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DEPARTMENT OF ENERGY
Environmental Management Los Alamos Field Office (EM-LA)
Los Alamos, New Mexico 87544

EMLA-2022-BF097-02-001

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

Subject: Submittal of the 2021 Annual Long-Term Monitoring and Maintenance Report for the Corrective Measures Implementation at Former 260 Outfall Area, Revision 1, and Comment Response

Dear Mr. Shean:

Enclosed please find two hard copies with electronic files of the "2021 Annual Long-Term Monitoring and Maintenance Report for the Corrective Measures Implementation at Former 260 Outfall Area, Revision 1." Enclosure 1 includes an electronic copy of a redline strikeout version of the report that incorporates all changes made in response to the New Mexico Environment Department's review comments dated March 28, 2022 (Enclosure 2). This report summarizes activities completed from August 2020 to July 2021 related to monitoring and maintenance of the Technical Area 16 260 Outfall former settling pond cap; monitoring of the surge bed water levels; monitoring of water quality at select springs and alluvial seep; and monitoring of alluvial groundwater and surface water quality at select locations within Cañon de Valle, S-Site Canyon, Pajarito Canyon, Water Canyon, and Fishladder Canyon.

If you have any questions, please contact Patrick McGuire at (505) 709-7918 (patrick.mcguire@em-la.doe.gov) or Cheryl Rodriguez at (505) 414-0450 (cheryl.rodriguez@em.doe.gov).

Sincerely,

ARTURO DURAN

Digitally signed by ARTURO DURAN
Date: 2022.05.26 16:36:37 -06'00'

Arturo Q. Duran
Compliance and Permitting Manager
U.S. Department of Energy
Environmental Management
Los Alamos Field Office

Enclosure(s):

1. Two hard copies with electronic files (including a redline strikeout version) – 2021 Annual Long-Term Monitoring and Maintenance Report for the Corrective Measures Implementation at Former 260 Outfall Area, Revision 1 (EM2022-0231)
2. Response to New Mexico Environment Department Review, 2021 Annual Long-Term Monitoring and Maintenance Report for the Corrective Measures Implementation at Former 260 Outfall Area, Dated March 28, 2022 (EM2022-0230)

cc (letter with CD/DVD enclosure[s]):
Laurie King, EPA Region 6, Dallas, TX
Raymond Martinez, San Ildefonso Pueblo, NM
Dino Chavarria, Santa Clara Pueblo, NM
Steve Yanicak, NMED-DOE-OB
Christopher Krambis, NMED-HWB
Chris Catechis, NMED-RPD
Cheryl Rodriguez, EM-LA
Hai Shen, EM-LA
emla.docs@em.doe.gov
n3brecords@em-la.doe.gov
Public Reading Room (EPRR)
PRS website

cc (letter emailed):
Jennifer Payne, LANL
Stephen Hoffman, NA-LA
William Alexander, N3B
Emily Day, N3B
Danny Katzman, N3B
Ashley Kowalewski, N3B
Kim Lebak, N3B
Joseph Legare, N3B
Dana Lindsay, N3B
Pamela Maestas, N3B
Christian Maupin, N3B
Patrick McGuire, N3B
Joseph Murdock, N3B
Joseph Sena, N3B
Troy Thomson, N3B
Steve Veenis, N3B
M. Lee Bishop, EM-LA
John Evans, EM-LA
Michael Mikolanis, EM-LA
David Nickless, EM-LA

May 2022
EM2022-0231

2021 Annual Long-Term Monitoring and Maintenance Report for the Corrective Measures Implementation at Former 260 Outfall Area, Revision 1

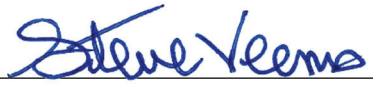
N3B Los Alamos

EM2022-0231

2021 Annual Long-Term Monitoring and Maintenance Report for the Corrective Measures Implementation at Former 260 Outfall Area, Revision 1

May 2022

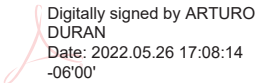
Responsible program director:

Steve Veenis		Program Director	Water Program	5/19/22
Printed Name	Signature	Title	Organization	Date

Responsible N3B representative:

Troy Thomson		Program Manager	N3B Environmental Remediation Program	5/19/22
Printed Name	Signature	Title	Organization	Date

Responsible DOE EM-LA representative:

Arturo Q. Duran	ARTURO DURAN 	Compliance and Permitting Manager	Office of Quality and Regulatory Compliance	
Printed Name	Signature	Title	Organization	Date

