Nitrogen, TKN	0.665		0.140	0.250	0.250	1	12/03/2020 17:02	WG1583567

Wet Chemistry by Method 4500S2 D-2011

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Sulfide	U		0.0250	0.0500	0.0500	1	11/24/2020 21:13	WG1582136

Wet Chemistry by Method 9056A

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Bromide	1.47		0.353	1.00	1.00	1	12/05/2020 01:49	WG1586285
Sulfate	0.687	J	0.594	5.00	5.00	1	12/05/2020 01:49	WG1586285

Wet Chemistry by Method 9060A

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
TOC (Total Organic Carbon)	11.4		0.102	1.00	1.00	1	11/29/2020 02:11	WG1583432

Metals (ICPMS) by Method 6020

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Magnesium,Dissolved	86.0		0.0735	1.00	1.00	1	12/01/2020 22:39	WG1583915

Volatile Organic Compounds (GC) by Method 8015D/GRO

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
TPH (GC/FID) Low Fraction	3.11		0.0314	0.100	0.100	1	12/01/2020 17:24	WG1584306
(S) a,a,a-Trifluorotoluene(FID)	*97.6*				*78.0-120*		*12/01/2020 17:24*	WG1584306

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Benzene	1.35		0.00471	0.00100	0.0500	50	12/02/2020 01:11	WG1584924
Ethylbenzene	0.00900		0.000137	0.00100	0.00100	1	11/30/2020 03:18	WG1583947
Methyl tert-butyl ether	2.93		0.00505	0.00100	0.0500	50	12/02/2020 01:11	WG1584924
Naphthalene	0.165	J	0.0500	0.00500	0.250	50	12/02/2020 01:11	WG1584924
Toluene	0.00741		0.000278	0.00100	0.00100	1	11/30/2020 03:18	WG1583947
1,2,4-Trimethylbenzene	U		0.000322	0.00100	0.00100	1	11/30/2020 03:18	WG1583947
1,3,5-Trimethylbenzene	U		0.000104	0.00100	0.00100	1	11/30/2020 03:18	WG1583947

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
o-Xylene	0.00245		0.000174	0.00100	0.00100	1	11/30/2020 03:18	WG1583947
m&p-Xylene	0.00894		0.000430	0.00200	0.00200	1	11/30/2020 03:18	WG1583947
Xylenes, Total	0.0114		0.000174	0.00300	0.00300	1	11/30/2020 03:18	WG1583947
(S) Toluene-d8	*101*				*80.0-120*		*11/30/2020 03:18*	WG1583947
(S) Toluene-d8	*104*				*80.0-120*		*12/02/2020 01:11*	WG1584924
(S) 4-Bromofluorobenzene	*91.2*				*77.0-126*		*11/30/2020 03:18*	WG1583947
(S) 4-Bromofluorobenzene	*92.6*				*77.0-126*		*12/02/2020 01:11*	WG1584924
(S) 1,2-Dichloroethane-d4	*94.9*				*70.0-130*		*11/30/2020 03:18*	WG1583947
(S) 1,2-Dichloroethane-d4	*108*				*70.0-130*		*12/02/2020 01:11*	WG1584924

Semi-Volatile Organic Compounds (GC) by Method 3511/8015

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
TPH (GC/FID) High Fraction	3.93		0.0247	0.100	0.100	1	12/03/2020 02:05	WG1584733
(S) o-Terphenyl	*116*				*31.0-160*		*12/03/2020 02:05*	WG1584733

Wet Chemistry by Method 2320 B-2011

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Alkalinity	790		8.45	20.0	20.0	1	12/03/2020 19:43	WG1585961

Sample Narrative:
L1288818-05 WG1585961: Endpoint pH 4.5

Wet Chemistry by Method 3500Fe B-2011

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Ferrous Iron	5.92	T8	0.150	0.0500	0.500	10	11/26/2020 20:58	WG1582803

Wet Chemistry by Method 351.2

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Kjeldahl Nitrogen, TKN	0.305		0.140	0.250	0.250	1	12/03/2020 17:03	WG1583567

Wet Chemistry by Method 4500S2 D-2011

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Sulfide	U		0.0250	0.0500	0.0500	1	11/24/2020 21:13	WG1582136

Wet Chemistry by Method 9056A

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Bromide	1.75		0.353	1.00	1.00	1	12/05/2020 03:34	WG1586285
Sulfate	337		5.94	5.00	50.0	10	12/05/2020 03:47	WG1586285

Wet Chemistry by Method 9060A

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
TOC (Total Organic Carbon)	11.0		0.102	1.00	1.00	1	11/29/2020 04:39	WG1583432

Metals (ICPMS) by Method 6020

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Magnesium,Dissolved	147		0.0735	1.00	1.00	1	12/02/2020 02:26	WG1583915

Volatile Organic Compounds (GC) by Method 8015D/GRO

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
TPH (GC/FID) Low Fraction	7.64		0.0314	0.100	0.100	1	12/01/2020 17:46	WG1584306
(S) a,a,a-Trifluorotoluene(FID)	*97.5*				*78.0-120*		*12/01/2020 17:46*	WG1584306

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Benzene	1.05		0.00235	0.00100	0.0250	25	12/02/2020 01:32	WG1584924
Ethylbenzene	0.515		0.00343	0.00100	0.0250	25	12/02/2020 01:32	WG1584924
Methyl tert-butyl ether	1.33		0.00253	0.00100	0.0250	25	12/02/2020 01:32	WG1584924
Naphthalene	0.0803		0.00100	0.00500	0.00500	1	11/30/2020 03:38	WG1583947
Toluene	0.00976		0.000278	0.00100	0.00100	1	11/30/2020 03:38	WG1583947
1,2,4-Trimethylbenzene	0.187		0.00805	0.00100	0.0250	25	12/02/2020 01:32	WG1584924
1,3,5-Trimethylbenzene	0.0407		0.000104	0.00100	0.00100	1	11/30/2020 03:38	WG1583947

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
o-Xylene	0.0285		0.00435	0.00100	0.0250	25	12/02/2020 01:32	WG1584924
m&p-Xylene	0.541		0.0107	0.00200	0.0500	25	12/02/2020 01:32	WG1584924
Xylenes, Total	0.570		0.00435	0.00300	0.0750	25	12/02/2020 01:32	WG1584924
(S) Toluene-d8	*86.4*				*80.0-120*		*11/30/2020 03:38*	WG1583947
(S) Toluene-d8	*104*				*80.0-120*		*12/02/2020 01:32*	WG1584924
(S) 4-Bromofluorobenzene	*82.9*				*77.0-126*		*11/30/2020 03:38*	WG1583947
(S) 4-Bromofluorobenzene	*96.1*				*77.0-126*		*12/02/2020 01:32*	WG1584924
(S) 1,2-Dichloroethane-d4	*96.1*				*70.0-130*		*11/30/2020 03:38*	WG1583947
(S) 1,2-Dichloroethane-d4	*107*				*70.0-130*		*12/02/2020 01:32*	WG1584924

Semi-Volatile Organic Compounds (GC) by Method 3511/8015

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
TPH (GC/FID) High Fraction	2.48		0.0247	0.100	0.100	1	12/04/2020 02:08	WG1585215
(S) o-Terphenyl	*104*				*31.0-160*		*12/04/2020 02:08*	WG1585215

1 Cp
2 Tc
3 Ss
4 Cn
5 Tr
6 Sr
7 Qc
8 Gl
9 Al
10 Sc

Wet Chemistry by Method 2320 B-2011

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Alkalinity	745		8.45	20.0	20.0	1	12/03/2020 15:58	WG1584350

Sample Narrative:
L1288818-06 WG1584350: Endpoint pH 4.5

Wet Chemistry by Method 3500Fe B-2011

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Ferrous Iron	1.14	T8	0.0150	0.0500	0.0500	1	11/28/2020 20:45	WG1583622

Wet Chemistry by Method 351.2

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Kjeldahl Nitrogen, TKN	0.319		0.140	0.250	0.250	1	12/03/2020 17:04	WG1583567

Wet Chemistry by Method 4500S2 D-2011

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Sulfide	U		0.0250	0.0500	0.0500	1	11/24/2020 21:14	WG1582136

Wet Chemistry by Method 9056A

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Bromide	1.91		0.353	1.00	1.00	1	12/05/2020 04:00	WG1586285
Sulfate	12.0		0.594	5.00	5.00	1	12/05/2020 04:00	WG1586285

Wet Chemistry by Method 9060A

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
TOC (Total Organic Carbon)	6.78		0.102	1.00	1.00	1	11/29/2020 05:06	WG1583432

Metals (ICPMS) by Method 6020

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Magnesium,Dissolved	116		0.0735	1.00	1.00	1	12/02/2020 02:29	WG1583915

Volatile Organic Compounds (GC) by Method 8015D/GRO

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
TPH (GC/FID) Low Fraction	34.0		0.628	0.100	2.00	20	12/01/2020 21:31	WG1584306
(S) a,a,a-Trifluorotoluene(FID)	*96.3*				*78.0-120*		*12/01/2020 21:31*	WG1584306

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Benzene	5.09		0.0235	0.00100	0.250	250	12/02/2020 01:52	WG1584924
Ethylbenzene	0.860		0.00274	0.00100	0.0200	20	11/30/2020 06:23	WG1583947
Methyl tert-butyl ether	3.61		0.00202	0.00100	0.0200	20	11/30/2020 06:23	WG1583947
Naphthalene	0.0700	J	0.0200	0.00500	0.100	20	11/30/2020 06:23	WG1583947
Toluene	5.38		0.0695	0.00100	0.250	250	12/02/2020 01:52	WG1584924
1,2,4-Trimethylbenzene	0.400		0.00644	0.00100	0.0200	20	11/30/2020 06:23	WG1583947
1,3,5-Trimethylbenzene	0.0876		0.00208	0.00100	0.0200	20	11/30/2020 06:23	WG1583947

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
o-Xylene	0.736		0.00348	0.00100	0.0200	20	11/30/2020 06:23	WG1583947
m&p-Xylene	1.72		0.00860	0.00200	0.0400	20	11/30/2020 06:23	WG1583947
Xylenes, Total	2.46		0.00348	0.00300	0.0600	20	11/30/2020 06:23	WG1583947
(S) Toluene-d8	*105*				*80.0-120*		*11/30/2020 06:23*	WG1583947
(S) Toluene-d8	*106*				*80.0-120*		*12/02/2020 01:52*	WG1584924
(S) 4-Bromofluorobenzene	*97.1*				*77.0-126*		*11/30/2020 06:23*	WG1583947
(S) 4-Bromofluorobenzene	*97.8*				*77.0-126*		*12/02/2020 01:52*	WG1584924
(S) 1,2-Dichloroethane-d4	*96.1*				*70.0-130*		*11/30/2020 06:23*	WG1583947
(S) 1,2-Dichloroethane-d4	*104*				*70.0-130*		*12/02/2020 01:52*	WG1584924

Semi-Volatile Organic Compounds (GC) by Method 3511/8015

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
TPH (GC/FID) High Fraction	2.64		0.0247	0.100	0.100	1	12/03/2020 02:25	WG1584733
(S) o-Terphenyl	*103*				*31.0-160*		*12/03/2020 02:25*	WG1584733

1 Cp
2 Tc
3 Ss
4 Cn
5 Tr
6 Sr
7 Qc
8 Gl
9 Al
10 Sc

Wet Chemistry by Method 2320 B-2011

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
Alkalinity	757		8.45	20.0	20.0	1	12/03/2020 16:05	WG1584350

Sample Narrative:
L1288818-07 WG1584350: Endpoint pH 4.5

Wet Chemistry by Method 3500Fe B-2011

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
Ferrous Iron	1.23	T8	0.0150	0.0500	0.0500	1	11/28/2020 20:46	WG1583622

Wet Chemistry by Method 351.2

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
Kjeldahl Nitrogen, TKN	0.352		0.140	0.250	0.250	1	12/03/2020 17:06	WG1583567

Wet Chemistry by Method 4500S2 D-2011

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
Sulfide	U		0.0250	0.0500	0.0500	1	11/24/2020 21:14	WG1582136

Wet Chemistry by Method 9056A

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
Bromide	1.89		0.353	1.00	1.00	1	12/05/2020 04:26	WG1586285
Sulfate	14.3		0.594	5.00	5.00	1	12/05/2020 04:26	WG1586285

Wet Chemistry by Method 9060A

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
TOC (Total Organic Carbon)	6.65		0.102	1.00	1.00	1	11/29/2020 05:33	WG1583432

Metals (ICPMS) by Method 6020

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
Magnesium,Dissolved	115		0.0735	1.00	1.00	1	12/02/2020 02:32	WG1583915

Volatile Organic Compounds (GC) by Method 8015D/GRO

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
TPH (GC/FID) Low Fraction	31.9		0.785	0.100	2.50	25	12/02/2020 16:15	WG1585269
(S) a,a,a-Trifluorotoluene(FID)	*84.6*				*78.0-120*		*12/02/2020 16:15*	WG1585269

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
Benzene	5.60		0.00941	0.00100	0.100	100	12/02/2020 02:13	WG1584924
Ethylbenzene	0.945		0.0137	0.00100	0.100	100	12/02/2020 02:13	WG1584924
Methyl tert-butyl ether	4.86		0.0101	0.00100	0.100	100	12/02/2020 02:13	WG1584924
Naphthalene	0.0808		0.00100	0.00500	0.00500	1	11/30/2020 03:59	WG1583947
Toluene	5.84		0.0278	0.00100	0.100	100	12/02/2020 02:13	WG1584924
1,2,4-Trimethylbenzene	0.479		0.0322	0.00100	0.100	100	12/02/2020 02:13	WG1584924
1,3,5-Trimethylbenzene	0.114		0.000104	0.00100	0.00100	1	11/30/2020 03:59	WG1583947

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
o-Xylene	0.834		0.0174	0.00100	0.100	100	12/02/2020 02:13	WG1584924
m&p-Xylene	2.04		0.0430	0.00200	0.200	100	12/02/2020 02:13	WG1584924
Xylenes, Total	2.87		0.0174	0.00300	0.300	100	12/02/2020 02:13	WG1584924
(S) Toluene-d8	*79.3*	J2			*80.0-120*		*11/30/2020 03:59*	WG1583947
(S) Toluene-d8	*105*				*80.0-120*		*12/02/2020 02:13*	WG1584924
(S) 4-Bromofluorobenzene	*77.1*				*77.0-126*		*11/30/2020 03:59*	WG1583947
(S) 4-Bromofluorobenzene	*93.1*				*77.0-126*		*12/02/2020 02:13*	WG1584924
(S) 1,2-Dichloroethane-d4	*97.4*				*70.0-130*		*11/30/2020 03:59*	WG1583947
(S) 1,2-Dichloroethane-d4	*112*				*70.0-130*		*12/02/2020 02:13*	WG1584924

Semi-Volatile Organic Compounds (GC) by Method 3511/8015

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
TPH (GC/FID) High Fraction	2.41		0.0247	0.100	0.100	1	12/03/2020 02:45	WG1584733
(S) o-Terphenyl	*103*				*31.0-160*		*12/03/2020 02:45*	WG1584733

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Benzene	0.000126	J	0.0000941	0.00100	0.00100	1	11/29/2020 22:02	WG1583891
Ethylbenzene	U		0.000137	0.00100	0.00100	1	11/29/2020 22:02	WG1583891
Methyl tert-butyl ether	U		0.000101	0.00100	0.00100	1	11/29/2020 22:02	WG1583891
Naphthalene	0.00102	J	0.00100	0.00500	0.00500	1	11/29/2020 22:02	WG1583891
Toluene	U		0.000278	0.00100	0.00100	1	11/29/2020 22:02	WG1583891
1,2,4-Trimethylbenzene	U		0.000322	0.00100	0.00100	1	11/29/2020 22:02	WG1583891
1,3,5-Trimethylbenzene	U		0.000104	0.00100	0.00100	1	11/29/2020 22:02	WG1583891
o-Xylene	U		0.000174	0.00100	0.00100	1	11/29/2020 22:02	WG1583891
m&p-Xylene	U		0.000430	0.00200	0.00200	1	11/29/2020 22:02	WG1583891
Xylenes, Total	U		0.000174	0.00300	0.00300	1	11/29/2020 22:02	WG1583891
(S) Toluene-d8	*109*				*80.0-120*		*11/29/2020 22:02*	WG1583891
(S) 4-Bromofluorobenzene	*94.5*				*77.0-126*		*11/29/2020 22:02*	WG1583891
(S) 1,2-Dichloroethane-d4	*98.1*				*70.0-130*		*11/29/2020 22:02*	WG1583891

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Benzene	U		0.0000941	0.00100	0.00100	1	11/29/2020 22:23	WG1583891
Ethylbenzene	U		0.000137	0.00100	0.00100	1	11/29/2020 22:23	WG1583891
Methyl tert-butyl ether	U		0.000101	0.00100	0.00100	1	11/29/2020 22:23	WG1583891
Naphthalene	U		0.00100	0.00500	0.00500	1	11/29/2020 22:23	WG1583891
Toluene	U		0.000278	0.00100	0.00100	1	11/29/2020 22:23	WG1583891
1,2,4-Trimethylbenzene	U		0.000322	0.00100	0.00100	1	11/29/2020 22:23	WG1583891
1,3,5-Trimethylbenzene	U		0.000104	0.00100	0.00100	1	11/29/2020 22:23	WG1583891
o-Xylene	U		0.000174	0.00100	0.00100	1	11/29/2020 22:23	WG1583891
m&p-Xylene	U		0.000430	0.00200	0.00200	1	11/29/2020 22:23	WG1583891
Xylenes, Total	U		0.000174	0.00300	0.00300	1	11/29/2020 22:23	WG1583891
(S) Toluene-d8	*107*				*80.0-120*		*11/29/2020 22:23*	WG1583891
(S) 4-Bromofluorobenzene	*88.1*				*77.0-126*		*11/29/2020 22:23*	WG1583891
(S) 1,2-Dichloroethane-d4	*102*				*70.0-130*		*11/29/2020 22:23*	WG1583891

Method Blank (MB)

(MB) R3599332-1 12/02/20 02:09

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Alkalinity	U		8.45	20.0

Sample Narrative:

BLANK: Endpoint pH 4.5

L1287958-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1287958-01 12/02/20 03:49 • (DUP) R3599332-3 12/02/20 03:58

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Alkalinity	67.3	68.8	1	2.16		20

Sample Narrative:

OS: Endpoint pH 4.5

DUP: Endpoint pH 4.5

L1288834-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1288834-01 12/02/20 05:42 • (DUP) R3599332-4 12/02/20 05:51

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Alkalinity	264	251	1	5.14		20

Sample Narrative:

OS: Endpoint pH 4.5

DUP: Endpoint pH 4.5

Laboratory Control Sample (LCS)

(LCS) R3599332-2 12/02/20 03:39

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Alkalinity	100	90.6	90.6	90.0-110	

Sample Narrative:

LCS: Endpoint pH 4.5

Method Blank (MB)

(MB) R3600088-1 12/03/20 13:04

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Alkalinity	U		8.45	20.0

Sample Narrative:

BLANK: Endpoint pH 4.5

L1288288-02 Original Sample (OS) • Duplicate (DUP)

(OS) L1288288-02 12/03/20 13:14 • (DUP) R3600088-2 12/03/20 13:21

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Alkalinity	431	425	1	1.32		20

Sample Narrative:

OS: Endpoint pH 4.5 Headspace

DUP: Endpoint pH 4.5

L1288818-03 Original Sample (OS) • Duplicate (DUP)

(OS) L1288818-03 12/03/20 15:43 • (DUP) R3600088-4 12/03/20 15:50

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Alkalinity	878	885	1	0.808		20

Sample Narrative:

OS: Endpoint pH 4.5

DUP: Endpoint pH 4.5

Laboratory Control Sample (LCS)

(LCS) R3600088-3 12/03/20 14:20

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Alkalinity	100	96.9	96.9	90.0-110	

Sample Narrative:

LCS: Endpoint pH 4.5

Method Blank (MB)

(MB) R3600274-1 12/03/20 19:05

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Alkalinity	U		8.45	20.0

Sample Narrative:

BLANK: Endpoint pH 4.5

L1288818-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1288818-01 12/03/20 19:23 • (DUP) R3600274-2 12/03/20 19:30

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Alkalinity	797	794	1	0.353		20

Sample Narrative:

OS: Endpoint pH 4.5

DUP: Endpoint pH 4.5

L1289374-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1289374-01 12/03/20 21:01 • (DUP) R3600274-4 12/03/20 21:07

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Alkalinity	246	236	1	3.92		20

Sample Narrative:

OS: Endpoint pH 4.5 Headspace

DUP: Endpoint pH 4.5

Laboratory Control Sample (LCS)

(LCS) R3600274-3 12/03/20 20:22

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Alkalinity	100	97.6	97.6	90.0-110	

Sample Narrative:

LCS: Endpoint pH 4.5

Method Blank (MB)

(MB) R3597736-1 11/26/20 20:44

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Ferrous Iron	U		0.0150	0.0500

L1288818-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1288818-01 11/26/20 20:55 • (DUP) R3597736-3 11/26/20 20:56

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Ferrous Iron	4.68	4.68	10	0.0427		20

L1288899-06 Original Sample (OS) • Duplicate (DUP)

(OS) L1288899-06 11/26/20 21:00 • (DUP) R3597736-4 11/26/20 21:01

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Ferrous Iron	U	U	1	0.000		20

Laboratory Control Sample (LCS)

(LCS) R3597736-2 11/26/20 20:44

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Ferrous Iron	1.00	0.996	99.6	85.0-115	

L1289319-02 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1289319-02 11/26/20 21:10 • (MS) R3597736-5 11/26/20 21:10 • (MSD) R3597736-6 11/26/20 21:10

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Ferrous Iron	1.00	U	0.923	0.965	92.3	96.5	1	80.0-120			4.45	20

Method Blank (MB)

(MB) R3598124-1 11/28/20 20:42

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Ferrous Iron	U		0.0150	0.0500

L1288818-06 Original Sample (OS) • Duplicate (DUP)

(OS) L1288818-06 11/28/20 20:45 • (DUP) R3598124-3 11/28/20 20:45

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Ferrous Iron	1.14	1.16	1	2.00		20

L1288863-09 Original Sample (OS) • Duplicate (DUP)

(OS) L1288863-09 11/28/20 20:53 • (DUP) R3598124-4 11/28/20 20:54

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Ferrous Iron	12.5	12.6	50	0.811		20

Laboratory Control Sample (LCS)

(LCS) R3598124-2 11/28/20 20:43

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Ferrous Iron	1.00	0.995	99.5	85.0-115	

L1289982-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1289982-01 11/28/20 21:01 • (MS) R3598124-5 11/28/20 21:01 • (MSD) R3598124-6 11/28/20 21:02

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Ferrous Iron	1.00	0.306	1.47	1.32	117	101	1	80.0-120			11.2	20

1 Cp
2 Tc
3 Ss
4 Cn
5 Tr
6 Sr
7 Qc
8 Gl
9 Al
10 Sc

Method Blank (MB)

(MB) R3600161-1 12/03/20 16:45

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Kjeldahl Nitrogen, TKN	U		0.140	0.250

L1288818-02 Original Sample (OS) • Duplicate (DUP)

(OS) L1288818-02 12/03/20 16:52 • (DUP) R3600161-3 12/03/20 16:53

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Kjeldahl Nitrogen, TKN	0.344	0.378	1	9.42		20

L1288822-02 Original Sample (OS) • Duplicate (DUP)

(OS) L1288822-02 12/03/20 19:28 • (DUP) R3600161-7 12/03/20 19:29

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Kjeldahl Nitrogen, TKN	3.38	3.33	1	1.49		20

Laboratory Control Sample (LCS)

(LCS) R3600161-2 12/03/20 16:47

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Kjeldahl Nitrogen, TKN	15.2	15.6	103	75.2-121	

L1288818-03 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1288818-03 12/03/20 16:55 • (MS) R3600161-4 12/03/20 16:56 • (MSD) R3600161-5 12/03/20 16:57

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Kjeldahl Nitrogen, TKN	5.00	1.20	6.27	5.90	101	94.0	1	90.0-110			6.08	20

L1288818-07 Original Sample (OS) • Matrix Spike (MS)

(OS) L1288818-07 12/03/20 17:06 • (MS) R3600161-6 12/03/20 17:07

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MS Rec. %	Dilution	Rec. Limits %	MS Qualifier
Kjeldahl Nitrogen, TKN	5.00	0.352	5.11	95.2	1	90.0-110	

Method Blank (MB)

(MB) R3597112-1 11/24/20 21:10

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Sulfide	U		0.0250	0.0500

L1288298-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1288298-01 11/24/20 21:10 • (DUP) R3597112-3 11/24/20 21:11

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Sulfide	U	U	1	0.000		20

L1288834-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1288834-01 11/24/20 21:14 • (DUP) R3597112-6 11/24/20 21:14

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Sulfide	0.0440	0.0490	1	10.8	J	20

Laboratory Control Sample (LCS)

(LCS) R3597112-2 11/24/20 21:10

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Sulfide	0.500	0.486	97.2	85.0-115	

L1288818-03 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1288818-03 11/24/20 21:12 • (MS) R3597112-4 11/24/20 21:13 • (MSD) R3597112-5 11/24/20 21:13

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Sulfide	1.00	0.102	1.38	1.35	128	124	1	80.0-120	J5	J5	2.28	20

Method Blank (MB)

(MB) R3600785-1 12/04/20 23:02

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Bromide	U		0.353	1.00
Sulfate	U		0.594	5.00

L1288818-02 Original Sample (OS) • Duplicate (DUP)

(OS) L1288818-02 12/05/20 00:57 • (DUP) R3600785-3 12/05/20 01:23

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Bromide	5.19	5.43	1	4.51		15
Sulfate	60.0	62.9	1	4.80		15

L1288991-12 Original Sample (OS) • Duplicate (DUP)

(OS) L1288991-12 12/05/20 09:13 • (DUP) R3600785-8 12/05/20 09:26

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Bromide	U	U	1	0.000		15
Sulfate	U	U	1	0.000		15

Laboratory Control Sample (LCS)

(LCS) R3600785-2 12/04/20 23:16

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Bromide	40.0	37.9	94.8	80.0-120	
Sulfate	40.0	38.6	96.6	80.0-120	

L1288818-03 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1288818-03 12/05/20 02:41 • (MS) R3600785-5 12/05/20 02:54 • (MSD) R3600785-6 12/05/20 03:08

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Bromide	50.0	1.62	47.1	47.6	91.0	91.9	1	80.0-120			0.924	15
Sulfate	50.0	263	305	304	84.4	82.0	1	80.0-120	E	E	0.393	15

L1288991-10 Original Sample (OS) • Matrix Spike (MS)

(OS) L1288991-10 12/05/20 08:08 • (MS) R3600785-7 12/05/20 08:21

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MS Rec. %	Dilution	Rec. Limits %	MS Qualifier
Bromide	50.0	1.62	49.4	95.5	1	80.0-120	
Sulfate	50.0	10.3	60.3	100	1	80.0-120	

Method Blank (MB)

(MB) R3598319-1 11/28/20 14:45

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
TOC (Total Organic Carbon)	U		0.102	1.00

L1288818-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1288818-01 11/28/20 23:32 • (DUP) R3598319-5 11/28/20 23:58

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
TOC (Total Organic Carbon)	13.4	13.6	1	1.42		20

L1288818-07 Original Sample (OS) • Duplicate (DUP)

(OS) L1288818-07 11/29/20 05:33 • (DUP) R3598319-8 11/29/20 06:00

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
TOC (Total Organic Carbon)	6.65	6.60	1	0.810		20

Laboratory Control Sample (LCS)

(LCS) R3598319-2 11/28/20 15:38

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
TOC (Total Organic Carbon)	75.0	73.5	98.1	85.0-115	

L1288780-09 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1288780-09 11/28/20 19:49 • (MS) R3598319-3 11/28/20 20:16 • (MSD) R3598319-4 11/28/20 22:38

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
TOC (Total Organic Carbon)	50.0	0.749	49.8	51.3	98.0	101	1	80.0-120			3.00	20

L1288818-03 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1288818-03 11/29/20 00:51 • (MS) R3598319-6 11/29/20 01:18 • (MSD) R3598319-7 11/29/20 01:45

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
TOC (Total Organic Carbon)	50.0	20.5	69.9	70.0	98.8	98.9	1	80.0-120			0.101	20

Method Blank (MB)

(MB) R3598267-1 11/29/20 19:00

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Magnesium,Dissolved	U		0.0735	1.00

Laboratory Control Sample (LCS)

(LCS) R3598267-2 11/29/20 19:03

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Magnesium,Dissolved	5.00	4.86	97.3	80.0-120	

L1288818-03 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1288818-03 11/29/20 19:07 • (MS) R3598267-4 11/29/20 19:13 • (MSD) R3598267-5 11/29/20 19:17

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Magnesium,Dissolved	5.00	121	122	122	29.4	19.2	1	75.0-125	V	V	0.420	20

Method Blank (MB)

(MB) R3599249-1 12/01/20 22:32

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Magnesium,Dissolved	U		0.0735	1.00

Laboratory Control Sample (LCS)

(LCS) R3599249-2 12/01/20 22:35

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Magnesium,Dissolved	5.00	4.66	93.3	80.0-120	

L1288818-04 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1288818-04 12/01/20 22:39 • (MS) R3599249-4 12/01/20 22:45 • (MSD) R3599249-5 12/01/20 22:48

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Magnesium,Dissolved	5.00	86.0	90.6	91.5	92.2	110	1	75.0-125			0.989	20

Method Blank (MB)

(MB) R3599165-2 12/01/20 13:41

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
TPH (GC/FID) Low Fraction	0.0348	J	0.0314	0.100
(S) a,a,a-Trifluorotoluene(FID)	*106*			*78.0-120*

Laboratory Control Sample (LCS)

(LCS) R3599165-1 12/01/20 12:41

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
TPH (GC/FID) Low Fraction	5.50	4.83	87.8	72.0-127	
(S) a,a,a-Trifluorotoluene(FID)			*103*	*78.0-120*	

L1288818-03 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1288818-03 12/01/20 21:09 • (MS) R3599165-3 12/01/20 22:39 • (MSD) R3599165-4 12/01/20 23:01

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
TPH (GC/FID) Low Fraction	55.0	5.08	55.0	53.8	90.8	88.6	10	10.0-160			2.21	22
(S) a,a,a-Trifluorotoluene(FID)					*98.5*	*97.3*		*78.0-120*				

Method Blank (MB)

(MB) R3599545-3 12/02/20 12:14

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
TPH (GC/FID) Low Fraction	U		0.0314	0.100
(S) a,a,a-Trifluorotoluene(FID)	*99.2*			*78.0-120*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3599545-1 12/02/20 11:12 • (LCSD) R3599545-2 12/02/20 11:32

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
TPH (GC/FID) Low Fraction	5.50	6.28	5.32	114	96.7	72.0-127			16.6	20
(S) a,a,a-Trifluorotoluene(FID)				*117*	*112*	*78.0-120*				

Method Blank (MB)

(MB) R3598511-3 11/29/20 14:09

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Benzene	U		0.0000941	0.00100
Ethylbenzene	U		0.000137	0.00100
Methyl tert-butyl ether	U		0.000101	0.00100
Naphthalene	U		0.00100	0.00500
Toluene	U		0.000278	0.00100
1,2,4-Trimethylbenzene	U		0.000322	0.00100
1,3,5-Trimethylbenzene	U		0.000104	0.00100
Xylenes, Total	U		0.000174	0.00300
o-Xylene	U		0.000174	0.00100
m&p-Xylenes	U		0.000430	0.00200
(S) Toluene-d8	*107*			*80.0-120*
(S) 4-Bromofluorobenzene	*89.9*			*77.0-126*
(S) 1,2-Dichloroethane-d4	*102*			*70.0-130*

Laboratory Control Sample (LCS)

(LCS) R3598511-1 11/29/20 13:08

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Benzene	0.00500	0.00432	86.4	70.0-123	
Ethylbenzene	0.00500	0.00454	90.8	79.0-123	
Methyl tert-butyl ether	0.00500	0.00415	83.0	68.0-125	
Naphthalene	0.00500	0.00272	54.4	54.0-135	
Toluene	0.00500	0.00485	97.0	79.0-120	
1,2,4-Trimethylbenzene	0.00500	0.00450	90.0	76.0-121	
1,3,5-Trimethylbenzene	0.00500	0.00401	80.2	76.0-122	
Xylenes, Total	0.0150	0.0134	89.3	79.0-123	
o-Xylene	0.00500	0.00441	88.2	80.0-122	
m&p-Xylenes	0.0100	0.00900	90.0	80.0-122	
(S) Toluene-d8			*107*	*80.0-120*	
(S) 4-Bromofluorobenzene			*92.0*	*77.0-126*	
(S) 1,2-Dichloroethane-d4			*98.9*	*70.0-130*	

Method Blank (MB)

(MB) R3599195-2 11/30/20 02:08

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Benzene	U		0.0000941	0.00100
Ethylbenzene	U		0.000137	0.00100
Methyl tert-butyl ether	U		0.000101	0.00100
Naphthalene	U		0.00100	0.00500
Toluene	U		0.000278	0.00100
1,2,4-Trimethylbenzene	U		0.000322	0.00100
1,3,5-Trimethylbenzene	U		0.000104	0.00100
Xylenes, Total	U		0.000174	0.00300
o-Xylene	U		0.000174	0.00100
m&p-Xylenes	U		0.000430	0.00200
(S) Toluene-d8	*109*			*80.0-120*
(S) 4-Bromofluorobenzene	*87.2*			*77.0-126*
(S) 1,2-Dichloroethane-d4	*102*			*70.0-130*

Laboratory Control Sample (LCS)

(LCS) R3599195-1 11/30/20 01:27

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Benzene	0.00500	0.00521	104	70.0-123	
Ethylbenzene	0.00500	0.00529	106	79.0-123	
Methyl tert-butyl ether	0.00500	0.00440	88.0	68.0-125	
Naphthalene	0.00500	0.00351	70.2	54.0-135	
Toluene	0.00500	0.00547	109	79.0-120	
1,2,4-Trimethylbenzene	0.00500	0.00489	97.8	76.0-121	
1,3,5-Trimethylbenzene	0.00500	0.00448	89.6	76.0-122	
Xylenes, Total	0.0150	0.0147	98.0	79.0-123	
o-Xylene	0.00500	0.00470	94.0	80.0-122	
m&p-Xylenes	0.0100	0.00998	99.8	80.0-122	
(S) Toluene-d8			*109*	*80.0-120*	
(S) 4-Bromofluorobenzene			*93.1*	*77.0-126*	
(S) 1,2-Dichloroethane-d4			*98.7*	*70.0-130*	

L1288818-03 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1288818-03 11/30/20 05:21 • (MS) R3599195-3 11/30/20 06:43 • (MSD) R3599195-4 11/30/20 07:04

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Benzene	0.0500	0.946	0.854	0.777	0.000	0.000	10	17.0-158	V	V	9.44	27
Ethylbenzene	0.0500	0.131	0.165	0.143	68.0	24.0	10	30.0-155		J6	14.3	27
Methyl tert-butyl ether	0.0500	0.441	0.386	0.390	0.000	0.000	10	28.0-150	V	V	1.03	29
Naphthalene	0.0500	0.0332	0.0685	0.0726	70.6	78.8	10	12.0-156			5.81	35
Toluene	0.0500	0.0544	0.0983	0.0906	87.8	72.4	10	26.0-154			8.15	28
1,2,4-Trimethylbenzene	0.0500	0.115	0.148	0.115	66.0	0.000	10	26.0-154		J6	25.1	27
1,3,5-Trimethylbenzene	0.0500	0.0101	0.0477	0.0476	75.2	75.0	10	28.0-153			0.210	27
Xylenes, Total	0.150	0.122	0.260	0.234	92.0	74.7	10	29.0-154			10.5	28
o-Xylene	0.0500	0.00748	0.0564	0.0527	97.8	90.4	10	45.0-144			6.78	26
m&p-Xylenes	0.100	0.115	0.204	0.181	89.0	66.0	10	43.0-146			11.9	26
(S) Toluene-d8					*103*	*102*		*80.0-120*				
(S) 4-Bromofluorobenzene					*98.3*	*93.7*		*77.0-126*				
(S) 1,2-Dichloroethane-d4					*97.3*	*97.6*		*70.0-130*				

Method Blank (MB)

(MB) R3599465-2 12/01/20 19:54

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Benzene	U		0.0000941	0.00100
Ethylbenzene	U		0.000137	0.00100
Methyl tert-butyl ether	U		0.000101	0.00100
Naphthalene	U		0.00100	0.00500
Toluene	U		0.000278	0.00100
1,2,4-Trimethylbenzene	U		0.000322	0.00100
Xylenes, Total	U		0.000174	0.00300
o-Xylene	U		0.000174	0.00100
m&p-Xylenes	U		0.000430	0.00200
(S) Toluene-d8	*106*			*80.0-120*
(S) 4-Bromofluorobenzene	*95.9*			*77.0-126*
(S) 1,2-Dichloroethane-d4	*110*			*70.0-130*

Laboratory Control Sample (LCS)

(LCS) R3599465-1 12/01/20 19:12

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Benzene	0.00500	0.00518	104	70.0-123	
Ethylbenzene	0.00500	0.00498	99.6	79.0-123	
Methyl tert-butyl ether	0.00500	0.00580	116	68.0-125	
Naphthalene	0.00500	0.00474	94.8	54.0-135	
Toluene	0.00500	0.00494	98.8	79.0-120	
1,2,4-Trimethylbenzene	0.00500	0.00457	91.4	76.0-121	
Xylenes, Total	0.0150	0.0146	97.3	79.0-123	
o-Xylene	0.00500	0.00472	94.4	80.0-122	
m&p-Xylenes	0.0100	0.00989	98.9	80.0-122	
(S) Toluene-d8			*101*	*80.0-120*	
(S) 4-Bromofluorobenzene			*95.4*	*77.0-126*	
(S) 1,2-Dichloroethane-d4			*114*	*70.0-130*	

Method Blank (MB)

(MB) R3599735-1 12/02/20 23:24

Analyte	MB Result	MB Qualifier	MB MDL	MB RDL
	mg/l		mg/l	mg/l
TPH (GC/FID) High Fraction	U		0.0247	0.100
(S) o-Terphenyl	*84.0*			*31.0-160*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3599735-2 12/02/20 23:44 • (LCSD) R3599735-3 12/03/20 00:04

Analyte	Spike Amount	LCS Result	LCSD Result	LCS Rec.	LCSD Rec.	Rec. Limits	LCS Qualifier	LCSD Qualifier	RPD	RPD Limits
	mg/l	mg/l	mg/l	%	%	%			%	%
TPH (GC/FID) High Fraction	1.50	1.58	1.63	105	109	50.0-150			3.12	20
(S) o-Terphenyl				*114*	*118*	*31.0-160*				

L1288818-03 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1288818-03 12/03/20 01:04 • (MS) R3599735-4 12/03/20 01:25 • (MSD) R3599735-5 12/03/20 01:45

Analyte	Spike Amount	Original Result	MS Result	MSD Result	MS Rec.	MSD Rec.	Dilution	Rec. Limits	MS Qualifier	MSD Qualifier	RPD	RPD Limits
	mg/l	mg/l	mg/l	mg/l	%	%		%			%	%
TPH (GC/FID) High Fraction	1.43	4.97	6.58	6.58	113	113	1	50.0-150			0.000	20
(S) o-Terphenyl					*124*	*136*		*31.0-160*				

Method Blank (MB)

(MB) R3600323-1 12/04/20 00:28

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
TPH (GC/FID) High Fraction	U		0.0247	0.100
(S) o-Terphenyl	*77.0*			*31.0-160*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3600323-2 12/04/20 00:48 • (LCSD) R3600323-3 12/04/20 01:08

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
TPH (GC/FID) High Fraction	1.50	1.55	1.54	103	103	50.0-150			0.647	20
(S) o-Terphenyl				*101*	*108*	*31.0-160*				

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Results Disclaimer - Information that may be provided by the customer, and contained within this report, include Permit Limits, Project Name, Sample ID, Sample Matrix, Sample Preservation, Field Blanks, Field Spikes, Field Duplicates, On-Site Data, Sampling Collection Dates/Times, and Sampling Location. Results relate to the accuracy of this information provided, and as the samples are received.