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1.0 INTRODUCTION

On March 28, 2022, the U.S. Department of Energy (DOE) Environmental Management Los Alamos Field Office (EM-LA) received comments from the New Mexico Environment Department (NMED) on the "2021 Annual Long-Term Monitoring and Maintenance Report for the Corrective Measures Implementation at Former 260 Outfall Area" (N3B 2021, 701683) (hereafter, the Long-Term Monitoring and Maintenance Report) within Technical Area 16 (TA-16) at Los Alamos National Laboratory (LANL or the Laboratory), which follows the Long-Term Monitoring and Maintenance Plan requirements specified in Appendix A to the "Remedy Completion Report for Corrective Measures Implementation at Consolidated Unit 16-021(c)-99" (hereafter the Corrective Measures Implementation [CMI] Remedy Completion Report) (LANL 2017, 602597). The purpose of this revision is to address NMED comments concerning the 2021 Annual Long-Term Monitoring and Maintenance Report (N3B 2021, 701683).

This annual Long-Term Monitoring and Maintenance Report covers the reporting period from August 2020 to July 2021 and typically includes information from two semiannual sampling events, one in August and the second in March. However, the August 2020 event was rescheduled to July 2020 and was reported in the "2020 Annual Long-Term Monitoring and Maintenance Report for the Corrective Measures Implementation at Former 260 Outfall Area" (N3B 2020, 701053) to replace the event that was postponed in March 2020. From March 1 to March 23, 2020, approvals to use portable electronic devices (PEDs) in the TA-16 area were pending. On March 24, 2020, EM-LA transitioned to essential mission critical activities (EMCA) status in response to the COVID-19 pandemic. NMED was notified of the transition to EMCA status on March 31, 2020 (DOE 2020, 700826). As a result of the EMCA status, the March 2020 sampling operations were paused. The second semiannual sampling event was conducted in July 2020 and was reported in the previous report. This report includes data from the March 2021 sampling event only.

The former 260 Outfall area consists of the high-explosives- (HE-) machining building (building 16-260) and associated sumps, drainlines, and troughs that discharged into the 260 Outfall drainage channel. The 260 Outfall drainage channel consists of the outfall, a former settling pond, and the lower portion of the drainage channel leading to Cañon de Valle (Figure 1.0-1). Historically, HE-contaminated water from the outfall entered the former settling pond and drained into the 260 Outfall drainage channel.

Corrective measures were implemented to address HE associated with the 260 Outfall, including Royal Demolition Explosive (RDX) and barium (a byproduct of processing HE Baratol), which are the primary contaminants addressed in the CMI remedy completion report (LANL 2017, 602597) and discussed in this report. Other compounds associated with the 260 Outfall include Her Majesty's Explosive (HMX); 2,4,6-trinitrotoluene (TNT); volatile organic compounds (VOCs); metals; and HE byproducts and degradation products. As part of the Long-Term Monitoring and Maintenance Plan, other analytes measured include semivolatile organic compounds (SVOCs), general inorganics, nitrogen-15/oxygen-18 isotopes in nitrate, and radionuclides. Where appropriate, these compounds are screened in accordance with the criteria established by the 2016 Compliance Order on Consent (Consent Order), and any compounds exceeding their respective screening levels are further discussed in this report. Additionally, field parameters (e.g., dissolved oxygen, oxidation-reduction potential [ORP], pH, specific conductance, temperature, and turbidity) were collected at select locations, and measurement results are provided.

This report discusses the monitoring and maintenance of the Outfall 260 former settling pond cap; monitoring of the surge bed water levels; monitoring of water quality at Sanitary Wastewater Systems Consolidation (SWSC) Spring, Burning Ground Spring, Martin Spring, and the permeable reactive barrier (PRB) alluvial seep (16-61439); and monitoring of groundwater and surface water (base flow) quality at select locations within Cañon de Valle, S-Site Canyon, Pajarito Canyon, Water Canyon, and Fishladder Canyon.

1.1 Regulatory Context

Long-term monitoring and maintenance activities follow the approach put forth in the CMI remedy completion report for corrective measures at Consolidated Unit 16-012(c)-99 (LANL 2017, 602597). The long-term water quality monitoring activities complement and integrate with the "Interim Facility-Wide Groundwater Monitoring Plan for the 2020 Monitoring Year, October 2019–September 2020" (IFGMP) (N3B 2019, 700451) and the "Interim Facility-Wide Groundwater Monitoring Plan for the 2021 Monitoring Year, October 2020–September 2021" (N3B 2020, 700927) for groundwater and surface water monitoring. Newport News Nuclear BWXT-Los Alamos, LLC (N3B) has implemented the IFGMP in accordance with Section XII of the Consent Order. The Long-Term Monitoring and Maintenance Plan was included in the CMI remedy completion report, Appendix A (LANL 2017, 602597). NMED approved the CMI remedy completion report on November 27, 2017 (NMED 2017, 602758).