Abbreviations and Definitions

MDL	Method Detection Limit.
MQL	Method Quantitation Limit.
RDL	Reported Detection Limit.
Rec.	Recovery.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
SDL	Sample Detection Limit.
(S)	Surrogate (Surrogate Standard) - Analytes added to every blank, sample, Laboratory Control Sample/Duplicate and Matrix Spike/Duplicate; used to evaluate analytical efficiency by measuring recovery. Surrogates are not expected to be detected in all environmental media.
U	Not detected at the Sample Detection Limit.
Unadj. MQL	Unadjusted Method Quantitation Limit.
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state “ND” (Not Detected) or “BDL” (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier	Description
B	The same analyte is found in the associated blank.
E	The analyte concentration exceeds the upper limit of the calibration range of the instrument established by the initial calibration (ICAL).
J	The identification of the analyte is acceptable; the reported value is an estimate.
J2	Surrogate recovery limits have been exceeded; values are outside lower control limits.
J5	The sample matrix interfered with the ability to make any accurate determination; spike value is high.
J6	The sample matrix interfered with the ability to make any accurate determination; spike value is low.
T8	Sample(s) received past/too close to holding time expiration.
V	The sample concentration is too high to evaluate accurate spike recoveries.

Pace National is the only environmental laboratory accredited/certified to support your work nationwide from one location. One phone call, one point of contact, one laboratory. No other lab is as accessible or prepared to handle your needs throughout the country. Our capacity and capability from our single location laboratory is comparable to the collective totals of the network laboratories in our industry. The most significant benefit to our one location design is the design of our laboratory campus. The model is conducive to accelerated productivity, decreasing turn-around time, and preventing cross contamination, thus protecting sample integrity. Our focus on premium quality and prompt service allows us to be YOUR LAB OF CHOICE.
* Not all certifications held by the laboratory are applicable to the results reported in the attached report.
* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace National.

State Accreditations

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN-03-2002-34
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	n/a
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO00356
Kentucky [1 6]	90010	South Carolina	84004
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana [1]	LA180010	Texas	T104704245-18-15
Maine	TN0002	Texas [5]	LAB0152
Maryland	324	Utah	TN00003
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	460132
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	9980939910
Montana	CERT0086	Wyoming	A2LA

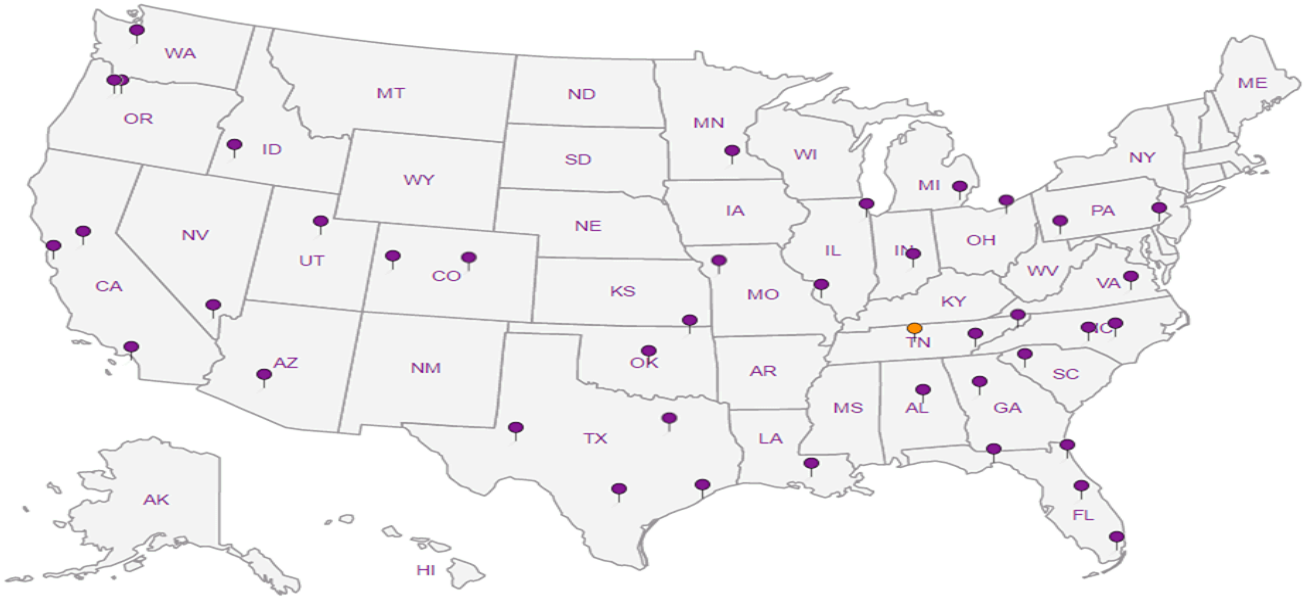
Third Party Federal Accreditations

A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

Our Locations

Pace National has sixty-four client support centers that provide sample pickup and/or the delivery of sampling supplies. If you would like assistance from one of our support offices, please contact our main office. Pace National performs all testing at our central laboratory.



TRC Solutions - Austin, TX

505 E. Huntland Dr, Ste 250
Austin, TX 78752

Billing Information:
Accounts Payable
21 Griffin Road North
Windsor, CT 06095

Pres Chk

Report to: Julie Speer

Email To: jspeer@trccompanies.com

Project Description: PilotTest Baseline GWM

City/State Collected:

Please Circle: PT MT CT ET

Phone: 512-684-3170
512-431-8184

Client Project # 387820.0000.0000 000

Lab Project # TRCATX-ARTESIAPILOT

Collected by (print): Cullen Kane

Site/Facility ID # Artesia Refinery

P.O. #

Collected by (signature): Cullen Kane

Immediately Packed on Ice N ___ Y X

Rush? (Lab MUST Be Notified)
___ Same Day ___ Five Day
___ Next Day ___ 5 Day (Rad Only)
___ Two Day X 10 Day (Rad Only)
___ Three Day

Quote #

Date Results Needed

Analysis / Container / Preservative

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	ALK,BROMIDE,SULFATE 250mlHDPE-NoPres	DROLVI 40mlAmb-HCl-BT	Diss. Mg 250mlHDPE-NoPres	FERUSFE 250mlAmb-HCl	GRO 40mlAmb HCl	SULFIDE 250mlAmb-S-NaOH+ZnAc	TKN 250mlHDPE-H2SO4	TOC 250mlHDPE-HCl	Total Mg 250mlHDPE-HNO3	V8260 40mlAmb-HCl	Remarks	Sample # (lab only)
KWB-4	Grab	GW		11/20/20	9:18	14	X	X	X	X	X	X	X	X		X		-01
KWB-5		GW		11/20/20	13:44	14												-02
MW-48		GW		11/19/20	9:33	35											MS/MSD	-03
MW-66		GW		11/18/20	16:44	14												-04
MW-99		GW																
MW-111		GW		11/20/20	12:01	14												-05
MW-112		GW																
MW-129		GW																
MW-131		GW		11/19/20	12:41	14												-06
RW-15C		GW																

* Matrix:
SS - Soil AIR - Air F - Filter
GW - Groundwater B - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other_____

Remarks: Lab filter dissolved magnesium

pH _____ Temp _____

Flow _____ Other _____

Samples returned via:
__ UPS X FedEx __ Courier _____

Tracking # 9050 0844 4154 / 3884

Relinquished by : (Signature) Cullen Kane
Date: 11/20/20 Time: 5:15
Received by: (Signature)

Relinquished by : (Signature)
Date: Time:
Received by: (Signature)

Relinquished by : (Signature)
Date: Time:
Received for lab by: (Signature)

Trip Blank Received: Yes / No HCL / MeoH TBR
4

Temp: °C Bottles Received:
0.7-1.2 +0.2 = 1.4 14

Date: 11-21-20 Time: 9:10

Sample Receipt Checklist
COC Seal Present/Intact: __NP X Y __N
COC Signed/Accurate: X Y __N
Bottles arrive intact: X Y __N
Correct bottles used: X Y __N
Sufficient volume sent: X Y __N
If Applicable
VOA Zero Headspace: X Y __N
Preservation Correct/Checked: X Y __N
RAD Screen <0.5 mR/hr: X Y __N

If preservation required by Login: Date/Time

Hold:

Condition: (NCF) OK

Chain of Custody Page ___ of ___

Pace Analytical®
National Center for Testing & Innovation

12065 Lebanon Rd
Mount Juliet, TN 37122
Phone: 615-758-5858
Phone: 800-767-5859
Fax: 615-758-5859

SDG # L1288818
E004

Acctnum: TRCATX
Template: T177935
Prelogin: P810148
PM: 526 - Chris McCord
PB:

Shipped Via:

TRC Solutions - Austin, TX

505 E. Huntland Dr, Ste 250
Austin, TX 78752

Billing Information:
Accounts Payable
21 Griffin Road North
Windsor, CT 06095

Pres Chk

Report to: Julie Speer

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___ Same Day ___ Five Day
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Quote #

Date Results Needed

Analysis / Container / Preservative

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	ALK,BROMIDE,SULFATE 250mlHDPE-NoPres	DROLVI 40mlAmb-HCl-BT	Diss. Mg 250mlHDPE-NoPres	FERUSFE 250mlAmb-HCl	GRO 40mlAmb HCl	SULFIDE 250mlAmb-S-NaOH+ZnAc	TKN 250mlHDPE-H2SO4	TOC 250mlHDPE-HCl	Total Mg 250mlHDPE-HNO3	V8260 40mlAmb-HCl	Remarks	Sample # (lab only)
RW-19		GW																
DUP-01	Grab	GW				14	X	X	X	X	X	X	X	X		X		-07
EB-01		GW																
		GW																
		GW																
TRIP BLANK 1		OT						X			X					X		-08
TRIP BLANK 2		OT						X			X					X		-09

Chain of Custody Page ___ of ___

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SDG # L1288818

Table #

Acctnum: TRCATX

Template: T177935

Prelogin: P810148

PM: 526 - Chris McCord

PB:

Shipped Via:

* Matrix:
SS - Soil AIR - Air F - Filter
GW - Groundwater B - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other Distilled water

Remarks: Lab filter dissolved magnesium

pH ___ Temp ___

Flow ___ Other ___

Samples returned via: __ UPS X FedEx __ Courier ___

Tracking #

Sample Receipt Checklist

COC Seal Present/Intact:	NP	Y N
COC Signed/Accurate:		Y N
Bottles arrive intact:		Y N
Correct bottles used:		Y N
Sufficient volume sent:		Y N
If Applicable		
VOA Zero Headspace:		Y N
Preservation Correct/Checked:		Y N
RAD Screen <0.5 mR/hr:		Y N

Relinquished by : (Signature)	Date: 11/20/20	Time: 5:15	Received by: (Signature)	Trip Blank Received: Yes / No HCL / MeoH TBR
Relinquished by : (Signature)	Date:	Time:	Received by: (Signature)	Temp: 0.7+1.2=1.9 °C Bottles Received:
Relinquished by : (Signature)	Date:	Time:	Received for lab by: (Signature)	Date: 11-21-20 Time:

If preservation required by Login: Date/Time

Hold:

Condition: NCF / OK

Pace Analytical National
DCS Water Study

Method: 300.0
Instrument: IC-11
Date Analyzed: 09/30/20

Analyte	Result (mg/l)	TV	MDL	%Rec	TV/MDL
BROMIDE	0.825	0.5	0.353	165	1.42
CHLORATE	0.0281	0.025	0.024	112	1.04
CHLORIDE	0.6487	0.5	0.379	130	1.32
FLUORIDE	0.0657	0.075	0.064	87.6	1.17
NITRATE	0.0701	0.05	0.048	140	1.04
NITRITE	0.0736	0.05	0.042	147	1.19
SULFATE	0.8259	0.5	0.594	165	0.84

Method: 2320 B-2011
Instrument: TITRANDO1
Date Analyzed: 07/30/20

Analyte	Result (mg/l)	TV	MDL	%Rec	TV/MDL
ALKALINITY	12.08765	10	8.45	121	1.18

Pace Analytical National
DCS Water Study

Method: 3500Fe B-2011
Instrument: DR6000-2
Date Analyzed: 10/03/20

Analyte	Result (mg/l)	TV	MDL	%Rec	TV/MDL
FERROUS IRON	0.025	0.025	0.015	100	1.67

Method: TOC 9060A/SM5310 B-2011 Water Instrument: TOC3
Laboratory: Pace Analytical Wetlab
Date: July 16, 2020
File: L1225070-04 WG1510066-5-TOC3-071620

DCS Study

Analyte	Result (mg/L)	Conc/TV	MDL (ppm)	% Rec	LOD Range TV/MDL	LOD Criteria 2-3 (P)	ESC Criteria 20-200% Rec
Total Organic Carbon (TOC)	0.717	0.5	0.102	143%	4.9		P

Method: 351.2
Instrument: LACHAT6
Date Analyzed: 07/24/20

Analyte	Result (mg/l)	TV	MDL	%Rec	TV/MDL
KJELDAHL NITROGEN, TKN	0.00627	1	0.14	0.627	7.14

Method: Sulfide water SM4500S2 D-2011 Instrument: DR6000-1

Laboratory: Pace Analytical Wetlab

Date: July 27, 2020

File: L1225041-01 WG1514933

DCS Study

Analyte	Result (mg/L)	Conc/TV	MDL (ppm)	% Rec	LOD Range TV/MDL	LOD Criteria 2-3 (P)	ESC Criteria 20-200% Rec
Sulfide	0.024	0.025	0.025	96%	1.0		P

Method: 8260B Instrument: VOCMS26
Laboratory: Pace National Matrix: water
Date: October 27, 2020
DCS Confirmation

Analyte	Calculated Result (ppb)	LOD TV/Conc (ppb)	MDL (ppb)	% Rec
1,1,1,2-TETRACHLOROETHANE	0.511944	0.5	0.147	102%
1,1,1-TRICHLOROETHANE	0.3993402	0.5	0.149	80%
1,1,2,2-TETRACHLOROETHANE	0.5140975	0.5	0.133	103%
1,1,2-TRICHLOROETHANE	0.4834007	0.5	0.158	97%
1,1,2-TRICHLOROTRIFLUOROETHANE	0.2024074	0.5	0.18	40%
1,1-DICHLOROETHANE	0.4647182	0.5	0.1	93%
1,1-DICHLOROETHENE	0.3367384	0.5	0.188	67%
1,1-DICHLOROPROPENE	0.4343358	0.5	0.142	87%
1,2,3-TRICHLOROBENZENE	0.4034377	0.5	0.23	81%
1,2,3-TRICHLOROPROPANE	0.9742147	1	0.237	97%
1,2,3-TRIMETHYLBENZENE	0.4491027	0.5	0.104	90%
1,2,4-TRICHLOROBENZENE	0.3851377	0.5	0.481	77%
1,2,4-TRIMETHYLBENZENE	0.5023522	0.5	0.322	100%
1,2-DIBROMO-3-CHLOROPROPANE	2.0506922	2	0.276	103%
1,2-DIBROMOETHANE	0.5357667	0.5	0.126	107%
1,2-DICHLOROBENZENE	0.4274949	0.5	0.107	85%
1,2-DICHLOROETHANE	0.4947475	0.5	0.0819	99%
1,2-DICHLOROPROPANE	0.4308559	0.5	0.149	86%
1,3,5-TRICHLOROBENZENE	0.4086926	0.5	0.1	82%
1,3,5-TRIMETHYLBENZENE	0.4705507	0.5	0.104	94%
1,3-BUTADIENE	6.0792192	1	0.299	608%
1,3-DICHLOROBENZENE	0.4475359	0.5	0.11	90%
1,3-DICHLOROPROPANE	0.4505793	0.5	0.11	90%
1,4-DICHLOROBENZENE	0.4607604	0.5	0.12	92%
1-METHYLNAPHTHALENE	4.989075	5	7.3	100%
2,2,4-TRIMETHYLPENTANE	0.5164502	0.5	0.391	103%
2,2-DICHLOROPROPANE	0.4634958	0.5	0.161	93%
2-BUTANONE (MEK)	11.1003737	10	1.19	111%
2-CHLOROETHYL VINYL ETHER	26.6016038	25	0.575	106%
2-CHLOROTOLUENE	0.4479835	0.5	0.106	90%
2-HEXANONE	11.1894364	10	0.787	112%
2-METHYLNAPHTHALENE	5.2780818	5	7.18	106%
4-CHLOROTOLUENE	0.4306482	0.5	0.114	86%
4-ETHYLTOLUENE	0.4454489	0.5	0.208	89%
4-METHYL-2-PENTANONE (MIBK)	11.2652958	10	0.478	113%
ACETONE	23.2114848	25	11.3	93%
ACROLEIN	21.2332421	25	2.54	85%
ACRYLONITRILE	11.2562846	10	0.671	113%

ALLYL CHLORIDE	10.9476847	10	0.5	109%
BENZENE	0.4877049	0.5	0.0941	98%
BROMOBENZENE	0.4242622	0.5	0.118	85%
BROMOCHLOROMETHANE	0.4488148	0.5	0.128	90%
BROMODICHLOROMETHANE	0.4548832	0.5	0.136	91%
BROMOFORM	0.4618608	0.5	0.129	92%
BROMOMETHANE	2.1109192	2	0.605	106%
CARBON DISULFIDE	0.4577671	0.5	0.0962	92%
CARBON TETRACHLORIDE	0.4454365	0.5	0.128	89%
CHLOROBENZENE	0.4726159	0.5	0.116	95%
CHLORODIBROMOMETHANE	0.4622989	0.5	0.14	92%
CHLOROETHANE	2.0143947	2	0.192	101%
CHLOROFORM	2.071635	2	0.111	104%
CHLOROMETHANE	0.962705	1	0.96	96%
CIS-1,2-DICHLOROETHENE	0.4194781	0.5	0.126	84%
CIS-1,3-DICHLOROPROPENE	0.4292647	0.5	0.111	86%
CYCLOHEXANE	0.3457662	0.5	0.188	69%
DIBROMOMETHANE	0.4229017	0.5	0.122	85%
DICHLORODIFLUOROMETHANE	1.8758316	2	0.374	94%
DICHLOROFLUOROMETHANE	2.0998595	2	0.13	105%
DICYCLOPENTADIENE	0.4517284	0.5	0.253	90%
DI-ISOPROPYL ETHER	0.4376398	0.5	0.105	88%
ETHANOL	10.8634116	50	42	22%
ETHYL ETHER	0.6166603	0.5	0.115	123%
ETHYL TERT-BUTYL ETHER	0.4541065	0.5	0.101	91%
ETHYLBENZENE	0.4564993	0.5	0.137	91%
HEXACHLORO-1,3-BUTADIENE	0.4235315	0.5	0.337	85%
IODOMETHANE	10.2860907	10	6	103%
ISOPROPYLBENZENE	0.4418757	0.5	0.105	88%
M&P-XYLENE	0.9839466	1	0.43	98%
METHYL ACETATE	10.3210896	10	1.29	103%
METHYL CYCLOHEXANE	0.4077204	0.5	0.66	82%
METHYL TERT-BUTYL ETHER	0.4077913	0.5	0.101	82%
METHYLENE CHLORIDE	2.0107782	2	0.43	101%
NAPHTHALENE	2.0113328	2	1	101%
N-BUTYLBENZENE	0.4051809	0.5	0.157	81%
n-Heptane	0.9364023	1	0.373	94%
n-HEXANE	5.2560459	5	0.749	105%
N-PROPYLBENZENE	0.4380269	0.5	0.0993	88%
O-XYLENE	0.4884578	0.5	0.174	98%
P-ISOPROPYLTOLUENE	0.4760968	0.5	0.12	95%
PROPENE	0.9025196	1	0.936	90%
SEC-BUTYLBENZENE	0.4178821	0.5	0.125	84%
STYRENE	0.455581	0.5	0.118	91%

T-AMYL ALCOHOL	24.1536866	25	4.9	97%
TERT-AMYL ETHYL ETHER	0.4300884	0.5	0.401	86%
TERT-AMYL METHYL ETHER	0.4217275	0.5	0.195	84%
TERT-BUTYL ALCOHOL	2.5511806	2.5	4.06	102%
TERT-BUTYLBENZENE	0.4527918	0.5	0.127	91%
TETRACHLOROETHENE	0.4281611	0.5	0.3	86%
TETRAHYDROFURAN	2.0804882	2	0.929	104%
TOLUENE	0.4832544	0.5	0.278	97%
TRANS-1,2-DICHLOROETHENE	0.5118694	0.5	0.149	102%
TRANS-1,3-DICHLOROPROPENE	0.4457162	0.5	0.118	89%
TRANS-1,4-DICHLORO-2-BUTENE	0.6638486	1	0.467	66%
TRICHLOROETHENE	0.4589283	0.5	0.19	92%
TRICHLOROFLUOROMETHANE	2.0143503	2	0.16	101%
VINYL ACETATE	12.3146668	10	0.692	123%
VINYL BROMIDE	0.1041947	0.5	0.3	21%
VINYL CHLORIDE	0.4646728	0.5	0.234	93%