Monitoring of groundwater from springs (including SWSC, Burning Ground, Bulldog, and Martin), alluvial wells, and intermediate and regional wells in the vicinity and downgradient of the 260 Outfall has historically been conducted as part of the TA-16 260 monitoring group activities conducted under the IFGMP. With the completion of surface CMI activities at Consolidated Unit 16-021(c)-99 and NMED's approval of the "Remedy Completion Report for Corrective Measures Implementation at Consolidated Unit 16-021(c)-99," including the Long-Term Monitoring and Maintenance Plan (LANL 2017, 602597; NMED 2017, 602758), the monitoring of surface water, alluvial groundwater, and springs has been incorporated into the IFGMP.

1.2 Conceptual Model for Transport of RDX and Barium

RDX and barium were the primary chemicals of potential concern (COPCs) in alluvial groundwater during the surface CMIs from 1999 to 2010 (LANL 2007, 098192). RDX is the most significant COPC within Cañon de Valle and Water Canyon (LANL 2017, 602597). RDX is a mobile compound that does not sorb strongly to environmental media and is readily transported in water. RDX dissolved in groundwater will partition between dissolved RDX and sorbed RDX. RDX sorbs minimally to tuff and sediment, with greater sorption if organic carbon is present. RDX can be degraded both biologically (i.e., microbial degradation) and chemically (hydrolysis) (LANL 2017, 602597). Long-term reduction of RDX is anticipated because of source removal (i.e., the elimination of the original outfall source of RDX with the cessation of National Pollutant Discharge Elimination System [NPDES] discharges into Cañon de Valle [1996], surface removal activities conducted in 2001, and the surface CMI in 2009 and 2010) and from naturally occurring degradation processes.

A review of the concentrations of RDX detected in alluvial monitoring wells indicates RDX is either below the 9.66-µg/L screening level or concentrations show statistically significant long-term decline. The CMI remedy completion report (LANL 2017, 602597) reported that the majority of detections of RDX in alluvial wells in Cañon de Valle were near or below the screening level of 9.66 µg/L. There have been higher concentrations of RDX observed in alluvial monitoring wells downstream of the 260 Outfall in the past 20 yr.

Although the majority of RDX concentrations in discharges from SWSC, Burning Ground, and Martin Springs and 16-61439 (PRB alluvial seep) from 2000 to 2020 were above the 9.66-µg/L screening level, concentrations measured between August 2020 and July 2021 are either less than when first detected or are declining, likely because of the RDX source-reduction actions implemented at Outfall 260 that began with the cessation of the wastewater discharge in 1996. (LANL 2017, 602597). At Bulldog Spring, RDX concentrations remained below the 9.66-µg/L screening level. In March 2021, RDX was detected above the 9.66-µg/L screening value at Burning Ground Spring, Martin Spring, and 16-61439. No concentrations are reported for SWSC Spring; samples could not be collected because the location was dry.

Consistent with the description in the CMI remedy completion report (LANL 2017, 602597), the March 2021 concentrations of RDX detected in the springs are considered protective of nearby surface water and alluvial groundwater because the concentrations decrease dramatically as the distance increases away from the source. The objective of long-term monitoring at each spring is to ensure concentrations remain low or stable with time and the regional aquifer is protected.

Barium was targeted for removal in addition to RDX during Outfall 260 source-removal activities. With the cessation of discharge from Outfall 260 to Cañon de Valle, the estimated inventory of barium has been significantly reduced (LANL 2002, 073706); however, elevated barium concentrations in Cañon de Valle alluvial groundwater and surface water persist (LANL 2017, 602597).

Barium mobility is controlled by sorption and the dynamics of surface and alluvial hydrology. Barium continues to be mobilized by fluctuating water levels in the alluvium. Barium is also irreversibly removed from groundwater when barite (barium sulfate) precipitates; however, because witherite (barium carbonate) is also present and dissolves when wet, barium concentrations in alluvial groundwater remain elevated, buffered by the geochemical processes (LANL 2017, 602597).

Barium is more persistent in shallow groundwater within Cañon de Valle and, to a lesser extent, in Martin Spring in S-Site Canyon; however, barium is not likely to migrate to perched-intermediate groundwater or the regional aquifer given its sorptive characteristics, making it considerably less mobile than RDX in oxidizing groundwater. Although barium is well buffered in the near-surface system, natural sorptive processes slowly remove it from the system. Barium is elevated only in the surface and alluvial systems, and its mobility is limited by conditions in near-surface soils and alluvial groundwater. In addition to flushing dissolved barium from pore water and desorbing any reversibly sorbed barium, higher alluvial groundwater levels can dissolve barium minerals, primarily witherite, present in the unsaturated zone (Reid et al. 2005, 093660). Alternatively, declining alluvial groundwater levels will precipitate barium minerals. The presence of barium minerals partially buffers barium concentrations in surface waters and significantly buffers barium concentrations in alluvial waters (Reid et al. 2005, 093660).