Method: 8015D/GRO
Laboratory: Pace National
Date: 9/16/2020

Instrument: VOCGC6
Matrix: water

DCS Study 0.055ppm

Analyte	Calculated Result (ppm)	LOD TV/Conc (ppm)	MDL (ppm)	% Rec	LOD Range TV/MDL (P)
TPHG C5 - C12	0.1384833	0.055	0.0304	252%	1.8
TPHG C6 - C12	0.0766452	0.055	0.0316	139%	1.7
TPH (GC/FID) Low Fraction	0.0626509	0.055	0.0314	114%	1.8

Method: DRO RV
Laboratory: Pace National - Mt. Juliet
Date: September 15, 2020
File: 0915_14
DCS Study 0.05 ppm

Instrument: SVGC34
Matrix: water

Analyte	Result (ppm)	TV	MDL	%Rec	TV/MDL
TPH (GC/FID) HIGH FRACTION	0.122	0.05	0.0247	244%	2.0

Pace Analytical®
National Center for Testing & Innovation

Login #: L1288818	Client: TRCATX	Date:11/21/20	Evaluated by:Cole Medley

Non-Conformance (check applicable items)

	Sample Integrity		Chain of Custody Clarification		
	Parameter(s) past holding time	X	Login Clarification Needed		**If Broken Container:**
	Temperature not in range		Chain of custody is incomplete		Insufficient packing material around container
	Improper container type		Please specify Metals requested.		Insufficient packing material inside cooler
	pH not in range.		Please specify TCLP requested.		Improper handling by carrier (FedEx / UPS / Cour
	Insufficient sample volume.		Received additional samples not listed on coc.		Sample was frozen
	Sample is biphasic.		Sample ids on containers do not match ids on coc		Container lid not intact
	Vials received with headspace.		Trip Blank not received.		**If no Chain of Custody:**
	Broken container	X	Client did not "X" analysis.		Received by:
	Broken container:		Chain of Custody is missing		Date/Time:
	Sufficient sample remains				Temp./Cont. Rec./pH:
					Carrier:
					Tracking#

Login Comments:

1. **Client did not list a collection date/time on COC or containers for ID: DUP-01**
2. **Analysis is not "X" for Total Mg but client still sent containers**

Client informed by:		Call	x	Email		Voice Mail		Date: 12/2/20	Time: 16:23
TSR Initials: CM	Client Contact: Julie Speer								

Login Instructions:

1. Use collect date 11/19/2020 at 0000.
2. Total Mg is on hold.

Pace Analytical®
National Center for Testing & Innovation

ANALYTICAL REPORT

December 28, 2020

TRC Solutions - Austin, TX

Sample Delivery Group:	L1297621
Samples Received:	12/17/2020
Project Number:	387820.0000.0000 000
Description:	PilotTest Baseline GWM
Site:	HFNR ARTESIA REFINERY
Report To:	Julie Speer 505 E. Huntland Dr, Ste 250 Austin, TX 78752

Entire Report Reviewed By:

Chris McCord
Project Manager

TABLE OF CONTENTS

MW-99 L1297621-01 GW

Collected by | Collected date/time 12/15/20 11:10 | Received date/time 12/17/20 10:20

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Wet Chemistry by Method 2320 B-2011	WG1595998	1	12/24/20 07:49	12/24/20 07:49	LRP	Mt. Juliet, TN
Wet Chemistry by Method 3500Fe B-2011	WG1595111	1	12/22/20 01:28	12/22/20 01:28	KPS	Mt. Juliet, TN
Wet Chemistry by Method 351.2	WG1596750	1	12/23/20 15:36	12/24/20 04:57	SDL	Mt. Juliet, TN
Wet Chemistry by Method 4500S2 D-2011	WG1594470	1	12/19/20 12:17	12/19/20 12:17	LRP	Mt. Juliet, TN
Wet Chemistry by Method 9056A	WG1596327	1	12/23/20 17:21	12/23/20 17:21	ELN	Mt. Juliet, TN
Wet Chemistry by Method 9060A	WG1594198	1	12/18/20 16:22	12/18/20 16:22	VRP	Mt. Juliet, TN
Metals (ICPMS) by Method 6020	WG1594776	1	12/19/20 19:51	12/20/20 20:23	LD	Mt. Juliet, TN
Volatile Organic Compounds (GC) by Method 8015D/GRO	WG1594847	25	12/20/20 20:05	12/20/20 20:05	TPR	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1594581	25	12/19/20 07:44	12/19/20 07:44	JCP	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1596287	500	12/23/20 06:42	12/23/20 06:42	ACG	Mt. Juliet, TN
Semi-Volatile Organic Compounds (GC) by Method 3511/8015	WG1595072	10	12/22/20 09:25	12/24/20 02:52	DMG	Mt. Juliet, TN

MW-112 L1297621-02 GW

Collected by | Collected date/time 12/15/20 09:05 | Received date/time 12/17/20 10:20

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Wet Chemistry by Method 2320 B-2011	WG1595998	1	12/24/20 08:04	12/24/20 08:04	LRP	Mt. Juliet, TN
Wet Chemistry by Method 3500Fe B-2011	WG1595111	5	12/22/20 01:35	12/22/20 01:35	KPS	Mt. Juliet, TN
Wet Chemistry by Method 351.2	WG1596750	1	12/23/20 15:36	12/24/20 05:01	SDL	Mt. Juliet, TN
Wet Chemistry by Method 4500S2 D-2011	WG1594470	1	12/19/20 12:18	12/19/20 12:18	LRP	Mt. Juliet, TN
Wet Chemistry by Method 9056A	WG1596327	1	12/23/20 19:06	12/23/20 19:06	ELN	Mt. Juliet, TN
Wet Chemistry by Method 9060A	WG1594198	1	12/19/20 04:21	12/19/20 04:21	VRP	Mt. Juliet, TN
Metals (ICPMS) by Method 6020	WG1594776	1	12/19/20 19:51	12/22/20 11:37	LAT	Mt. Juliet, TN
Volatile Organic Compounds (GC) by Method 8015D/GRO	WG1594847	10	12/20/20 19:22	12/20/20 19:22	TPR	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1594581	10	12/19/20 08:05	12/19/20 08:05	JCP	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1596287	200	12/23/20 07:03	12/23/20 07:03	ACG	Mt. Juliet, TN
Semi-Volatile Organic Compounds (GC) by Method 3511/8015	WG1595072	1	12/22/20 09:25	12/23/20 18:17	DMG	Mt. Juliet, TN

MW-129 L1297621-03 GW

Collected by | Collected date/time 12/14/20 17:25 | Received date/time 12/17/20 10:20

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Wet Chemistry by Method 2320 B-2011	WG1595998	1	12/24/20 08:12	12/24/20 08:12	LRP	Mt. Juliet, TN
Wet Chemistry by Method 3500Fe B-2011	WG1595111	5	12/22/20 01:36	12/22/20 01:36	KPS	Mt. Juliet, TN
Wet Chemistry by Method 351.2	WG1596750	1	12/23/20 15:36	12/24/20 05:02	SDL	Mt. Juliet, TN
Wet Chemistry by Method 4500S2 D-2011	WG1594470	1	12/19/20 12:18	12/19/20 12:18	LRP	Mt. Juliet, TN
Wet Chemistry by Method 9056A	WG1596327	1	12/23/20 19:41	12/23/20 19:41	ELN	Mt. Juliet, TN
Wet Chemistry by Method 9060A	WG1594198	1	12/19/20 04:41	12/19/20 04:41	VRP	Mt. Juliet, TN
Metals (ICPMS) by Method 6020	WG1594776	1	12/19/20 19:51	12/22/20 11:41	LAT	Mt. Juliet, TN
Volatile Organic Compounds (GC) by Method 8015D/GRO	WG1594938	10	12/20/20 10:57	12/20/20 10:57	JHH	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1594581	10	12/19/20 08:25	12/19/20 08:25	JCP	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1596287	200	12/23/20 07:23	12/23/20 07:23	ACG	Mt. Juliet, TN
Semi-Volatile Organic Compounds (GC) by Method 3511/8015	WG1595072	1	12/22/20 09:25	12/23/20 18:43	DMG	Mt. Juliet, TN

RW-19 L1297621-04 GW

Collected by | Collected date/time 12/14/20 14:30 | Received date/time 12/17/20 10:20

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Wet Chemistry by Method 2320 B-2011	WG1595998	1	12/24/20 08:20	12/24/20 08:20	LRP	Mt. Juliet, TN
Wet Chemistry by Method 3500Fe B-2011	WG1595111	1	12/22/20 01:37	12/22/20 01:37	KPS	Mt. Juliet, TN
Wet Chemistry by Method 351.2	WG1596750	1	12/23/20 15:36	12/24/20 05:03	SDL	Mt. Juliet, TN
Wet Chemistry by Method 4500S2 D-2011	WG1594470	1	12/19/20 12:18	12/19/20 12:18	LRP	Mt. Juliet, TN
Wet Chemistry by Method 9056A	WG1596327	1	12/23/20 20:15	12/23/20 20:15	ELN	Mt. Juliet, TN

1 Cp
2 Tc
3 Ss
4 Cn
5 Tr
6 Sr
7 Qc
8 Gl
9 Al
10 Sc

RW-19 L1297621-04 GW

Collected by	Collected date/time	Received date/time
	12/14/20 14:30	12/17/20 10:20

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Wet Chemistry by Method 9056A	WG1596327	5	12/23/20 20:33	12/23/20 20:33	ELN	Mt. Juliet, TN
Wet Chemistry by Method 9060A	WG1594198	1	12/19/20 05:01	12/19/20 05:01	VRP	Mt. Juliet, TN
Metals (ICPMS) by Method 6020	WG1594776	1	12/19/20 19:51	12/22/20 11:44	LAT	Mt. Juliet, TN
Volatile Organic Compounds (GC) by Method 8015D/GRO	WG1594938	50	12/20/20 11:23	12/20/20 11:23	JHH	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1594581	50	12/19/20 08:46	12/19/20 08:46	JCP	Mt. Juliet, TN
Semi-Volatile Organic Compounds (GC) by Method 3511/8015	WG1595072	1	12/22/20 09:25	12/23/20 19:09	DMG	Mt. Juliet, TN

DUP-01 L1297621-05 GW

Collected by	Collected date/time	Received date/time
	12/14/20 14:35	12/17/20 10:20

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Wet Chemistry by Method 2320 B-2011	WG1595998	1	12/24/20 08:38	12/24/20 08:38	LRP	Mt. Juliet, TN
Wet Chemistry by Method 3500Fe B-2011	WG1595111	1	12/22/20 01:37	12/22/20 01:37	KPS	Mt. Juliet, TN
Wet Chemistry by Method 351.2	WG1596750	1	12/23/20 15:36	12/24/20 05:05	SDL	Mt. Juliet, TN
Wet Chemistry by Method 4500S2 D-2011	WG1594470	1	12/19/20 12:18	12/19/20 12:18	LRP	Mt. Juliet, TN
Wet Chemistry by Method 9056A	WG1596327	1	12/23/20 20:50	12/23/20 20:50	ELN	Mt. Juliet, TN
Wet Chemistry by Method 9056A	WG1596327	5	12/23/20 21:08	12/23/20 21:08	ELN	Mt. Juliet, TN
Wet Chemistry by Method 9060A	WG1594198	1	12/18/20 19:48	12/18/20 19:48	VRP	Mt. Juliet, TN
Metals (ICPMS) by Method 6020	WG1594776	1	12/19/20 19:51	12/22/20 11:48	LAT	Mt. Juliet, TN
Volatile Organic Compounds (GC) by Method 8015D/GRO	WG1594938	100	12/20/20 11:50	12/20/20 11:50	JHH	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1594581	100	12/19/20 09:07	12/19/20 09:07	JCP	Mt. Juliet, TN
Semi-Volatile Organic Compounds (GC) by Method 3511/8015	WG1595072	5	12/22/20 09:25	12/24/20 03:54	DMG	Mt. Juliet, TN

EB-01 L1297621-06 GW

Collected by	Collected date/time	Received date/time
	12/14/20 17:35	12/17/20 10:20

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Wet Chemistry by Method 2320 B-2011	WG1595998	1	12/24/20 08:47	12/24/20 08:47	LRP	Mt. Juliet, TN
Wet Chemistry by Method 3500Fe B-2011	WG1595111	1	12/22/20 01:38	12/22/20 01:38	KPS	Mt. Juliet, TN
Wet Chemistry by Method 351.2	WG1596750	1	12/23/20 15:36	12/24/20 05:06	SDL	Mt. Juliet, TN
Wet Chemistry by Method 4500S2 D-2011	WG1594470	1	12/19/20 12:19	12/19/20 12:19	LRP	Mt. Juliet, TN
Wet Chemistry by Method 9056A	WG1596327	1	12/24/20 10:49	12/24/20 10:49	MCG	Mt. Juliet, TN
Wet Chemistry by Method 9060A	WG1594198	1	12/18/20 20:03	12/18/20 20:03	VRP	Mt. Juliet, TN
Metals (ICPMS) by Method 6020	WG1594776	1	12/19/20 19:51	12/22/20 11:51	LAT	Mt. Juliet, TN
Volatile Organic Compounds (GC) by Method 8015D/GRO	WG1594938	1	12/20/20 07:25	12/20/20 07:25	JHH	Mt. Juliet, TN
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1594581	1	12/19/20 03:52	12/19/20 03:52	JCP	Mt. Juliet, TN
Semi-Volatile Organic Compounds (GC) by Method 3511/8015	WG1595072	1	12/22/20 09:25	12/24/20 02:26	DMG	Mt. Juliet, TN

TRIP BLANK L1297621-07 GW

Collected by	Collected date/time	Received date/time
	12/14/20 00:00	12/17/20 10:20

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Volatile Organic Compounds (GC/MS) by Method 8260B	WG1594581	1	12/19/20 03:10	12/19/20 03:10	JCP	Mt. Juliet, TN

All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times, unless qualified or notated within the report. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.

Chris McCord
Project Manager

Sample Delivery Group (SDG) Narrative

pH outside of method requirement.

Lab Sample ID	Project Sample ID	Method
L1297621-03	MW-129	3511/8015
L1297621-04	RW-19	3511/8015
L1297621-05	DUP-01	3511/8015

This data package consists of this signature page, the laboratory review checklist, and the following reportable data as applicable:

R1 - Field chain-of-custody documentation;

R2 - Sample identification cross-reference;

R3 - Test reports (analytical data sheets) for each environmental sample that includes:

a. Items consistent with NELAC Chapter 5,

b. dilution factors,

c. preparation methods,

d. cleanup methods, and

e. if required for the project, tentatively identified compounds (TICs).

R4 - Surrogate recovery data including:

a. Calculated recovery (%R), and

b. The laboratory's surrogate QC limits.

R5 - Test reports/summary forms for blank samples;

R6 - Test reports/summary forms for laboratory control samples (LCSs) including:

a. LCS spiking amounts,

b. Calculated %R for each analyte, and

c. The laboratory's LCS QC limits.

R7 - Test reports for project matrix spike/matrix spike duplicates (MS/MSDs) including:

a. Samples associated with the MS/MSD clearly identified,

b. MS/MSD spiking amounts,

c. Concentration of each MS/MSD analyte measured in the parent and spiked samples,

d. Calculated %Rs and relative percent differences (RPDs), and

e. The laboratory's MS/MSD QC limits

R8 - Laboratory analytical duplicate (if applicable) recovery and precision:

a. The amount of analyte measured in the duplicate,

b. The calculated RPD, and

c. The laboratory's QC limits for analytical duplicates.

R9 - List of method quantitation limits (MQLs) and detectability check sample results for each analyte for each method and matrix.

R10 - Other problems or anomalies.

Release Statement: I am responsible for the release of this laboratory data package. This laboratory is NELAC accredited under the Texas Laboratory Accreditation Program for all the methods, analytes, and matrices reported in this data package except as noted in the Exception Reports. The data have been reviewed and are technically compliant with the requirements of the methods used, except where noted by the laboratory in the Exception Reports. By my signature below, I affirm to the best of my knowledge all problems/anomalies observed by the laboratory have been identified in the Laboratory Review Checklist, and no information affecting the quality of the data has been knowingly withheld.

Chris McCord
Project Manager

Laboratory Review Checklist: Reportable Data

Laboratory Name: Pace Analytical National	LRC Date: 12/28/2020 16:27
Project Name: PilotTest Baseline GWM	Laboratory Job Number: L1297621-01, 02, 03, 04, 05, 06 and 07
Reviewer Name: Chris McCord	Prep Batch Number(s): WG1594198, WG1594470, WG1594776, WG1595111, WG1594847, WG1594581, WG1595072, WG1596287, WG1596750, WG1596327, WG1595998 and WG1594938

#[1]	A[2]	Description	Yes	No	NA[3]	NR[4]	ER#[5]
R1	OI	Chain-of-custody (C-O-C)					
		Did samples meet the laboratory's standard conditions of sample acceptability upon receipt?	X				
		Were all departures from standard conditions described in an exception report?			X		
R2	OI	Sample and quality control (QC) identification					
		Are all field sample ID numbers cross-referenced to the laboratory ID numbers?	X				
		Are all laboratory ID numbers cross-referenced to the corresponding QC data?	X				
R3	OI	Test reports					
		Were all samples prepared and analyzed within holding times?		X			1
		Other than those results < MQL, were all other raw values bracketed by calibration standards?		X			2
		Were calculations checked by a peer or supervisor?	X				
		Were all analyte identifications checked by a peer or supervisor?	X				
		Were sample detection limits reported for all analytes not detected?	X				
		Were all results for soil and sediment samples reported on a dry weight basis?	X				
		Were % moisture (or solids) reported for all soil and sediment samples?			X		
		Were bulk soils/solids samples for volatile analysis extracted with methanol per SW846 Method 5035?			X		
		If required for the project, are TICs reported?			X		
R4	O	Surrogate recovery data					
		Were surrogates added prior to extraction?	X				
		Were surrogate percent recoveries in all samples within the laboratory QC limits?		X			3
R5	OI	Test reports/summary forms for blank samples					
		Were appropriate type(s) of blanks analyzed?	X				
		Were blanks analyzed at the appropriate frequency?	X				
		Were method blanks taken through the entire analytical process, including preparation and, if applicable, cleanup procedures?	X				
		Were blank concentrations < MQL?	X				
R6	OI	Laboratory control samples (LCS):					
		Were all COCs included in the LCS?	X				
		Was each LCS taken through the entire analytical procedure, including prep and cleanup steps?	X				
		Were LCSs analyzed at the required frequency?	X				
		Were LCS (and LCSD, if applicable) %Rs within the laboratory QC limits?	X				
		Does the detectability check sample data document the laboratory's capability to detect the COCs at the MDL used to calculate the SDLs?	X				
		Was the LCSD RPD within QC limits?	X				
R7	OI	Matrix spike (MS) and matrix spike duplicate (MSD) data					
		Were the project/method specified analytes included in the MS and MSD?	X				
		Were MS/MSD analyzed at the appropriate frequency?	X				
		Were MS (and MSD, if applicable) %Rs within the laboratory QC limits?		X			4
		Were MS/MSD RPDs within laboratory QC limits?		X			5
R8	OI	Analytical duplicate data					
		Were appropriate analytical duplicates analyzed for each matrix?	X				
		Were analytical duplicates analyzed at the appropriate frequency?	X				
		Were RPDs or relative standard deviations within the laboratory QC limits?	X				
R9	OI	Method quantitation limits (MQLs):					
		Are the MQLs for each method analyte included in the laboratory data package?	X				
		Do the MQLs correspond to the concentration of the lowest non-zero calibration standard?	X				
		Are unadjusted MQLs and DCSs included in the laboratory data package?	X				
R10	OI	Other problems/anomalies					
		Are all known problems/anomalies/special conditions noted in this LRC and ER?		X			6
		Was applicable and available technology used to lower the SDL to minimize the matrix interference effects on the sample results?	X				
		Is the laboratory NELAC-accredited under the Texas Laboratory Accreditation Program for the analytes, matrices and methods associated with this laboratory data package?	X				

1. Items identified by the letter "R" must be included in the laboratory data package submitted in the TRRP-required report(s). Items identified by the letter "S" should be retained and made available upon request for the appropriate retention period.
2. O = organic analyses; I = inorganic analyses (and general chemistry, when applicable);
3. NA = Not applicable;
4. NR = Not reviewed;
5. ER# = Exception Report identification number (an Exception Report should be completed for an item if "NR" or "No" is checked).