Barium concentrations in alluvial groundwater within Cañon de Valle continue to be elevated. Concentrations in spring water are generally less than the 2000-µg/L screening level. Barium concentrations show a long-term decline in alluvial groundwater samples collected from location CDV-16-02656, upgradient of the former PRB, suggesting a diminishing source; however, location CDV-16-611923, upstream of the former PRB cutoff wall, showed a significant spike in barium concentrations after the PRB was installed in 2010. After the cutoff wall was installed, water levels in the alluvium above the cutoff wall rose, saturating sediments that likely contained witherite, which is the mobile fraction of barium. As the witherite dissolved, barium concentrations in groundwater spiked. The elevated barium eventually dissipated after flooding breached the cutoff wall in 2011.

Surface water and alluvial groundwater include a mix of spring water and water from upgradient locations and sources. Barium concentrations at surface water (i.e., Cañon de Valle below MDA P) have declined to below the 2000-µg/L screening level when last sampled in 2019, while barium concentrations in alluvial groundwater have been steadily declining. At Burning Ground Spring and SWSC Spring, barium concentrations remain below the 2000-µg/L screening level. Barium concentrations at 16-61439 (alluvial seep) remain above the screening level.

The CMI performance objectives were to reduce concentrations of barium and RDX in alluvial groundwater to prevent their migration to deeper groundwater. The Long-Term Monitoring and Maintenance Plan established performance-monitoring points as follows: the five existing alluvial wells in Cañon de Valle, three existing alluvial wells in S-Site Canyon, two surface-water sampling points along

the perennial surface water reach of Cañon de Valle, one surface-water sampling point in S-Site Canyon, and at the springs.

1.3 Monitoring Objectives

Key objectives of the long-term monitoring program include the following:

- monitoring effectiveness of the low-permeability cap and surge-bed grouting to ensure infiltrating water does not encounter and mobilize residual COPCs in the outfall area and underlying shallow vadose zone
- monitoring the long-term trend in COPC concentrations (primarily HE and barium) in springs, surface water, and alluvial groundwater to ensure historically declining and/or stable concentrations persist

2.0 LONG-TERM MONITORING AND MAINTENANCE SAMPLING AND RESULTS

Section 2.0 presents the data collected for this 2021 annual Long-Term Monitoring and Maintenance Report. The focus of the discussion is RDX and barium, identified as the primary COPCs targeted in the corrective measures implemented at former 260 Outfall. Other constituents are monitored as part of long-term monitoring and maintenance, and sampling results for all constituents monitored in the 2021 long-term monitoring and maintenance program are provided in this report. The results are screened against their respective screening levels, and the constituents that exceed their screening levels are discussed in more detail in this report.

2.1 Sampling

The purpose of the long-term monitoring activities is to assess the long-term effectiveness of the CMI for Consolidated Unit 16-021(c)-99, to monitor the long-term trends in COPC concentrations, and to support continuous evaluation of the conceptual model for the fate and transport of residual COPCs in nearby springs, surface water, and alluvial groundwater.

Sampling of groundwater, surface water, and springs for the TA-16 260 monitoring group is conducted semiannually (LANL 2017, 602406); however, as stated in section 1.0, the timing of the semiannual sampling events was interrupted by PED approvals and COVID-19 restrictions. In the CMI remedy completion report, Appendix A (LANL 2017, 602597), the analytes and sampling frequencies proposed in the IFGMP (N3B 2018, 700000) for alluvial groundwater, surface water, and springs for the TA-16 260 monitoring group were adapted as the long-term monitoring requirements for the former 260 Outfall area. Table 2.1-1 summarizes the monitoring locations (i.e., TA-16 260 monitoring group); parameters measured; and sampling frequencies for the springs, alluvial groundwater, and surface waters that make up the 2021 long-term monitoring program. The suite of compounds measured includes HEXMOD (i.e., RDX, HMX, TNT, and degradation byproducts), per- and polyfluoroalkyl substances (PFAS), VOCs, metals, SVOCs, general inorganics, low-level tritium, radionuclides, and nitrogen-15/oxygen-18 isotopes in nitrate. Table 2.1-2 provides a list of the field parameters and measurement results. Appendix A provides the field forms associated with sample collection.

2.2 Results

This section presents the results for the primary COPCs associated with the Outfall 260 drainage channel (i.e., RDX and barium) and the concentrations measured in the springs, surface water, and alluvial groundwater in Cañon de Valle, S-Site Canyon, Pajarito Canyon, Water Canyon, and Fishladder Canyon. The other constituents monitored as part of the Long-Term Monitoring and Maintenance Plan are screened against their respective screening levels, and any exceedances identified are further discussed in this section. All validated analytical results are provided in Appendix B (on CD included with this document).