Laboratory Review Checklist: Supporting Data

Laboratory Name: Pace Analytical National	LRC Date: 12/28/2020 16:27
Project Name: PilotTest Baseline GWM	Laboratory Job Number: L1297621-01, 02, 03, 04, 05, 06 and 07
Reviewer Name: Chris McCord	Prep Batch Number(s): WG1594198, WG1594470, WG1594776, WG1595111, WG1594847, WG1594581, WG1595072, WG1596287, WG1596750, WG1596327, WG1595998 and WG1594938

#[1]	A[2]	Description	Yes	No	NA[3]	NR[4]	ER#[5]
S1	OI	Initial calibration (ICAL)					
		Were response factors and/or relative response factors for each analyte within QC limits?	X				
		Were percent RSDs or correlation coefficient criteria met?	X				
		Was the number of standards recommended in the method used for all analytes?	X				
		Were all points generated between the lowest and highest standard used to calculate the curve?	X				
		Are ICAL data available for all instruments used?	X				
		Has the initial calibration curve been verified using an appropriate second source standard?	X				
S2	OI	Initial and continuing calibration verification (ICCV and CCV) and continuing calibration blank (CCB):					
		Was the CCV analyzed at the method-required frequency?	X				
		Were percent differences for each analyte within the method-required QC limits?	X				
		Was the ICAL curve verified for each analyte?	X				
		Was the absolute value of the analyte concentration in the inorganic CCB < MDL?	X				
S3	O	Mass spectral tuning					
		Was the appropriate compound for the method used for tuning?	X				
		Were ion abundance data within the method-required QC limits?	X				
S4	O	Internal standards (IS)					
		Were IS area counts and retention times within the method-required QC limits?	X				
S5	OI	Raw data (NELAC Section 5.5.10)					
		Were the raw data (for example, chromatograms, spectral data) reviewed by an analyst?	X				
		Were data associated with manual integrations flagged on the raw data?	X				
S6	O	Dual column confirmation					
		Did dual column confirmation results meet the method-required QC?			X		
S7	O	Tentatively identified compounds (TICs)					
		If TICs were requested, were the mass spectra and TIC data subject to appropriate checks?			X		
S8	I	Interference Check Sample (ICS) results					
		Were percent recoveries within method QC limits?	X				
S9	I	Serial dilutions, post digestion spikes, and method of standard additions					
		Were percent differences, recoveries, and the linearity within the QC limits specified in the method?	X				
S10	OI	Method detection limit (MDL) studies					
		Was a MDL study performed for each reported analyte?	X				
		Is the MDL either adjusted or supported by the analysis of DCSs?	X				
S11	OI	Proficiency test reports					
		Was the laboratory's performance acceptable on the applicable proficiency tests or evaluation studies?	X				
S12	OI	Standards documentation					
		Are all standards used in the analyses NIST-traceable or obtained from other appropriate sources?	X				
S13	OI	Compound/analyte identification procedures					
		Are the procedures for compound/analyte identification documented?	X				
S14	OI	Demonstration of analyst competency (DOC)					
		Was DOC conducted consistent with NELAC Chapter 5?	X				
		Is documentation of the analyst's competency up-to-date and on file?	X				
S15	OI	Verification/validation documentation for methods (NELAC Chapter 5)					
		Are all the methods used to generate the data documented, verified, and validated, where applicable?	X				
S16	OI	Laboratory standard operating procedures (SOPs)					
		Are laboratory SOPs current and on file for each method performed	X				

1. Items identified by the letter "R" must be included in the laboratory data package submitted in the TRRP-required report(s). Items identified by the letter "S" should be retained and made available upon request for the appropriate retention period.
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3. NA = Not applicable;
4. NR = Not reviewed;
5. ER# = Exception Report identification number (an Exception Report should be completed for an item if "NR" or "No" is checked).

Laboratory Review Checklist: Exception Reports

Laboratory Name: Pace Analytical National	LRC Date: 12/28/2020 16:27
Project Name: PilotTest Baseline GWM	Laboratory Job Number: L1297621-01, 02, 03, 04, 05, 06 and 07
Reviewer Name: Chris McCord	Prep Batch Number(s): WG1594198, WG1594470, WG1594776, WG1595111, WG1594847, WG1594581, WG1595072, WG1596287, WG1596750, WG1596327, WG1595998 and WG1594938

ER #[1]	Description
1	3500Fe B-2011 WG1595111 L1297621-01, 02, 03, 04, 05 and 06: Prepared and/or analyzed past holding time as defined in the method. Concentrations should be considered minimum values.
2	9056A WG1596327 R3607001-5: The analyte concentration exceeds the upper limit of the calibration range of the instrument established by the initial calibration (ICAL). 8260B WG1594581 R3606385-4 and 5: The analyte concentration exceeds the upper limit of the calibration range of the instrument established by the initial calibration (ICAL).
3	3511/8015 WG1595072 o-Terphenyl R3606656-3 and 4: Percent Recovery is outside of established control limits.
4	8260B WG1594581 Benzene, Methyl tert-butyl ether, Toluene, 1,2,4-Trimethylbenzene: Percent Recovery is outside of established control limits. 3500Fe B-2011 WG1594470 Sulfide: Percent Recovery is outside of established control limits. 351.2 WG1596750 Kjeldahl Nitrogen, TKN: Percent Recovery is outside of established control limits. 8260B WG1594581 Naphthalene: Percent Recovery is outside of established control limits.
5	8015D/GRO WG1594847 TPH (GC/FID) Low Fraction: Relative Percent Difference is outside of established control limits.
6	3511/8015 WG1595072 L1297621-03, 04 and 05: pH outside of method requirement.

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2. O = organic analyses; I = inorganic analyses (and general chemistry, when applicable);
3. NA = Not applicable;
4. NR = Not reviewed;
5. ER# = Exception Report identification number (an Exception Report should be completed for an item if “NR” or “No” is checked).

Wet Chemistry by Method 2320 B-2011

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
Alkalinity	772		8.45	20.0	20.0	1	12/24/2020 07:49	WG1595998

Sample Narrative:
L1297621-01 WG1595998: Endpoint pH 4.5 Headspace

Wet Chemistry by Method 3500Fe B-2011

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
Ferrous Iron	0.250	T8	0.0150	0.0500	0.0500	1	12/22/2020 01:28	WG1595111

Wet Chemistry by Method 351.2

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
Kjeldahl Nitrogen, TKN	0.957	J6	0.140	0.250	0.250	1	12/24/2020 04:57	WG1596750

Wet Chemistry by Method 4500S2 D-2011

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
Sulfide	1.83	J6	0.0250	0.0500	0.0500	1	12/19/2020 12:17	WG1594470

Wet Chemistry by Method 9056A

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
Bromide	1.11		0.353	1.00	1.00	1	12/23/2020 17:21	WG1596327
Sulfate	52.4		0.594	5.00	5.00	1	12/23/2020 17:21	WG1596327

Wet Chemistry by Method 9060A

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
TOC (Total Organic Carbon)	10.3		0.102	1.00	1.00	1	12/18/2020 16:22	WG1594198

Metals (ICPMS) by Method 6020

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
Magnesium,Dissolved	92.9		0.0735	1.00	1.00	1	12/20/2020 20:23	WG1594776

Volatile Organic Compounds (GC) by Method 8015D/GRO

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
TPH (GC/FID) Low Fraction	38.5	J3	0.785	0.100	2.50	25	12/20/2020 20:05	WG1594847
(S) a,a,a-Trifluorotoluene(FID)	*94.5*				*78.0-120*		*12/20/2020 20:05*	WG1594847

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
Benzene	3.43		0.0471	0.00100	0.500	500	12/23/2020 06:42	WG1596287
Ethylbenzene	1.42		0.00343	0.00100	0.0250	25	12/19/2020 07:44	WG1594581
Methyl tert-butyl ether	2.97	V	0.00253	0.00100	0.0250	25	12/19/2020 07:44	WG1594581
Naphthalene	0.197	J6	0.0250	0.00500	0.125	25	12/19/2020 07:44	WG1594581
Toluene	2.87		0.139	0.00100	0.500	500	12/23/2020 06:42	WG1596287
1,2,4-Trimethylbenzene	0.548	V	0.00805	0.00100	0.0250	25	12/19/2020 07:44	WG1594581
1,3,5-Trimethylbenzene	0.110		0.00260	0.00100	0.0250	25	12/19/2020 07:44	WG1594581

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
o-Xylene	0.913		0.00435	0.00100	0.0250	25	12/19/2020 07:44	WG1594581
m&p-Xylene	2.15		0.0107	0.00200	0.0500	25	12/19/2020 07:44	WG1594581
Xylenes, Total	3.06		0.00435	0.00300	0.0750	25	12/19/2020 07:44	WG1594581
(S) Toluene-d8	*103*				*80.0-120*		*12/19/2020 07:44*	WG1594581
(S) Toluene-d8	*106*				*80.0-120*		*12/23/2020 06:42*	WG1596287
(S) 4-Bromofluorobenzene	*98.4*				*77.0-126*		*12/19/2020 07:44*	WG1594581
(S) 4-Bromofluorobenzene	*89.1*				*77.0-126*		*12/23/2020 06:42*	WG1596287
(S) 1,2-Dichloroethane-d4	*97.8*				*70.0-130*		*12/19/2020 07:44*	WG1594581
(S) 1,2-Dichloroethane-d4	*123*				*70.0-130*		*12/23/2020 06:42*	WG1596287

Semi-Volatile Organic Compounds (GC) by Method 3511/8015

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
TPH (GC/FID) High Fraction	5.19		0.247	0.100	1.00	10	12/24/2020 02:52	WG1595072
(S) o-Terphenyl	*121*				*31.0-160*		*12/24/2020 02:52*	WG1595072

Wet Chemistry by Method 2320 B-2011

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Alkalinity	720		8.45	20.0	20.0	1	12/24/2020 08:04	WG1595998

Sample Narrative:
L1297621-02 WG1595998: Endpoint pH 4.5 Headspace

Wet Chemistry by Method 3500Fe B-2011

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Ferrous Iron	4.44	T8	0.0750	0.0500	0.250	5	12/22/2020 01:35	WG1595111

Wet Chemistry by Method 351.2

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Kjeldahl Nitrogen, TKN	U		0.140	0.250	0.250	1	12/24/2020 05:01	WG1596750

Wet Chemistry by Method 4500S2 D-2011

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Sulfide	U		0.0250	0.0500	0.0500	1	12/19/2020 12:18	WG1594470

Wet Chemistry by Method 9056A

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Bromide	6.12		0.353	1.00	1.00	1	12/23/2020 19:06	WG1596327
Sulfate	U		0.594	5.00	5.00	1	12/23/2020 19:06	WG1596327

Wet Chemistry by Method 9060A

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
TOC (Total Organic Carbon)	5.99		0.102	1.00	1.00	1	12/19/2020 04:21	WG1594198

Metals (ICPMS) by Method 6020

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Magnesium,Dissolved	174		0.0735	1.00	1.00	1	12/22/2020 11:37	WG1594776

Volatile Organic Compounds (GC) by Method 8015D/GRO

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
TPH (GC/FID) Low Fraction	22.1		0.314	0.100	1.00	10	12/20/2020 19:22	WG1594847
(S) a,a,a-Trifluorotoluene(FID)	*95.9*				*78.0-120*		*12/20/2020 19:22*	WG1594847

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Benzene	2.04		0.0188	0.00100	0.200	200	12/23/2020 07:03	WG1596287
Ethylbenzene	1.05		0.00137	0.00100	0.0100	10	12/19/2020 08:05	WG1594581
Methyl tert-butyl ether	1.07		0.00101	0.00100	0.0100	10	12/19/2020 08:05	WG1594581
Naphthalene	0.166		0.0100	0.00500	0.0500	10	12/19/2020 08:05	WG1594581
Toluene	0.228		0.00278	0.00100	0.0100	10	12/19/2020 08:05	WG1594581
1,2,4-Trimethylbenzene	0.407		0.00322	0.00100	0.0100	10	12/19/2020 08:05	WG1594581
1,3,5-Trimethylbenzene	0.104		0.00104	0.00100	0.0100	10	12/19/2020 08:05	WG1594581

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
o-Xylene	0.553		0.00174	0.00100	0.0100	10	12/19/2020 08:05	WG1594581
m&p-Xylene	1.72		0.00430	0.00200	0.0200	10	12/19/2020 08:05	WG1594581
Xylenes, Total	2.27		0.00174	0.00300	0.0300	10	12/19/2020 08:05	WG1594581
(S) Toluene-d8	*102*				*80.0-120*		*12/19/2020 08:05*	WG1594581
(S) Toluene-d8	*104*				*80.0-120*		*12/23/2020 07:03*	WG1596287
(S) 4-Bromofluorobenzene	*98.1*				*77.0-126*		*12/19/2020 08:05*	WG1594581
(S) 4-Bromofluorobenzene	*93.2*				*77.0-126*		*12/23/2020 07:03*	WG1596287
(S) 1,2-Dichloroethane-d4	*100*				*70.0-130*		*12/19/2020 08:05*	WG1594581
(S) 1,2-Dichloroethane-d4	*115*				*70.0-130*		*12/23/2020 07:03*	WG1596287

Semi-Volatile Organic Compounds (GC) by Method 3511/8015

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
TPH (GC/FID) High Fraction	2.96		0.0247	0.100	0.100	1	12/23/2020 18:17	WG1595072
(S) o-Terphenyl	*114*				*31.0-160*		*12/23/2020 18:17*	WG1595072

Wet Chemistry by Method 2320 B-2011

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Alkalinity	740		8.45	20.0	20.0	1	12/24/2020 08:12	WG1595998

Sample Narrative:
L1297621-03 WG1595998: Endpoint pH 4.5 Headspace

Wet Chemistry by Method 3500Fe B-2011

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Ferrous Iron	5.89	T8	0.0750	0.0500	0.250	5	12/22/2020 01:36	WG1595111

Wet Chemistry by Method 351.2

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Kjeldahl Nitrogen, TKN	U		0.140	0.250	0.250	1	12/24/2020 05:02	WG1596750

Wet Chemistry by Method 4500S2 D-2011

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Sulfide	U		0.0250	0.0500	0.0500	1	12/19/2020 12:18	WG1594470

Wet Chemistry by Method 9056A

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Bromide	1.23		0.353	1.00	1.00	1	12/23/2020 19:41	WG1596327
Sulfate	90.7		0.594	5.00	5.00	1	12/23/2020 19:41	WG1596327

Wet Chemistry by Method 9060A

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
TOC (Total Organic Carbon)	10.2		0.102	1.00	1.00	1	12/19/2020 04:41	WG1594198

Metals (ICPMS) by Method 6020

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Magnesium,Dissolved	117		0.0735	1.00	1.00	1	12/22/2020 11:41	WG1594776

Volatile Organic Compounds (GC) by Method 8015D/GRO

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
TPH (GC/FID) Low Fraction	22.6		0.314	0.100	1.00	10	12/20/2020 10:57	WG1594938
(S) a,a,a-Trifluorotoluene(FID)	*88.1*				*78.0-120*		*12/20/2020 10:57*	WG1594938

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Benzene	1.18		0.000941	0.00100	0.0100	10	12/19/2020 08:25	WG1594581
Ethylbenzene	0.793		0.00137	0.00100	0.0100	10	12/19/2020 08:25	WG1594581
Methyl tert-butyl ether	4.17		0.0202	0.00100	0.200	200	12/23/2020 07:23	WG1596287
Naphthalene	0.0971		0.0100	0.00500	0.0500	10	12/19/2020 08:25	WG1594581
Toluene	1.88		0.00278	0.00100	0.0100	10	12/19/2020 08:25	WG1594581
1,2,4-Trimethylbenzene	0.243		0.00322	0.00100	0.0100	10	12/19/2020 08:25	WG1594581
1,3,5-Trimethylbenzene	0.0556		0.00104	0.00100	0.0100	10	12/19/2020 08:25	WG1594581

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
o-Xylene	0.353		0.00174	0.00100	0.0100	10	12/19/2020 08:25	WG1594581
m&p-Xylene	1.14		0.00430	0.00200	0.0200	10	12/19/2020 08:25	WG1594581
Xylenes, Total	1.49		0.00174	0.00300	0.0300	10	12/19/2020 08:25	WG1594581
(S) Toluene-d8	*100*				*80.0-120*		*12/19/2020 08:25*	WG1594581
(S) Toluene-d8	*110*				*80.0-120*		*12/23/2020 07:23*	WG1596287
(S) 4-Bromofluorobenzene	*96.6*				*77.0-126*		*12/19/2020 08:25*	WG1594581
(S) 4-Bromofluorobenzene	*94.6*				*77.0-126*		*12/23/2020 07:23*	WG1596287
(S) 1,2-Dichloroethane-d4	*97.9*				*70.0-130*		*12/19/2020 08:25*	WG1594581
(S) 1,2-Dichloroethane-d4	*123*				*70.0-130*		*12/23/2020 07:23*	WG1596287

Semi-Volatile Organic Compounds (GC) by Method 3511/8015

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
TPH (GC/FID) High Fraction	3.92		0.0247	0.100	0.100	1	12/23/2020 18:43	WG1595072
(S) o-Terphenyl	*117*				*31.0-160*		*12/23/2020 18:43*	WG1595072

1 Cp
2 Tc
3 Ss
4 Cn
5 Tr
6 Sr
7 Qc
8 Gl
9 Al
10 Sc

Wet Chemistry by Method 2320 B-2011

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
Alkalinity	930		8.45	20.0	20.0	1	12/24/2020 08:20	WG1595998

Sample Narrative:
L1297621-04 WG1595998: Endpoint pH 4.5 Headspace

Wet Chemistry by Method 3500Fe B-2011

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
Ferrous Iron	0.914	T8	0.0150	0.0500	0.0500	1	12/22/2020 01:37	WG1595111

Wet Chemistry by Method 351.2

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
Kjeldahl Nitrogen, TKN	0.315		0.140	0.250	0.250	1	12/24/2020 05:03	WG1596750

Wet Chemistry by Method 4500S2 D-2011

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
Sulfide	0.0450	J	0.0250	0.0500	0.0500	1	12/19/2020 12:18	WG1594470

Wet Chemistry by Method 9056A

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
Bromide	2.84		0.353	1.00	1.00	1	12/23/2020 20:15	WG1596327
Sulfate	118		2.97	5.00	25.0	5	12/23/2020 20:33	WG1596327

Wet Chemistry by Method 9060A

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
TOC (Total Organic Carbon)	14.1		0.102	1.00	1.00	1	12/19/2020 05:01	WG1594198

Metals (ICPMS) by Method 6020

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
Magnesium,Dissolved	144		0.0735	1.00	1.00	1	12/22/2020 11:44	WG1594776

Volatile Organic Compounds (GC) by Method 8015D/GRO

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
TPH (GC/FID) Low Fraction	20.5		1.57	0.100	5.00	50	12/20/2020 11:23	WG1594938
(S) a,a,a-Trifluorotoluene(FID)	*91.6*				*78.0-120*		*12/20/2020 11:23*	WG1594938

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
Benzene	2.06		0.00471	0.00100	0.0500	50	12/19/2020 08:46	WG1594581
Ethylbenzene	0.801		0.00685	0.00100	0.0500	50	12/19/2020 08:46	WG1594581
Methyl tert-butyl ether	4.58		0.00505	0.00100	0.0500	50	12/19/2020 08:46	WG1594581
Naphthalene	0.193	J	0.0500	0.00500	0.250	50	12/19/2020 08:46	WG1594581
Toluene	0.0457	J	0.0139	0.00100	0.0500	50	12/19/2020 08:46	WG1594581
1,2,4-Trimethylbenzene	0.568		0.0161	0.00100	0.0500	50	12/19/2020 08:46	WG1594581
1,3,5-Trimethylbenzene	0.0296	J	0.00520	0.00100	0.0500	50	12/19/2020 08:46	WG1594581

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
o-Xylene	0.0362	J	0.00870	0.00100	0.0500	50	12/19/2020 08:46	WG1594581
m&p-Xylene	0.594		0.0215	0.00200	0.100	50	12/19/2020 08:46	WG1594581
Xylenes, Total	0.630		0.00870	0.00300	0.150	50	12/19/2020 08:46	WG1594581
(S) Toluene-d8	*100*				*80.0-120*		*12/19/2020 08:46*	WG1594581
(S) 4-Bromofluorobenzene	*98.3*				*77.0-126*		*12/19/2020 08:46*	WG1594581
(S) 1,2-Dichloroethane-d4	*98.8*				*70.0-130*		*12/19/2020 08:46*	WG1594581

Semi-Volatile Organic Compounds (GC) by Method 3511/8015

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
TPH (GC/FID) High Fraction	9.02		0.0247	0.100	0.100	1	12/23/2020 19:09	WG1595072
(S) o-Terphenyl	*132*				*31.0-160*		*12/23/2020 19:09*	WG1595072

Wet Chemistry by Method 2320 B-2011

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
Alkalinity	917		8.45	20.0	20.0	1	12/24/2020 08:38	WG1595998

Sample Narrative:
L1297621-05 WG1595998: Endpoint pH 4.5 Headspace

Wet Chemistry by Method 3500Fe B-2011

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
Ferrous Iron	0.936	T8	0.0150	0.0500	0.0500	1	12/22/2020 01:37	WG1595111

Wet Chemistry by Method 351.2

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
Kjeldahl Nitrogen, TKN	0.365		0.140	0.250	0.250	1	12/24/2020 05:05	WG1596750

Wet Chemistry by Method 4500S2 D-2011

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
Sulfide	0.0330	J	0.0250	0.0500	0.0500	1	12/19/2020 12:18	WG1594470

Wet Chemistry by Method 9056A

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
Bromide	3.42		0.353	1.00	1.00	1	12/23/2020 20:50	WG1596327
Sulfate	118		2.97	5.00	25.0	5	12/23/2020 21:08	WG1596327

Wet Chemistry by Method 9060A

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
TOC (Total Organic Carbon)	14.8		0.102	1.00	1.00	1	12/18/2020 19:48	WG1594198

Metals (ICPMS) by Method 6020

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
Magnesium,Dissolved	145		0.0735	1.00	1.00	1	12/22/2020 11:48	WG1594776

Volatile Organic Compounds (GC) by Method 8015D/GRO

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
TPH (GC/FID) Low Fraction	20.9		3.14	0.100	10.0	100	12/20/2020 11:50	WG1594938
(S) a,a,a-Trifluorotoluene(FID)	*91.8*				*78.0-120*		*12/20/2020 11:50*	WG1594938

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
Benzene	2.22		0.00941	0.00100	0.100	100	12/19/2020 09:07	WG1594581
Ethylbenzene	0.862		0.0137	0.00100	0.100	100	12/19/2020 09:07	WG1594581
Methyl tert-butyl ether	5.02		0.0101	0.00100	0.100	100	12/19/2020 09:07	WG1594581
Naphthalene	0.215	J	0.100	0.00500	0.500	100	12/19/2020 09:07	WG1594581
Toluene	0.0505	J	0.0278	0.00100	0.100	100	12/19/2020 09:07	WG1594581
1,2,4-Trimethylbenzene	0.622		0.0322	0.00100	0.100	100	12/19/2020 09:07	WG1594581
1,3,5-Trimethylbenzene	0.0354	J	0.0104	0.00100	0.100	100	12/19/2020 09:07	WG1594581

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
o-Xylene	0.0329	J	0.0174	0.00100	0.100	100	12/19/2020 09:07	WG1594581
m&p-Xylene	0.647		0.0430	0.00200	0.200	100	12/19/2020 09:07	WG1594581
Xylenes, Total	0.680		0.0174	0.00300	0.300	100	12/19/2020 09:07	WG1594581
(S) Toluene-d8	*101*				*80.0-120*		*12/19/2020 09:07*	WG1594581
(S) 4-Bromofluorobenzene	*96.5*				*77.0-126*		*12/19/2020 09:07*	WG1594581
(S) 1,2-Dichloroethane-d4	*98.8*				*70.0-130*		*12/19/2020 09:07*	WG1594581

Semi-Volatile Organic Compounds (GC) by Method 3511/8015

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
TPH (GC/FID) High Fraction	10.8		0.123	0.100	0.500	5	12/24/2020 03:54	WG1595072
(S) o-Terphenyl	*114*				*31.0-160*		*12/24/2020 03:54*	WG1595072

Wet Chemistry by Method 2320 B-2011

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Alkalinity	U		8.45	20.0	20.0	1	12/24/2020 08:47	WG1595998

Sample Narrative:
L1297621-06 WG1595998: Endpoint pH 4.5 Headspace

Wet Chemistry by Method 3500Fe B-2011

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Ferrous Iron	U	T8	0.0150	0.0500	0.0500	1	12/22/2020 01:38	WG1595111

Wet Chemistry by Method 351.2

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Kjeldahl Nitrogen, TKN	U		0.140	0.250	0.250	1	12/24/2020 05:06	WG1596750

Wet Chemistry by Method 4500S2 D-2011

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Sulfide	U		0.0250	0.0500	0.0500	1	12/19/2020 12:19	WG1594470

Wet Chemistry by Method 9056A

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Bromide	U		0.353	1.00	1.00	1	12/24/2020 10:49	WG1596327
Sulfate	U		0.594	5.00	5.00	1	12/24/2020 10:49	WG1596327

Wet Chemistry by Method 9060A

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
TOC (Total Organic Carbon)	0.681	B J	0.102	1.00	1.00	1	12/18/2020 20:03	WG1594198

Metals (ICPMS) by Method 6020

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Magnesium,Dissolved	U		0.0735	1.00	1.00	1	12/22/2020 11:51	WG1594776

Volatile Organic Compounds (GC) by Method 8015D/GRO

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
TPH (GC/FID) Low Fraction	U		0.0314	0.100	0.100	1	12/20/2020 07:25	WG1594938
(S) a,a,a-Trifluorotoluene(FID)	*92.0*				*78.0-120*		*12/20/2020 07:25*	WG1594938

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Benzene	U		0.0000941	0.00100	0.00100	1	12/19/2020 03:52	WG1594581
Ethylbenzene	0.000173	J	0.000137	0.00100	0.00100	1	12/19/2020 03:52	WG1594581
Methyl tert-butyl ether	U		0.000101	0.00100	0.00100	1	12/19/2020 03:52	WG1594581
Naphthalene	U		0.00100	0.00500	0.00500	1	12/19/2020 03:52	WG1594581
Toluene	U		0.000278	0.00100	0.00100	1	12/19/2020 03:52	WG1594581
1,2,4-Trimethylbenzene	U		0.000322	0.00100	0.00100	1	12/19/2020 03:52	WG1594581
1,3,5-Trimethylbenzene	U		0.000104	0.00100	0.00100	1	12/19/2020 03:52	WG1594581

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
o-Xylene	U		0.000174	0.00100	0.00100	1	12/19/2020 03:52	WG1594581
m&p-Xylene	U		0.000430	0.00200	0.00200	1	12/19/2020 03:52	WG1594581
Xylenes, Total	U		0.000174	0.00300	0.00300	1	12/19/2020 03:52	WG1594581
(S) Toluene-d8	*101*				*80.0-120*		*12/19/2020 03:52*	WG1594581
(S) 4-Bromofluorobenzene	*95.5*				*77.0-126*		*12/19/2020 03:52*	WG1594581
(S) 1,2-Dichloroethane-d4	*101*				*70.0-130*		*12/19/2020 03:52*	WG1594581

Semi-Volatile Organic Compounds (GC) by Method 3511/8015

Analyte	Result mg/l	Qualifier	SDL mg/l	Unadj. MQL mg/l	MQL mg/l	Dilution	Analysis date / time	Batch
TPH (GC/FID) High Fraction	0.149		0.0247	0.100	0.100	1	12/24/2020 02:26	WG1595072
(S) o-Terphenyl	*112*				*31.0-160*		*12/24/2020 02:26*	WG1595072

Volatile Organic Compounds (GC/MS) by Method 8260B

Analyte	Result	Qualifier	SDL	Unadj. MQL	MQL	Dilution	Analysis	Batch
	mg/l		mg/l	mg/l	mg/l		date / time	
Benzene	U		0.0000941	0.00100	0.00100	1	12/19/2020 03:10	WG1594581
Ethylbenzene	U		0.000137	0.00100	0.00100	1	12/19/2020 03:10	WG1594581
Methyl tert-butyl ether	U		0.000101	0.00100	0.00100	1	12/19/2020 03:10	WG1594581
Naphthalene	U		0.00100	0.00500	0.00500	1	12/19/2020 03:10	WG1594581
Toluene	U		0.000278	0.00100	0.00100	1	12/19/2020 03:10	WG1594581
1,2,4-Trimethylbenzene	U		0.000322	0.00100	0.00100	1	12/19/2020 03:10	WG1594581
1,3,5-Trimethylbenzene	U		0.000104	0.00100	0.00100	1	12/19/2020 03:10	WG1594581
o-Xylene	U		0.000174	0.00100	0.00100	1	12/19/2020 03:10	WG1594581
m&p-Xylene	U		0.000430	0.00200	0.00200	1	12/19/2020 03:10	WG1594581
Xylenes, Total	U		0.000174	0.00300	0.00300	1	12/19/2020 03:10	WG1594581
(S) Toluene-d8	*99.3*				*80.0-120*		*12/19/2020 03:10*	WG1594581
(S) 4-Bromofluorobenzene	*98.9*				*77.0-126*		*12/19/2020 03:10*	WG1594581
(S) 1,2-Dichloroethane-d4	*102*				*70.0-130*		*12/19/2020 03:10*	WG1594581

Method Blank (MB)

(MB) R3607038-1 12/24/20 06:52

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Alkalinity	U		8.45	20.0

Sample Narrative:

BLANK: Endpoint pH 4.5

L1297621-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1297621-01 12/24/20 07:49 • (DUP) R3607038-2 12/24/20 07:56

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Alkalinity	772	774	1	0.216		20

Sample Narrative:

OS: Endpoint pH 4.5 Headspace

DUP: Endpoint pH 4.5

L1297927-08 Original Sample (OS) • Duplicate (DUP)

(OS) L1297927-08 12/24/20 10:15 • (DUP) R3607038-4 12/24/20 10:24

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Alkalinity	U	U	1	0.000		20

Sample Narrative:

OS: Endpoint pH 4.5 Headspace

DUP: Endpoint pH 4.5

Laboratory Control Sample (LCS)

(LCS) R3607038-3 12/24/20 08:27

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Alkalinity	100	98.2	98.2	90.0-110	

Sample Narrative:

LCS: Endpoint pH 4.5

Method Blank (MB)

(MB) R3606014-1 12/22/20 00:53

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Ferrous Iron	U		0.0150	0.0500

L1297621-05 Original Sample (OS) • Duplicate (DUP)

(OS) L1297621-05 12/22/20 01:37 • (DUP) R3606014-6 12/22/20 01:37

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Ferrous Iron	0.936	0.914	1	2.38		20

Laboratory Control Sample (LCS)

(LCS) R3606014-2 12/22/20 00:53

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Ferrous Iron	1.00	0.977	97.7	85.0-115	

L1296559-07 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1296559-07 12/22/20 01:23 • (MS) R3606014-4 12/22/20 01:24 • (MSD) R3606014-5 12/22/20 01:26

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Ferrous Iron	1.00	U	0.956	0.970	95.6	97.0	1	80.0-120			1.45	20

L1297621-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1297621-01 12/22/20 01:28 • (MS) R3606014-7 12/22/20 02:02 • (MSD) R3606014-8 12/22/20 02:02

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Ferrous Iron	1.00	0.250	1.20	1.20	94.8	95.3	1	80.0-120			0.416	20

Method Blank (MB)

(MB) R3606883-1 12/24/20 04:54

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Kjeldahl Nitrogen, TKN	U		0.140	0.250

L1297641-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1297641-01 12/24/20 05:14 • (DUP) R3606883-6 12/24/20 05:16

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Kjeldahl Nitrogen, TKN	0.296	0.297	1	0.337		20

L1297641-02 Original Sample (OS) • Duplicate (DUP)

(OS) L1297641-02 12/24/20 05:17 • (DUP) R3606883-7 12/24/20 05:18

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Kjeldahl Nitrogen, TKN	0.939	0.874	1	7.17		20

Laboratory Control Sample (LCS)

(LCS) R3606883-2 12/24/20 04:55

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Kjeldahl Nitrogen, TKN	15.2	16.3	107	75.2-121	

L1297621-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1297621-01 12/24/20 04:57 • (MS) R3606883-3 12/24/20 04:58 • (MSD) R3606883-4 12/24/20 04:59

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Kjeldahl Nitrogen, TKN	5.00	0.957	5.75	5.42	95.9	89.3	1	90.0-110		J6	5.91	20

L1297621-06 Original Sample (OS) • Matrix Spike (MS)

(OS) L1297621-06 12/24/20 05:06 • (MS) R3606883-5 12/24/20 05:10

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MS Rec. %	Dilution	Rec. Limits %	MS Qualifier
Kjeldahl Nitrogen, TKN	5.00	U	4.57	91.4	1	90.0-110	

Method Blank (MB)

(MB) R3605380-1 12/19/20 12:17

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Sulfide	U		0.0250	0.0500

L1297621-04 Original Sample (OS) • Duplicate (DUP)

(OS) L1297621-04 12/19/20 12:18 • (DUP) R3605380-5 12/19/20 12:18

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Sulfide	0.0450	0.0370	1	19.5	J	20

L1297927-05 Original Sample (OS) • Duplicate (DUP)

(OS) L1297927-05 12/19/20 12:20 • (DUP) R3605380-6 12/19/20 12:20

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Sulfide	U	U	1	0.000		20

Laboratory Control Sample (LCS)

(LCS) R3605380-2 12/19/20 12:17

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Sulfide	0.500	0.537	107	85.0-115	

L1297621-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1297621-01 12/19/20 12:17 • (MS) R3605380-3 12/19/20 12:17 • (MSD) R3605380-4 12/19/20 12:17

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Sulfide	1.00	1.83	2.00	1.96	17.4	13.8	1	80.0-120	J6	J6	1.82	20

Method Blank (MB)

(MB) R3607001-1 12/23/20 13:27

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Bromide	U		0.353	1.00
Sulfate	U		0.594	5.00

L1297701-01 Original Sample (OS) • Duplicate (DUP)

(OS) L1297701-01 12/23/20 22:35 • (DUP) R3607001-5 12/23/20 22:52

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Bromide	U	U	1	0.000		15
Sulfate	417	415	1	0.366	E	15

L1297927-08 Original Sample (OS) • Duplicate (DUP)

(OS) L1297927-08 12/24/20 02:21 • (DUP) R3607001-6 12/24/20 02:38

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
Bromide	U	U	1	0.000		15
Sulfate	U	U	1	0.000		15

Laboratory Control Sample (LCS)

(LCS) R3607001-2 12/23/20 13:44

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Bromide	40.0	40.0	100	80.0-120	
Sulfate	40.0	40.3	101	80.0-120	

L1297621-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1297621-01 12/23/20 17:21 • (MS) R3607001-3 12/23/20 17:39 • (MSD) R3607001-4 12/23/20 17:56

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Bromide	50.0	1.11	52.6	54.1	103	106	1	80.0-120			2.87	15
Sulfate	50.0	52.4	97.3	97.8	89.8	90.9	1	80.0-120			0.543	15

L1297927-08 Original Sample (OS) • Matrix Spike (MS)

(OS) L1297927-08 12/24/20 02:21 • (MS) R3607001-7 12/24/20 02:56

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MS Rec. %	Dilution	Rec. Limits %	MS Qualifier
Bromide	50.0	U	51.4	103	1	80.0-120	
Sulfate	50.0	U	51.2	102	1	80.0-120	

Method Blank (MB)

(MB) R3605376-1 12/18/20 13:11

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
TOC (Total Organic Carbon)	0.510	J	0.102	1.00

L1297621-06 Original Sample (OS) • Duplicate (DUP)

(OS) L1297621-06 12/18/20 20:03 • (DUP) R3605376-5 12/18/20 20:18

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
TOC (Total Organic Carbon)	0.681	0.613	1	10.5	J	20

L1297713-04 Original Sample (OS) • Duplicate (DUP)

(OS) L1297713-04 12/18/20 23:28 • (DUP) R3605376-6 12/18/20 23:53

Analyte	Original Result mg/l	DUP Result mg/l	Dilution	DUP RPD %	DUP Qualifier	DUP RPD Limits %
TOC (Total Organic Carbon)	11.1	11.1	1	0.0904		20

Laboratory Control Sample (LCS)

(LCS) R3605376-2 12/18/20 13:46

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
TOC (Total Organic Carbon)	75.0	69.9	93.2	85.0-115	

L1297713-08 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1297713-08 12/19/20 01:13 • (MS) R3605376-7 12/19/20 01:32 • (MSD) R3605376-8 12/19/20 01:52

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
TOC (Total Organic Carbon)	50.0	8.84	57.3	55.5	96.8	93.2	1	80.0-120			3.18	20

L1297621-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1297621-01 12/18/20 16:22 • (MS) R3605376-9 12/19/20 03:44 • (MSD) R3605376-10 12/19/20 04:06

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
TOC (Total Organic Carbon)	50.0	10.3	55.7	56.6	90.7	92.7	1	80.0-120			1.75	20

Method Blank (MB)

(MB) R3605618-1 12/20/20 20:16

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Magnesium,Dissolved	U		0.0735	1.00

Laboratory Control Sample (LCS)

(LCS) R3605618-2 12/20/20 20:19

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
Magnesium,Dissolved	5.00	4.94	98.8	80.0-120	

L1297621-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1297621-01 12/20/20 20:23 • (MS) R3605618-4 12/20/20 20:29 • (MSD) R3605618-5 12/20/20 20:33

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Magnesium,Dissolved	5.00	92.9	98.6	98.7	115	115	1	75.0-125			0.0206	20

Method Blank (MB)

(MB) R3606301-3 12/20/20 14:00

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
TPH (GC/FID) Low Fraction	U		0.0314	0.100
(S) a,a,a-Trifluorotoluene(FID)	*95.6*			*78.0-120*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3606301-1 12/20/20 11:46 • (LCSD) R3606301-2 12/20/20 12:07

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
TPH (GC/FID) Low Fraction	5.50	5.18	5.19	94.2	94.4	72.0-127			0.193	20
(S) a,a,a-Trifluorotoluene(FID)				*102*	*101*	*78.0-120*				

L1297621-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1297621-01 12/20/20 20:05 • (MS) R3606301-4 12/20/20 23:22 • (MSD) R3606301-5 12/20/20 23:44

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
TPH (GC/FID) Low Fraction	138	38.5	120	182	59.1	104	25	10.0-160		J3	41.1	22
(S) a,a,a-Trifluorotoluene(FID)					*99.6*	*102*		*78.0-120*				

Method Blank (MB)

(MB) R3607631-2 12/20/20 02:59

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
TPH (GC/FID) Low Fraction	U		0.0314	0.100
(S) a,a,a-Trifluorotoluene(FID)	*91.6*			*78.0-120*

Laboratory Control Sample (LCS)

(LCS) R3607631-1 12/20/20 02:06

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
TPH (GC/FID) Low Fraction	5.50	4.79	87.1	72.0-127	
(S) a,a,a-Trifluorotoluene(FID)			*85.8*	*78.0-120*	

Method Blank (MB)

(MB) R3606385-3 12/19/20 00:16

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Benzene	U		0.0000941	0.00100
Ethylbenzene	U		0.000137	0.00100
Methyl tert-butyl ether	U		0.000101	0.00100
Naphthalene	U		0.00100	0.00500
Toluene	U		0.000278	0.00100
1,2,4-Trimethylbenzene	U		0.000322	0.00100
1,3,5-Trimethylbenzene	U		0.000104	0.00100
Xylenes, Total	U		0.000174	0.00300
o-Xylene	U		0.000174	0.00100
m&p-Xylenes	U		0.000430	0.00200
(S) Toluene-d8	*101*			*80.0-120*
(S) 4-Bromofluorobenzene	*96.9*			*77.0-126*
(S) 1,2-Dichloroethane-d4	*101*			*70.0-130*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3606385-1 12/18/20 23:12 • (LCSD) R3606385-2 12/18/20 23:34