To present and evaluate the results from the sampling events, the data are organized by canyon, beginning with the most upgradient sample location and moving downgradient within each canyon (Figure 1.0-1), as follows:

- Cañon de Valle segment 1
    - ❖ CDV-16-02656 (background)
    - ❖ CDV-16-02657r
    - ❖ SWSC Spring
    - ❖ Burning Ground Spring
- Cañon de Valle segment 2
    - ❖ 16-61439 (PRB alluvial seep)
    - ❖ CDV-16-611923
    - ❖ CDV-16-611937
    - ❖ Cañon de Valle below MDA P
    - ❖ CDV-16-02659
- S-Site Canyon
    - ❖ Martin Spring
    - ❖ MSC-16-06293
    - ❖ MSC-16-06294
- Pajarito Canyon
    - ❖ Bulldog Spring
    - ❖ Pajarito below S&N Ancho E Basin Confluence (Confluence)
- Water Canyon
    - ❖ Between E252 and Water at Beta
    - ❖ Water at Beta
- Fishladder Canyon
    - ❖ FLC-16-25280

As described above, the Long-Term Monitoring and Maintenance Plan prescribes the sampling of spring water, surface water, and alluvial groundwater performed in March 2021. The 2021 Long-Term Monitoring and Maintenance Plan sampling events were performed in March 2021. Table 2.2-1 presents the RDX

results by canyon or canyon segment. Barium levels are monitored in filtered samples collected from spring water, surface water, and alluvial groundwater. Table 2.2-2 presents the barium results by canyon or canyon segment.

Analytes, other than barium or RDX, with screening levels were screened against those levels. Any exceedances are discussed in section 4, and Table 2.2-3 presents the analytes that exceeded their respective screening levels.

2.3 Deviations

Sampling at Water Canyon/Cañon de Valle (TA-16 260 monitoring group included) for the second quarter of monitoring year (MY) 2020 was canceled because groundwater field crews were unable to access Weapons Facilities Operations security areas from March 1 to March 23; approvals to use PEDs in the TA-16 area were pending. Then, beginning on March 24, 2020, EM-LA transitioned to EMCA status in response to the COVID-19 pandemic. NMED was notified of the transition to EMCA status on March 31, 2020 (DOE 2020, 700826). As a result of the EMCA status, the March 2020 sampling operations were paused. The second semiannual sampling event was conducted in July 2020, and all data were reported in the previous “2020 Annual Long-Term Monitoring and Maintenance Report for the Corrective Measures Implementation at Former 260 Outfall Area” (N3B 2020, 701053). The July 2020 event was scheduled to replace both the March and August sampling events for 2020.

Regarding the omission of the polychlorinated biphenyls (PCBs) and dioxin/furan data from the 2020 annual Long-Term Monitoring and Maintenance Report, the following discussion is provided. When the sampling campaign was implemented in July 2020, following the EMCA shutdown, many of the locations to be sampled were dry or did not have sufficient water to enable collection of a sample. Where there was sufficient water for sample collection in July 2020, PCBs and dioxins/furans were analyzed, but the results are only partially included in Appendix B of the 2020 annual Long-Term Monitoring and Maintenance Report. While PCB and dioxin/furan analyses were performed on samples collected from Burning Ground Spring, 16-61439, CDV-16-611937, Martin Spring, Bulldog Spring, and Between E252 and Water at Beta in July 2020, the PCB and dioxin/furan sampling results were inadvertently excluded from the 2020 annual Long-Term Monitoring and Maintenance Report. This information was reported and discussed in the “Response to Draft New Mexico Environment Department's Comments on the 2020 Annual Long-Term Monitoring and Maintenance Report for the Corrective Measures Implementation at Former 260 Outfall Area, September 2020, LANL-20-064, Dated February 10, 2021,” dated March 2021 (N3B 2021, 701345).

Another deviation to the Long-Term Monitoring and Maintenance Plan requirements resulted from the lack of water at eight sampling locations. Either the location was dry or there was insufficient water for sampling. These locations include the following:

- CDV-16-02657r
- SWSC Spring
- CDV-16-611923
- Cañon de Valle below MDA P
- MSC-16-06293
- MSC-16-06294
- Water at Beta
- FLC-16-25280

Tables 2.1-2, 2.2-1, and 2.2-2 present this information and indicate whether the location was dry or had insufficient water for sampling.

3.0 INSPECTION AND MAINTENANCE

Sections 3.1 and 3.2, respectively, discuss (1) the inspection and maintenance approach for the low-permeability cap on the former settling pond and (2) monitoring of the surge bed monitoring well installed to monitor the effectiveness of the injection grouting.

3.1 Low-Permeability Cap

The objective of the low-permeability cap on top of the former settling pond is to prevent surface water run-on and infiltration into the outfall area and underlying shallow vadose zone that contain residual RDX. The low-permeability cap is inspected semiannually for evidence of settling, cracking, erosion, water ponding, undesirable vegetation growth, and animal intrusion. Each year, inspections are conducted in March or April to check for damage that may be associated with winter and snowmelt conditions and in September to monitor for damage from summer rainfall runoff.

In the September 2020 inspection of the low-permeability cap, no erosion, cracking, settlement, or ponding water was observed. Although there was no evidence of burrowing animals, two ponderosa pines were removed from the cap, and the slopes were observed to be adequate for water runoff. No maintenance items were identified during the inspection.

In the March 2021 inspection of the low-permeability cap, no erosion, cracking, settlement, or ponding water was observed. There was no evidence of burrowing animals, and the slopes were observed to be adequate for water runoff. One ponderosa pine was removed from the cap. No maintenance items were identified during the inspection. The inspection forms used to document the fall and spring inspections are provided in Appendix C.

Storm water run-on and runoff controls are in place to prevent erosion of the low-permeability cap and to prevent runoff and sediment from moving farther down the 260 Outfall drainage channel. Monitoring and maintenance of the storm water control structures at the former 260 Outfall area continue under NPDES Permit No. NM0030759 (Individual Permit or Permit), issued by the U.S. Environmental Protection Agency, Region 6, on September 30, 2010 (EPA 2010, 213450) and authorizing discharge of storm water associated with historical industrial activities at the Laboratory. Storm water controls installed at the site under the Individual Permit currently include vegetation, earthen berms, curbing, riprap, a rock check dam, and the low-permeability cap; therefore, an additional inspection of the low-permeability cap is performed when these controls are inspected as required by the Permit. An inspection of the storm water control structures, including the low-permeability cap at former 260 Outfall area, was performed on July 22, 2021. The inspection form is provided in Appendix C.

3.2 Surge Bed Monitoring Well

The surge bed monitoring well was installed to evaluate the effectiveness of the grout injected into the subsurface surge bed and of the low-permeability cap by monitoring for the appearance of water in the surge bed. Observations of water levels in the surge bed monitoring well during semiannual inspections have confirmed no detectable volume of water within the well. Additionally, throughout the MY 2021 season, water levels have been monitored by a dedicated in-well transducer; no water has been detected in the surge bed monitoring well. The raw transducer data are provided in Appendix D.

4.0 DISCUSSION AND CONCLUSIONS

This section discusses the RDX and barium results from the March 2021 sampling event and how the results compare with the historical trends (January 2001 through January 2021) and support the conceptual model. When appropriate, RDX and barium concentration trends were analyzed using the Mann-Kendall method. Appendix E provides a description of the methods used and the results. In addition, this section describes other analytes (e.g., iron, manganese, and boron) detected above their respective screening levels and how these relate to the conditions in the alluvial groundwater.

4.1 RDX

The complete RDX data records for Cañon de Valle segments 1 and 2 are presented in Figures 4.1-1 and 4.1-2, respectively. These figures provide a comprehensive review of the RDX concentrations in waters in each segment and how the RDX sample results compare with the historical data trends. Based on a review of these data from locations that have not been dry for several sampling events, RDX concentrations in alluvial groundwater remain below the 9.66-µg/L screening level or show a long-term decline. CdV-16-02659 shows a statistically significant decline in RDX concentrations (Appendix E, Figure E-1), with the last sample result below the 9.66-µg/L screening level. Burning Ground Spring (the only spring that was not dry) and location 16-61439 (PBR Alluvial Seep) had concentrations above the screening level of 9.66 µg/L. It can be concluded that the conditions in the surface water, alluvial groundwater, and springs are consistent with the concept that RDX concentrations vary across the canyon, but most locations have RDX concentrations below the 9.66-µg/L screening level.

Plate 1 shows the spatial distribution of RDX across Cañon de Valle since the completion of the CMI.

The S-Site Canyon RDX data record is shown in Figure 4.1-3, and the spatial distribution of RDX detected since the corrective measures is provided on Plate 1. The Martin Spring water RDX concentrations remain above the screening level, although the sample results from the period of record (Figure 4.1-3) are consistent with the conclusion that RDX levels continue to decline over time. A Mann-Kendall trend analysis was performed on the RDX data from the period of record and shows a statistically significant decreasing trend at the 95% confidence level (Appendix E, Figure E-2). Both MSC-16-06293 and MSC-16-06294 were dry during the last sampling event. Plate 1 shows RDX concentrations across the canyon with no impacts to surface water downgradient of Martin Spring, suggesting the RDX concentration in Martin Spring is a localized condition.