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Benzene	0.00500	0.00496	0.00495	99.2	99.0	70.0-123			0.202	20
Ethylbenzene	0.00500	0.00487	0.00498	97.4	99.6	79.0-123			2.23	20
Methyl tert-butyl ether	0.00500	0.00474	0.00500	94.8	100	68.0-125			5.34	20
Naphthalene	0.00500	0.00455	0.00502	91.0	100	54.0-135			9.82	20
Toluene	0.00500	0.00487	0.00497	97.4	99.4	79.0-120			2.03	20
1,2,4-Trimethylbenzene	0.00500	0.00421	0.00440	84.2	88.0	76.0-121			4.41	20
1,3,5-Trimethylbenzene	0.00500	0.00451	0.00466	90.2	93.2	76.0-122			3.27	20
Xylenes, Total	0.0150	0.0143	0.0148	95.3	98.7	79.0-123			3.44	20
o-Xylene	0.00500	0.00480	0.00500	96.0	100	80.0-122			4.08	20
m&p-Xylenes	0.0100	0.00949	0.00981	94.9	98.1	80.0-122			3.32	20
(S) Toluene-d8				*99.4*	*98.5*	*80.0-120*				
(S) 4-Bromofluorobenzene				*96.3*	*95.7*	*77.0-126*				
(S) 1,2-Dichloroethane-d4				*104*	*102*	*70.0-130*				

1 Cp
2 Tc
3 Ss
4 Cn
5 Tr
6 Sr
7 Qc
8 Gl
9 Al
10 Sc

L1297621-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1297621-01 12/19/20 07:44 • (MS) R3606385-4 12/19/20 10:09 • (MSD) R3606385-5 12/19/20 10:30

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Benzene	0.125	8.07	7.84	8.19	0.000	96.0	25	17.0-158	E V	E	4.37	27
Ethylbenzene	0.125	1.42	1.46	1.55	32.0	104	25	30.0-155			5.98	27
Methyl tert-butyl ether	0.125	2.97	2.93	3.07	0.000	80.0	25	28.0-150	V		4.67	29
Naphthalene	0.125	0.197	0.191	0.212	0.000	12.0	25	12.0-156	J6		10.4	35
Toluene	0.125	6.69	6.30	6.74	0.000	40.0	25	26.0-154	E V	E	6.75	28
1,2,4-Trimethylbenzene	0.125	0.548	0.557	0.595	7.20	37.6	25	26.0-154	V		6.60	27
1,3,5-Trimethylbenzene	0.125	0.110	0.209	0.216	79.2	84.8	25	28.0-153			3.29	27
Xylenes, Total	0.375	3.06	3.26	3.44	53.3	101	25	29.0-154			5.37	28
o-Xylene	0.125	0.913	0.970	1.03	45.6	93.6	25	45.0-144			6.00	26
m&p-Xylenes	0.250	2.15	2.29	2.41	56.0	104	25	43.0-146			5.11	26
(S) Toluene-d8					*96.4*	*101*		*80.0-120*				
(S) 4-Bromofluorobenzene					*98.0*	*98.2*		*77.0-126*				
(S) 1,2-Dichloroethane-d4					*102*	*103*		*70.0-130*				

1 Cp
2 Tc
3 Ss
4 Cn
5 Tr
6 Sr
7 Qc
8 Gl
9 Al
10 Sc

Method Blank (MB)

(MB) R3606680-3 12/22/20 21:59

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
Benzene	U		0.0000941	0.00100
Methyl tert-butyl ether	U		0.000101	0.00100
Toluene	U		0.000278	0.00100
(S) Toluene-d8	*110*			*80.0-120*
(S) 4-Bromofluorobenzene	*88.8*			*77.0-126*
(S) 1,2-Dichloroethane-d4	*118*			*70.0-130*

Laboratory Control Sample (LCS) • Laboratory Control Sample Duplicate (LCSD)

(LCS) R3606680-1 12/22/20 20:58 • (LCSD) R3606680-2 12/22/20 21:18

Analyte	Spike Amount mg/l	LCS Result mg/l	LCSD Result mg/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Benzene	0.00500	0.00485	0.00443	97.0	88.6	70.0-123			9.05	20
Methyl tert-butyl ether	0.00500	0.00497	0.00485	99.4	97.0	68.0-125			2.44	20
Toluene	0.00500	0.00490	0.00454	98.0	90.8	79.0-120			7.63	20
(S) Toluene-d8				*106*	*107*	*80.0-120*				
(S) 4-Bromofluorobenzene				*94.0*	*93.2*	*77.0-126*				
(S) 1,2-Dichloroethane-d4				*119*	*123*	*70.0-130*				

Method Blank (MB)

(MB) R3606656-1 12/23/20 09:44

Analyte	MB Result mg/l	MB Qualifier	MB MDL mg/l	MB RDL mg/l
TPH (GC/FID) High Fraction	U		0.0247	0.100
(S) o-Terphenyl	*118*			*31.0-160*

Laboratory Control Sample (LCS)

(LCS) R3606656-2 12/23/20 10:10

Analyte	Spike Amount mg/l	LCS Result mg/l	LCS Rec. %	Rec. Limits %	LCS Qualifier
TPH (GC/FID) High Fraction	1.50	1.77	118	50.0-150	
(S) o-Terphenyl			*118*	*31.0-160*	

L1297621-01 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L1297621-01 12/24/20 02:52 • (MS) R3606656-3 12/23/20 23:56 • (MSD) R3606656-4 12/24/20 00:22

Analyte	Spike Amount mg/l	Original Result mg/l	MS Result mg/l	MSD Result mg/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
TPH (GC/FID) High Fraction	1.50	5.19	7.26	7.02	138	128	10	50.0-150			3.36	20
(S) o-Terphenyl					*326*	*253*		*31.0-160*	J1	J1		

Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Results Disclaimer - Information that may be provided by the customer, and contained within this report, include Permit Limits, Project Name, Sample ID, Sample Matrix, Sample Preservation, Field Blanks, Field Spikes, Field Duplicates, On-Site Data, Sampling Collection Dates/Times, and Sampling Location. Results relate to the accuracy of this information provided, and as the samples are received.

Abbreviations and Definitions

MDL	Method Detection Limit.
MQL	Method Quantitation Limit.
RDL	Reported Detection Limit.
Rec.	Recovery.
RPD	Relative Percent Difference.
SDG	Sample Delivery Group.
SDL	Sample Detection Limit.
(S)	Surrogate (Surrogate Standard) - Analytes added to every blank, sample, Laboratory Control Sample/Duplicate and Matrix Spike/Duplicate; used to evaluate analytical efficiency by measuring recovery. Surrogates are not expected to be detected in all environmental media.
U	Not detected at the Sample Detection Limit.
Unadj. MQL	Unadjusted Method Quantitation Limit.
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Limits	These are the target % recovery ranges or % difference value that the laboratory has historically determined as normal for the method and analyte being reported. Successful QC Sample analysis will target all analytes recovered or duplicated within these ranges.
Original Sample	The non-spiked sample in the prep batch used to determine the Relative Percent Difference (RPD) from a quality control sample. The Original Sample may not be included within the reported SDG.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state “ND” (Not Detected) or “BDL” (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier	Description
B	The same analyte is found in the associated blank.
E	The analyte concentration exceeds the upper limit of the calibration range of the instrument established by the initial calibration (ICAL).
J	The identification of the analyte is acceptable; the reported value is an estimate.
J1	Surrogate recovery limits have been exceeded; values are outside upper control limits.
J3	The associated batch QC was outside the established quality control range for precision.
J6	The sample matrix interfered with the ability to make any accurate determination; spike value is low.
T8	Sample(s) received past/too close to holding time expiration.
V	The sample concentration is too high to evaluate accurate spike recoveries.

Pace National is the only environmental laboratory accredited/certified to support your work nationwide from one location. One phone call, one point of contact, one laboratory. No other lab is as accessible or prepared to handle your needs throughout the country. Our capacity and capability from our single location laboratory is comparable to the collective totals of the network laboratories in our industry. The most significant benefit to our one location design is the design of our laboratory campus. The model is conducive to accelerated productivity, decreasing turn-around time, and preventing cross contamination, thus protecting sample integrity. Our focus on premium quality and prompt service allows us to be YOUR LAB OF CHOICE.
* Not all certifications held by the laboratory are applicable to the results reported in the attached report.
* Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace National.

State Accreditations

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN000032021-1
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey–NELAP	TN002
California	2932	New Mexico [1]	TN00003
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina [1]	DW21704
Georgia	NELAP	North Carolina [3]	41
Georgia [1]	923	North Dakota	R-140
Idaho	TN00003	Ohio–VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LAO00356
Kentucky [1 6]	KY90010	South Carolina	84004
Kentucky [2]	16	South Dakota	n/a
Louisiana	AI30792	Tennessee [1 4]	2006
Louisiana [1]	LA180010	Texas	T104704245-20-18
Maine	TN00003	Texas [5]	LAB0152
Maryland	324	Utah	TN00003
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	460132
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	998093910
Montana	CERT0086	Wyoming	A2LA

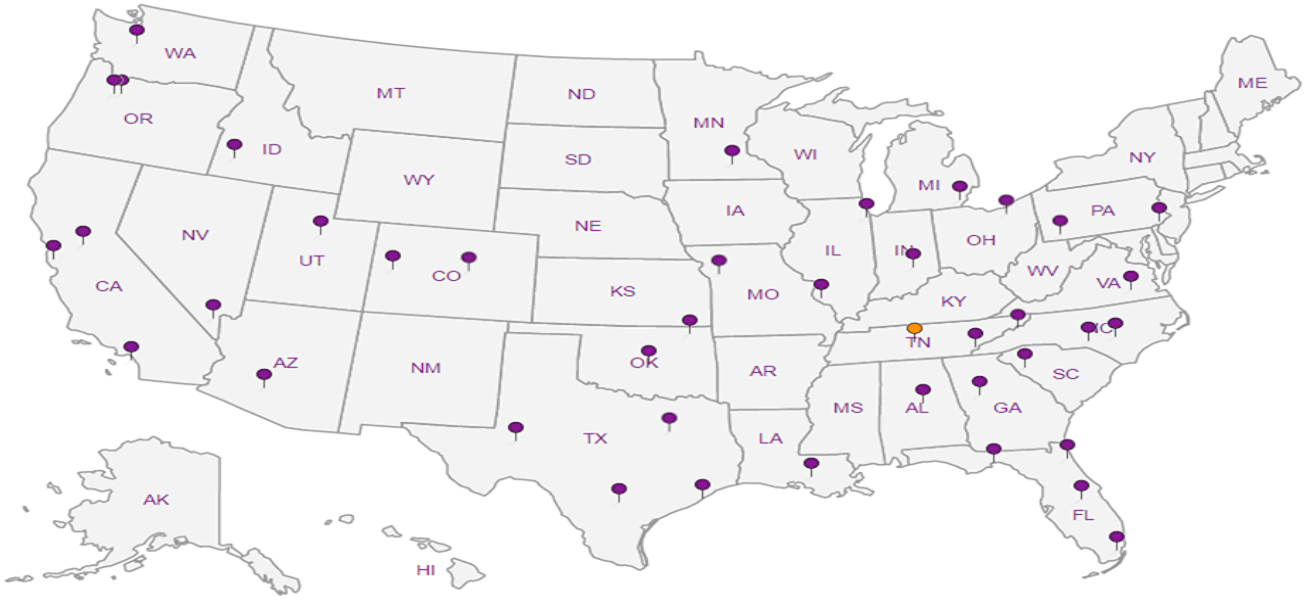
Third Party Federal Accreditations

A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 [5]	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA–Crypto	TN00003		

[1] Drinking Water [2] Underground Storage Tanks [3] Aquatic Toxicity [4] Chemical/Microbiological [5] Mold [6] Wastewater n/a Accreditation not applicable

Our Locations

Pace National has sixty-four client support centers that provide sample pickup and/or the delivery of sampling supplies. If you would like assistance from one of our support offices, please contact our main office. Pace National performs all testing at our central laboratory.



TRC Solutions - Austin, TX

505 E. Huntland Dr, Ste 250
Austin, TX 78752

Billing Information:
Accounts Payable
21 Griffin Road North
Windsor, CT 06095

Pres Chk

Report to: **Julie Speer**

Email To: jspeer@trccompanies.com

Project Description: **PilotTest Baseline GWM**

City/State Collected:

Please Circle: PT MT CT ET

Phone: **512-431-8184**

Client Project # **387820.0000.0000 000**

Lab Project # **TRCATX-ARTESIAPILOT**

Collected by (print):

Site/Facility ID # **HFNR ARTESIA REFINERY**

P.O. #

Collected by (signature):

Immediately Packed on Ice N ____ Y ____

Rush? (Lab MUST Be Notified)
___ Same Day ___ Five Day
___ Next Day ___ 5 Day (Rad Only)
___ Two Day ___ 10 Day (Rad Only)
___ Three Day

Quote #

Date Results Needed

Analysis / Container / Preservative

Chain of Custody Page ___ of ___

Pace Analytical® National Center for Testing & Innovation

L1297621

12065 Lebanon Rd
Mount Juliet, TN 37122
Phone: 615-758-5858
Phone: 800-767-5859
Fax: 615-758-5859

SDG # D158

Ta

Acctnum: **TRCATX**

Template: **T179200**

Prelogin: **P816323**

PM: **526 - Chris McCord**

PB:

Shipped Via:

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs	ALK,BROMIDE,SULFATE 250mlHDPE-NoPres	DROLVI 40mlAmb-HCl-BT	Diss. Mg 250mlHDPE-NoPres	FERUSFE 250mlAmb-HCl	GRO 40mlAmb HCl	SULFIDE 250mlAmb-S-NaOH+ZnAc	TKN 250mlHDPE-H2SO4	TOC 250mlHDPE-HCl	V8260 40mlAmb-HCl	Remarks	Sample # (lab only)
MW-99	G	GW		12/15/20	1110	~~16~~	✓	✓	✓	✓	✓	✓	✓	✓	✓	MS/MSD	-01
MW-112		GW		12/15/20	905	13	✓	✓	✓	✓	✓	✓	✓	✓	✓		-02
MW-129		GW		12/14/20	1725	13	✓	✓	✓	✓	✓	✓	✓	✓	✓		-03
~~RW-15C~~		GW														JPO 12/16/20	
RW-19		GW		12/14/20	1430	13	✓	✓	✓	✓	✓	✓	✓	✓	✓		-04
DUP-01		GW		12/14/20	1435	13	✓	✓	✓	✓	✓	✓	✓	✓	✓		-05
EB-01		GW		12/14/20	1735	13	✓	✓	✓	✓	✓	✓	✓	✓	✓		-06
TRIP Blank	—	GW		—	—	2									✓		-07
		GW															
		GW															

* Matrix:
SS - Soil AIR - Air F - Filter
GW - Groundwater B - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other_____

Remarks: LAB Field Filter Dissolved Mg JPO 12/16/20
~~MS/MSD - MW-99~~ JPO 12/15/20
TRIP Blank 1 - For Each COOLER

pH _____ Temp _____

Flow _____ Other _____

Samples returned via:
__ UPS __ FedEx __ Courier _____

Tracking #

Sample Receipt Checklist

COC Seal Present/Intact:	NP	Y N
COC Signed/Accurate:		Y N
Bottles arrive intact:		Y N
Correct bottles used:		Y N
Sufficient volume sent:		Y N
If Applicable		
VOA Zero Headspace:		Y N
Preservation Correct/Checked:		Y N
RAD Screen <0.5 mR/hr:		Y N

Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Trip Blank Received: Yes / No HCL / MeoH TBR
Per PO Mgt	12/16/20	1230		
Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Temp: 2.3+1-0.2=2.1 °C Bottles Received: 9
Relinquished by: (Signature)	Date:	Time:	Received for lab by: (Signature)	Date: 12/17 Time: 16:20

If preservation required by Login: Date/Time

Hold:

Condition: NCF / OK

Pace Analytical National
DCS Water Study

Method: 9060A
Instrument: TOC5, TOC8
Date Analyzed: November 14, 2020

Analyte	Result (mg/l)	TV	MDL	%Rec	TV/MDL
TOC (TOTAL ORGANIC CARBON)	0.6331406	0.5	0.102	127	4.9
TOTAL INORGANIC CARBON	0.6967	0.5	0.32	139	1.56
DOC	0.7519	0.5	0.106	150	4.72

Pace Analytical National
DCS Water Study

Method: 351.2
Instrument: LACHAT6
Date Analyzed: October 5, 2020

Analyte	Result (mg/l)	TV	MDL	%Rec	TV/MDL
KJELDAHL NITROGEN, TKN	0.027	0.15	0.14	18	1.07

Method: Sulfide water SM4500S2 D-2011 Instrument: DR6000-1

Laboratory: Pace Analytical Wetlab

Date: July 27, 2020

File: L1225041-01 WG1514933

DCS Study

Analyte	Result (mg/L)	Conc/TV	MDL (ppm)	% Rec	LOD Range TV/MDL	LOD Criteria 2-3 (P)	ESC Criteria 20-200% Rec
Sulfide	0.024	0.025	0.025	96%	1.0		P

Method: 2320 B-2011
Instrument: TITRANDO1
Date Analyzed: 07/30/20

Analyte	Result (mg/l)	TV	MDL	%Rec	TV/MDL
ALKALINITY	12.08765	10	8.45	121	1.18

Pace Analytical National
DCS Water Study

Method: 3500Fe B-2011
Instrument: DR6000-2
Date Analyzed: 10/03/20

Analyte	Result (mg/l)	TV	MDL	%Rec	TV/MDL
FERROUS IRON	0.025	0.025	0.015	100	1.67

Pace Analytical National
DCS Water Study

Method: 300.0
Instrument: IC-11
Date Analyzed: 09/30/20

Analyte	Result (mg/l)	TV	MDL	%Rec	TV/MDL
BROMIDE	0.825	0.5	0.353	165	1.42
CHLORATE	0.0281	0.025	0.024	112	1.04
CHLORIDE	0.6487	0.5	0.379	130	1.32
FLUORIDE	0.0657	0.075	0.064	87.6	1.17
NITRATE	0.0701	0.05	0.048	140	1.04
NITRITE	0.0736	0.05	0.042	147	1.19
SULFATE	0.8259	0.5	0.594	165	0.84

Method: 8260B Instrument: VOCMS26
Laboratory: Pace National Matrix: water
Date: October 27, 2020
DCS Confirmation

Analyte	Calculated Result (ppb)	LOD TV/Conc (ppb)	MDL (ppb)	% Rec
1,1,1,2-TETRACHLOROETHANE	0.511944	0.5	0.147	102%
1,1,1-TRICHLOROETHANE	0.3993402	0.5	0.149	80%
1,1,2,2-TETRACHLOROETHANE	0.5140975	0.5	0.133	103%
1,1,2-TRICHLOROETHANE	0.4834007	0.5	0.158	97%
1,1,2-TRICHLOROTRIFLUOROETHANE	0.2024074	0.5	0.18	40%
1,1-DICHLOROETHANE	0.4647182	0.5	0.1	93%
1,1-DICHLOROETHENE	0.3367384	0.5	0.188	67%
1,1-DICHLOROPROPENE	0.4343358	0.5	0.142	87%
1,2,3-TRICHLOROBENZENE	0.4034377	0.5	0.23	81%
1,2,3-TRICHLOROPROPANE	0.9742147	1	0.237	97%
1,2,3-TRIMETHYLBENZENE	0.4491027	0.5	0.104	90%
1,2,4-TRICHLOROBENZENE	0.3851377	0.5	0.481	77%
1,2,4-TRIMETHYLBENZENE	0.5023522	0.5	0.322	100%
1,2-DIBROMO-3-CHLOROPROPANE	2.0506922	2	0.276	103%
1,2-DIBROMOETHANE	0.5357667	0.5	0.126	107%
1,2-DICHLOROBENZENE	0.4274949	0.5	0.107	85%
1,2-DICHLOROETHANE	0.4947475	0.5	0.0819	99%
1,2-DICHLOROPROPANE	0.4308559	0.5	0.149	86%
1,3,5-TRICHLOROBENZENE	0.4086926	0.5	0.1	82%
1,3,5-TRIMETHYLBENZENE	0.4705507	0.5	0.104	94%
1,3-BUTADIENE	6.0792192	1	0.299	608%
1,3-DICHLOROBENZENE	0.4475359	0.5	0.11	90%
1,3-DICHLOROPROPANE	0.4505793	0.5	0.11	90%
1,4-DICHLOROBENZENE	0.4607604	0.5	0.12	92%
1-METHYLNAPHTHALENE	4.989075	5	7.3	100%
2,2,4-TRIMETHYLPENTANE	0.5164502	0.5	0.391	103%
2,2-DICHLOROPROPANE	0.4634958	0.5	0.161	93%
2-BUTANONE (MEK)	11.1003737	10	1.19	111%
2-CHLOROETHYL VINYL ETHER	26.6016038	25	0.575	106%
2-CHLOROTOLUENE	0.4479835	0.5	0.106	90%
2-HEXANONE	11.1894364	10	0.787	112%
2-METHYLNAPHTHALENE	5.2780818	5	7.18	106%
4-CHLOROTOLUENE	0.4306482	0.5	0.114	86%
4-ETHYLTOLUENE	0.4454489	0.5	0.208	89%
4-METHYL-2-PENTANONE (MIBK)	11.2652958	10	0.478	113%
ACETONE	23.2114848	25	11.3	93%
ACROLEIN	21.2332421	25	2.54	85%
ACRYLONITRILE	11.2562846	10	0.671	113%