The Pajarito Canyon locations include a spring location at Bulldog Spring and a surface water location at the Confluence. Figure 4.1-4 presents the data record for both locations. Bulldog Spring water RDX concentrations are consistently below the screening level, including the result of the samples collected in March 2021. At the Confluence surface water location, the RDX results are consistent with past data—concentrations are below 9.66 µg/L. Plate 1 shows the spatial distribution of RDX across the canyon.

The Water Canyon RDX data record is presented in Figure 4.1-5. Figure 4.1-5 demonstrates that the samples are consistent with historical results, which indicate RDX is well below the screening level or not detected. Samples from the March 2021 sampling event were not available for Water Canyon at Beta because the location was dry at the time of sampling; however, Between E252 and Water at Beta was sampled and sample results were nondetected for RDX. Plate 1 shows the spatial distribution of RDX across the canyon.

Figure 4.1-6 presents the data record for the Fishladder Canyon. In March 2021 results were not available because the location was dry at the time of sampling. However, the historical record indicates no impacts to Fishladder Canyon alluvial groundwater above the RDX screening level.

The sample results support the conceptual model for RDX by demonstrating the following:

- Concentrations of RDX in alluvial monitoring wells continue to be below the 9.66-µg/L screening level.
- Most alluvial wells in Cañon de Valle are near or below the screening level of 9.66 µg/L.
- RDX concentrations for the March 2021 sampling result in water from Martin Spring are above the 9.66-µg/L screening level but are steadily declining.
- The current concentrations of RDX detected in the springs suggest the water is not impacting alluvial groundwater, as concentrations indicate a dramatic decrease away from the source but may influence surface water RDX concentration during unusually wet years.

The sample results are consistent with past RDX concentration results and do not indicate a change to the RDX conceptual site model. In addition, the monitoring and observations support the conclusion that the low-permeability cap and the stabilized surge bed remedies continue to be effective.

4.2 Barium

Barium concentration data records for the Cañon de Valle segments 1 and 2 are presented in Figures 4.2-1 and 4.2-2, respectively. These figures provide a comprehensive review of barium impacts to each segment since the start of the IFGMP program and a comparison of the sample barium results with the existing data trends. A review of these data indicate that the temporal and spatial trends, and conditions in the surface water, alluvial groundwater, and springs, are consistent with conditions described in the CMI remedy report (LANL 2017, 602597); therefore, these conditions are still considered protective of the regional groundwater.

Plate 2 shows the spatial distribution of barium across Cañon de Valle segments 1 and 2 since the completion of the early phase (i.e., cessation of the Outfall 260 discharge and first phase of soil removal) of the CMI. In general, barium concentrations at each location are detected above the screening level; however, the barium results indicate that barium concentrations are declining at alluvial well locations where barium concentrations exceed the screening level. Mann-Kendall trend analyses performed on all the alluvial wells show decreasing trends, with CdV-16-02656 and CdV-16-16-611937 resulting in barium concentration below the 2000-µg/L screening level. Alluvial wells CdV-16-62656, CdV-16-02659, CdV-16-611923, and CdV-16-611937 all have decreasing barium concentration trends based on Mann-Kendall trend analysis. Appendix E Figures E-3 through E-6 provide the Mann-Kendall trend analysis for each location.

In S-Site Canyon, Pajarito Canyon, Water Canyon, and Fishladder Canyon, barium is not detected above the 2000-µg/L screening level, which is consistent with the historical data record as seen in Figure 4.2-3 (S-Site Canyon), Figure 4.2-4 (Pajarito Canyon), Figure 4.2-5 (Water Canyon), and Figure 4.2-6 (Fishladder Canyon). Plate 2 shows the spatial distribution of barium across the canyons.

Based on the sample results and comparison with the existing barium data records, the following observations support the conceptual model:

- Concentrations in springs are less than the 2000-µg/L screening level, except at 16-61439 (PRB alluvial seep).
- Barium concentrations at both CdV-16-06259 and 16-61439 remain above 2000 µg/L but continue to show long-term decline.
- Except for Cañon de Valle, the other canyons in the Long-Term Monitoring and Maintenance Plan sampling program are not impacted with barium above the screening level.

As the sample results are consistent with past barium concentration results and the conceptual site model, no change to the conceptual model is indicated. The barium results are congruent with the RDX results and support the finding of the continued effectiveness of the low-permeability cap and the stabilized surge bed.