ALLYL CHLORIDE	10.9476847	10	0.5	109%
BENZENE	0.4877049	0.5	0.0941	98%
BROMOBENZENE	0.4242622	0.5	0.118	85%
BROMOCHLOROMETHANE	0.4488148	0.5	0.128	90%
BROMODICHLOROMETHANE	0.4548832	0.5	0.136	91%
BROMOFORM	0.4618608	0.5	0.129	92%
BROMOMETHANE	2.1109192	2	0.605	106%
CARBON DISULFIDE	0.4577671	0.5	0.0962	92%
CARBON TETRACHLORIDE	0.4454365	0.5	0.128	89%
CHLOROBENZENE	0.4726159	0.5	0.116	95%
CHLORODIBROMOMETHANE	0.4622989	0.5	0.14	92%
CHLOROETHANE	2.0143947	2	0.192	101%
CHLOROFORM	2.071635	2	0.111	104%
CHLOROMETHANE	0.962705	1	0.96	96%
CIS-1,2-DICHLOROETHENE	0.4194781	0.5	0.126	84%
CIS-1,3-DICHLOROPROPENE	0.4292647	0.5	0.111	86%
CYCLOHEXANE	0.3457662	0.5	0.188	69%
DIBROMOMETHANE	0.4229017	0.5	0.122	85%
DICHLORODIFLUOROMETHANE	1.8758316	2	0.374	94%
DICHLOROFLUOROMETHANE	2.0998595	2	0.13	105%
DICYCLOPENTADIENE	0.4517284	0.5	0.253	90%
DI-ISOPROPYL ETHER	0.4376398	0.5	0.105	88%
ETHANOL	10.8634116	50	42	22%
ETHYL ETHER	0.6166603	0.5	0.115	123%
ETHYL TERT-BUTYL ETHER	0.4541065	0.5	0.101	91%
ETHYLBENZENE	0.4564993	0.5	0.137	91%
HEXACHLORO-1,3-BUTADIENE	0.4235315	0.5	0.337	85%
IODOMETHANE	10.2860907	10	6	103%
ISOPROPYLBENZENE	0.4418757	0.5	0.105	88%
M&P-XYLENE	0.9839466	1	0.43	98%
METHYL ACETATE	10.3210896	10	1.29	103%
METHYL CYCLOHEXANE	0.4077204	0.5	0.66	82%
METHYL TERT-BUTYL ETHER	0.4077913	0.5	0.101	82%
METHYLENE CHLORIDE	2.0107782	2	0.43	101%
NAPHTHALENE	2.0113328	2	1	101%
N-BUTYLBENZENE	0.4051809	0.5	0.157	81%
n-Heptane	0.9364023	1	0.373	94%
n-HEXANE	5.2560459	5	0.749	105%
N-PROPYLBENZENE	0.4380269	0.5	0.0993	88%
O-XYLENE	0.4884578	0.5	0.174	98%
P-ISOPROPYLTOLUENE	0.4760968	0.5	0.12	95%
PROPENE	0.9025196	1	0.936	90%
SEC-BUTYLBENZENE	0.4178821	0.5	0.125	84%
STYRENE	0.455581	0.5	0.118	91%

T-AMYL ALCOHOL	24.1536866	25	4.9	97%
TERT-AMYL ETHYL ETHER	0.4300884	0.5	0.401	86%
TERT-AMYL METHYL ETHER	0.4217275	0.5	0.195	84%
TERT-BUTYL ALCOHOL	2.5511806	2.5	4.06	102%
TERT-BUTYLBENZENE	0.4527918	0.5	0.127	91%
TETRACHLOROETHENE	0.4281611	0.5	0.3	86%
TETRAHYDROFURAN	2.0804882	2	0.929	104%
TOLUENE	0.4832544	0.5	0.278	97%
TRANS-1,2-DICHLOROETHENE	0.5118694	0.5	0.149	102%
TRANS-1,3-DICHLOROPROPENE	0.4457162	0.5	0.118	89%
TRANS-1,4-DICHLORO-2-BUTENE	0.6638486	1	0.467	66%
TRICHLOROETHENE	0.4589283	0.5	0.19	92%
TRICHLOROFLUOROMETHANE	2.0143503	2	0.16	101%
VINYL ACETATE	12.3146668	10	0.692	123%
VINYL BROMIDE	0.1041947	0.5	0.3	21%
VINYL CHLORIDE	0.4646728	0.5	0.234	93%

Method: 8015D/GRO
Laboratory: Pace National
Date: 9/16/2020

Instrument: VOCGC6
Matrix: water

DCS Study 0.055ppm

Analyte	Calculated Result (ppm)	LOD TV/Conc (ppm)	MDL (ppm)	% Rec	LOD Range TV/MDL (P)
TPHG C5 - C12	0.1384833	0.055	0.0304	252%	1.8
TPHG C6 - C12	0.0766452	0.055	0.0316	139%	1.7
TPH (GC/FID) Low Fraction	0.0626509	0.055	0.0314	114%	1.8

Method: DRO RV
Laboratory: Pace National - Mt. Juliet
Date: September 15, 2020
File: 0915_14
DCS Study 0.05 ppm

Instrument: SVGC34
Matrix: water

Analyte	Result (ppm)	TV	MDL	%Rec	TV/MDL
TPH (GC/FID) HIGH FRACTION	0.122	0.05	0.0247	244%	2.0

Pace Analytical National
DCS Water Study

Method: 6020
Instrument: ICPMS10
Date Analyzed: 10/21/20

Analyte	Result (mg/l)	TV	MDL	%Rec	TV/MDL
ALUMINUM	0.05938868	0.05	0.0554	119	0.903
ANTIMONY	0.000580659	0.002	0.00132	29	1.52
ARSENIC	0.000587837	0.001	0.000735	58.8	1.36
BARIUM	0.001103299	0.01	0.00778	11	1.29
BERYLLIUM	0.000732534	0.0005	0.000454	147	1.1
BORON	0.01980344	0.01	0.0143	198	0.699
CADMIUM	0.000632656	0.0005	0.000478	127	1.05
CALCIUM	0.505145	0.5	0.48	101	1.04
CHROMIUM	0.001231857	0.0016	0.00149	77	1.07
COBALT	0.000609533	0.0005	0.000477	122	1.05
COPPER	0.0007324	0.003	0.0025	24.4	1.2
IRON	0.06207392	0.05	0.0489	124	1.02
LEAD	0.00070569	0.003	0.00249	23.5	1.2
LITHIUM	0.00088166	0.001	0.000936	88.2	1.07
MAGNESIUM	0.5099847	0.5	0.465	102	1.08
MANGANESE	0.00117123	0.0025	0.00132	46.8	1.89
MOLYBDENUM	0.001135507	0.001	0.000953	114	1.05
NICKEL	0.000681213	0.001	0.000952	68.1	1.05
POTASSIUM	0.508214	1	0.534	50.8	1.87
SELENIUM	0.000560427	0.001	0.000657	56	1.52
SILVER	0.00058249	0.001	0.000513	58.2	1.95
SODIUM	0.5388693	0.5	0.63	108	0.794
STRONTIUM	0.005071601	0.005	0.0046	101	1.09
THALLIUM	0.00062245	0.0005	0.00046	124	1.09
THORIUM	0.005036417	0.005	0.0043	101	1.16
TIN	0.000761423	0.001	0.00097	76.1	1.03
TITANIUM	0.005111328	0.005	0.0052	102	0.962
URANIUM	0.000609843	0.0005	0.00754	122	0.0663
VANADIUM	0.001214809	0.001	0.000986	121	1.01
ZINC	0.003759271	0.0125	0.00996	30.1	1.26

Data Review

Data reported by Pace Analytical in Mount Juliet, Tennessee, for the groundwater samples collected in November and December 2020 were reviewed to ensure that reported analytical results met the data quality requirements contained in the United States Environmental Protection Agency (USEPA) *National Functional Guidelines for Organic Superfund Methods Data Review* (USEPA, November 2020), *National Functional Guidelines for Inorganic Superfund Methods Data Review* (USEPA, November 2020), and the individual methods, as applicable. Quality control (QC) data indicate that measurement data are sufficient to meet method quality objectives, reported data are defensible, and QC mechanisms were generally effective in ensuring measurement data reliability within the expected limits of sampling and analytical error.

Analytes that were detected in the both the associated blank and sample were evaluated as follows: Corresponding samples at concentrations within five times the maximum blank concentration for inorganic analytes and within 10 times the maximum blank concentrations for organic analytes may include measurement contributions from the laboratory (for method blanks) and/or field (for equipment and trip blanks).

The following criteria were used in evaluation of the field duplicates: When both results are ≥ five times the reporting limit (RL), relative percent differences (RPDs) must be <30%. When one or both results are < five times the RL, the absolute difference must be < the RL.

The following criteria were used in evaluation of laboratory duplicates: When both results are ≥ five times the RL, RPDs must be <20%.

The following sections discuss the QC issues identified during the data review for data reports L1288818 and L1297621. One significant issue was identified. Due to significantly low (<30%; professional judgement) recoveries in the matrix spike (MS)/matrix spike duplicate (MSD) analyses, the nondetect result for sulfide in samples MW-112 and MW-129 are not useable for project objectives.

Lab Report L1288818

Sample identifiers cross-referenced to laboratory identifications are presented below.

Sample ID	Lab ID
KWB-4	L1288818-01
KWB-5	L1288818-02
MW-48	L1288818-03
MW-66	L1288818-04
MW-111	L1288818-05
MW-131	L1288818-06
DUP-01*	L1288818-07
TRIP BLANK 1	L1288818-08
TRIP BLANK 2	L1288818-09

*Field duplicate of MW-131

Data Review Checklist	Yes	No	Not Applicable
Did all samples meet the laboratory's standard conditions of sample acceptability upon receipt?		X	
All samples within holding times?		X	
Any detection in method blanks?	X		
Any detection in equipment blanks?			X
Any detection in trip blanks?	X		
Any LCS or LCS duplicates (LCSD) percent recoveries (%R) out of laboratory defined limits?		X	
Any LCS/LCSD RPD above laboratory defined limits?		X	
Any MS or MSD %R outside of laboratory defined limits?	X		
Any MS/MSD RPD above laboratory defined limits?		X	
Any surrogate %R outside of laboratory defined limits?	X		
Any laboratory duplicate RPD above laboratory defined limits?		X	
Any field duplicate data additionally flagged as estimated?		X	
Any analyte analyzed by a nonequivalent method than planned?		X	

Standard Conditions

The laboratory noted that the volatile organic compound (VOC) analyses of samples KWB-5 and MW-66, and total petroleum hydrocarbon (TPH) (GC/FID) high fraction analyses of samples KWB-4, KWB-5, MW-48, MW-66, MW-111, MW-131, and DUP-01 were performed using a container with a pH outside of the method requirement (pH $\leq$2). This pH issue shortens the holding time to seven days and these samples were analyzed for VOCs and/or TPH (GC/FID) high fraction after seven days of collection. Therefore, potential low bias exists for the positive and nondetect VOC results in samples KWB-5 and MW-66 and the positive results for TPH (GC/FID) high fraction in samples KWB-4, KWB-5, MW-48, MW-66, MW-111, MW-131, and DUP-01.

Holding Times

Samples KWB-4, KWB-5, MW-48, MW-66, MW-111, MW-131, and DUP-01 were analyzed outside the 24-hour holding time for ferrous iron; thus, results for ferrous iron in these samples may be biased low.

Laboratory Method Blanks

TPH (GC/FID) low fraction was detected in one of the method blanks. After sample-specific dilution factors were taken into account, the TPH (GC/FID) low fraction results in samples KWB-4 and KWB-5 were detected at concentrations within 10 times the method blank concentration. Therefore, TPH (GC/FID) low fraction results in samples KWB-4 and KWB-5 may include measurement contributions from laboratory sources.

Surrogate Recoveries

One of the surrogates, toluene-d8, in the undiluted VOC analysis of sample DUP-01 recovered below the laboratory-defined limits. Therefore, potential low bias exists for the positive results for naphthalene and 1,3,5-trimethylbenzene in the undiluted VOC analysis of sample DUP-01.

Trip Blanks

Benzene and naphthalene were detected in one of the trip blanks, TRIP BLANK 1. Benzene was not detected within 10 times the concentration in the associated trip blank in any related samples; therefore, there is no impact on data usability for benzene. After sample-specific dilution factors were taken into account, naphthalene was detected in samples KWB-4, KWB-5, MW-48, and MW-66, and MW-131 less than 10 times the trip blank concentration. Therefore, these samples may include measurement contributions from transport from the field to the laboratory.

MS/MSDs

MS/MSD analyses were performed on the following samples:

- MW-48: Total Kjeldahl nitrogen (TKN), sulfide, bromide, sulfate, total organic carbon (TOC), dissolved magnesium, TPH (GC/FID) low fraction, TPH (GC/FID) high fraction, VOCs
- DUP-01: TKN
- MW-66: Dissolved magnesium

The %Rs of sulfide in the MS (128%) and MSD (124%) performed on sample MW-48 were above the laboratory-defined recovery limits (80.0-120%). Thus, the positive result for sulfide in sample MW-48 may be biased high.

The %Rs of dissolved manganese in the MS and MSD performed on sample MW-48 were below the laboratory-defined recovery limits (75.0-125%). However, the concentration of this analyte in the unspiked sample was greater than four times the spiked concentration; thus, the recoveries of dissolved manganese were not used to evaluate potential matrix effects.

The %Rs of benzene (0%/0%), ethylbenzene (ok/24.0%), methyl tert-butyl ether (MTBE) (0%/0%), and 1,2,4-trimethylbenzene (ok/0%) in the MS and/or MSD performed on sample MW-48 were below the laboratory-defined recovery limits (17.0-158%, 30.0-155%, 28.0-150%, and 26.0-154%, respectively). The concentrations of benzene and MTBE in the unspiked sample were greater than four times the spiked concentration; thus, the recoveries of benzene and MTBE were not used to evaluate potential matrix effects. The positive results for ethylbenzene and 1,2,4-trimethylbenzene in sample MW-48 may be biased low.

Laboratory Duplicates

Laboratory duplicate analyses were performed on the following samples:

- KWB-4: Alkalinity, ferrous iron, TOC
- KWB-5: TKN, bromide, sulfate
- MW-48: Alkalinity
- MW-131: Ferrous iron
- DUP-01: TOC

All criteria were met.

Field Duplicates

Samples MW-131 and DUP-01 were submitted as the field duplicate pair. All criteria were met.

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Sample identifiers cross-referenced to laboratory identifications are presented below.

Sample ID	Lab ID
MW-99	L1297621-01
MW-112	L1297621-02
MW-129	L1297621-03
RW-19	L1297621-04
DUP-01*	L1297621-05
EB-01	L1297621-06
TRIP BLANK	L1297621-07

*Field duplicate of RW-19

Data Review Checklist	Yes	No	Not Applicable
Did all samples meet the laboratory's standard conditions of sample acceptability upon receipt?		X	
All samples within holding times?		X	
Any detection in method blanks?	X		
Any detection in equipment blanks?	X		
Any detection in trip blanks?		X	
Any LCS or LCSD %R out of laboratory defined limits?		X	
Any LCS/LCSD RPD above laboratory defined limits?		X	
Any MS or MSD %R outside of laboratory defined limits?	X		
Any MS/MSD RPD above laboratory defined limits?	X		
Any surrogate %R outside of laboratory defined limits?		X	
Any laboratory duplicate RPD above laboratory defined limits?		X	
Any field duplicate data additionally flagged as estimated?		X	
Any analyte analyzed by a nonequivalent method than planned?		X	

Standard Conditions

The laboratory noted that the TPH (GC/FID) high fraction analyses of samples MW-129, RW-19, and DUP-01 were performed using a container with a pH outside of the method requirement (pH $\leq$2). This pH issue shortens the holding time to seven days and these samples were analyzed for TPH (GC/FID) high fraction after seven days of collection. Therefore, potential low bias exists for the positive TPH (GC/FID) high fraction results in MW-129, RW-19, and DUP-01.

Holding Times

Samples MW-99, MW-112, MW-129, RW-19, DUP-01, and EB-01 were analyzed outside of the 24-hour holding time for ferrous iron; thus, results for ferrous iron in these samples may be biased low.

Laboratory Method Blanks

TOC was detected in the method blank. The TOC result in the equipment blank, EB-01, was detected at concentrations within 10 times the method blank concentration. Therefore, the TOC result in EB-01 may include measurement contributions from laboratory sources.

Equipment Blanks

The following analytes were detected in the equipment blank, EB-01: TOC, ethylbenzene, and TPH (GC/FID) high fraction. As discussed above, TOC was detected in the equipment blank, EB-01, at a concentration less than 10 times the associated method blank concentration; therefore, the result for TOC in the equipment blank was probably the result of laboratory method blank contamination and did not affect any associated field samples. Ethylbenzene results were greater than 10 times the equipment blank concentration in the related samples; therefore, there was no impact on data usability for ethylbenzene. After sample-specific dilution factors were taken into account, the result for TPH (GC/FID) high fraction was within 10 times the equipment blank concentration in sample MW-99. Therefore, the result for TPH (GC/FID) high fraction in sample MW-99 may include measurement contributions from the field.

MS/MSDs

MS/MSD analyses were performed on the following samples:

- MW-99: Ferrous iron, TKN, sulfide, bromide, sulfate, TOC, dissolved magnesium, TPH (GC/FID) low fraction, VOCs, TPH (GC/FID) high fraction
- EB-01: TKN

The MSD %R for TKN (89.3%) and the MS/MSD %Rs for sulfide (17.4%/13.8%) in the MS and MSD performed on sample MW-99 were below the laboratory-defined recovery limits (90.0-110% and 80.0-120%, respectively). Thus, the positive and/or nondetect results for TKN in samples MW-99, MW-112, MW-129, RW-19, and DUP-01, and the positive results for sulfide in samples MW-99 RW-19, and DUP-01 may be biased low. **Due to significantly low (<30%; professional judgement) recoveries in the MS/MSD analyses, the nondetect result for sulfide in samples MW-112 and MW-129 cannot be used for project objectives.**

The RPD (41.1%) for TPH (GC/FID) low fraction in the MS and MSD performed on sample MW-99 exceeded the laboratory-defined control limit (22%). Thus, the positive result for TPH (GC/FID) low fraction in sample MW-99 may be uncertain.

The MS and/or MSD %Rs of benzene (0%/ok), MTBE (0%/ok), naphthalene (0%/12.0%*), toluene (0%/ok), and 1,2,4-trimethylbenzene (7.20%/ok) in the MS/MSD performed on sample MW-99 were below the laboratory-defined recovery limits (17.0-158%, 28-150%, 20.0*-156%, 26.0-154%, and 26.0-154%, respectively). *A low limit of 20%R was used for naphthalene based on EPA National Functional Guidelines for Organic Superfund Methods Data Review; the laboratory's low limit of 12% for naphthalene was not used in this review. The concentrations of benzene, MTBE, toluene, and 1,2,4-trimethylbenzene in the unspiked samples were greater than four times the spiked concentration; thus, the recoveries of benzene, MTBE, toluene, and 1,2,4-trimethylbenzene were not used to evaluate potential matrix effects. The positive result for naphthalene in sample MW-99 may be biased low.

Laboratory Duplicates

Laboratory duplicate analyses were performed on the following samples:

- MW-99: Alkalinity
- RW-19: Sulfide
- DUP-01: Ferrous iron
- EB-01: TOC

All criteria were met.

Field Duplicates

Samples RW-19 and DUP-01 were submitted as the field duplicate pair. All criteria were met.