4.3 Other Analytes Exceeding their Respective Screening Levels

All the analytes monitored as part of the Long-Term Monitoring and Maintenance Plan sampling program were screened against their respective screening levels. Based on these results, iron, manganese, and boron were identified as compounds exceeding screening levels. Table 2.2-3 presents the analytes exceeding their respective screening levels. Note that in the 2020 Annual Long-Term Monitoring and Maintenance Report, aluminum and perchloroethylene were listed as analytes exceeding their respective screening levels; however, their results from the March 2021 sampling event did not indicate exceedances. Therefore, aluminum and perchloroethylene are not presented in Table 2.2-3, nor are they discussed in this report.

During the March 2021 sampling event, iron and manganese exceeded their respective screening levels (1000 µg/L and 200 µg/L) with maximum concentrations of 1200 µg/L and 321 µg/L, respectively, in one sample collected at CDV-16-611937 (CAWA-21-218613). Alluvial groundwater conditions at sample location CVD-16-611937 were reducing during the sampling event. In March 2021, the dissolved oxygen concentration was measured at 1.49 mg/L, and the ORP was measured at 96.4 mV, indicating reducing conditions. Reducing conditions at CVD-16-611937 were likely due to the lack of fresh water flushing the groundwater at this location.

One reason for these exceedances is the redox-sensitive nature of these analytes, as localized conditions become more reduced in the alluvial groundwater and the anaerobic bacteria convert iron and manganese into their more reduced (and more soluble) forms. The detection of iron and manganese above their screening levels in March 2021 correlates well with the localized reducing conditions in the alluvial groundwater at this location.

The March 2021 sampling results showed all locations sampled contained iron, with a range from 30.0 µg/L to 1200 µg/L in filtered samples. Iron concentrations did not exceeded 1000 µg/L at any sampling location other than CVD-16-611937.

Boron also exceeded its screening level (750 µg/L) with a maximum concentration of 1270 µg/L detected at Martin Spring during the March 2021 sampling event. Elevated concentrations of boron in Martin Spring water are well documented and relate to historical Laboratory releases at TA-16 (LANL 2018, 602963).

4.4 Conclusions

The CMI objectives were to reduce the concentrations of barium and RDX in alluvial groundwater to prevent the migration of these compounds into deeper groundwater. The Long-Term Monitoring and Maintenance Plan was implemented to (1) monitor the performance of the CMI in terms of these objectives to evaluate the effectiveness of the low-permeability cap and surge-bed grouting in ensuring that infiltrating water does not encounter and mobilize residual RDX in the outfall area and underlying shallow vadose zone and (2) monitor the long-term trend in concentrations of RDX and barium in springs, surface water, and alluvial groundwater to ensure historically declining and/or stable concentrations persist. The 2021 sampling and inspection program has met these objectives.

5.0 RECOMMENDATIONS

Based on the results from the March 2021 semiannual sampling event and the inspections of the low-permeability cap and surge-bed grouting addressed in this report, EM-LA recommends that the Long-Term Monitoring and Maintenance Plan continue through MY 2022. Sampling and inspection will be continuous to evaluate the effectiveness of the low-permeability cap and surge-bed grouting and monitor the long-term trends in COPC (RDX and barium) concentrations. Alluvial groundwater, surface water, and spring water are anticipated to continue showing stable or declining concentrations of RDX and barium. If the data show a significant increase in COPC concentrations over time, the conditions in the vicinity of former 260 Outfall will be reassessed to identify the cause and evaluate whether additional corrective action is necessary.

Inspections of the low-permeability cap and surge bed will continue on a semiannual basis. If maintenance items are identified, they will be promptly addressed and reported in the subsequent annual report.

6.0 REFERENCES AND MAP DATA SOURCES

6.1 References

The following reference list includes documents cited in this report. Parenthetical information following each reference provides the author(s), publication date, and ERID, ESHID, or EMID. ERIDs were assigned by Los Alamos National Laboratory's (the Laboratory's) Associate Directorate for Environmental Management (IDs through 599999); ESHIDs were assigned by the Laboratory's Associate Directorate for Environment, Safety, and Health (IDs 600000 through 699999); and EMIDs are assigned by N3B (IDs 700000 and above).

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6.2 Map Data Sources

Hillshade; Los Alamos National Laboratory, ER-ES, As published; \\slip\gis\Data\HYP\LiDAR\2014Bare_Earth\BareEarth_DEM_Mosiac.gdb; 2014.

Structures; Los Alamos National Laboratory, KSL Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 29 November 2010.

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Paved Road Arcs; Los Alamos National Laboratory, FWO Site Support Services, Planning, Locating and Mapping Section; 06 January 2004; as published 29 November 2010.

Drainage Channel; Los Alamos National Laboratory, ER-ES, As published, GIS projects folder; \\slip\GIS\Projects\11-Projects\11-0108\\gdb\gdb_11-0108_generic.mdb; drainage; 2017.

TA-16 260 Outfall, As Published, GIS project folder: Q:\14-Projects\14-0080\project_data.gdb\ polygon\outfall_260

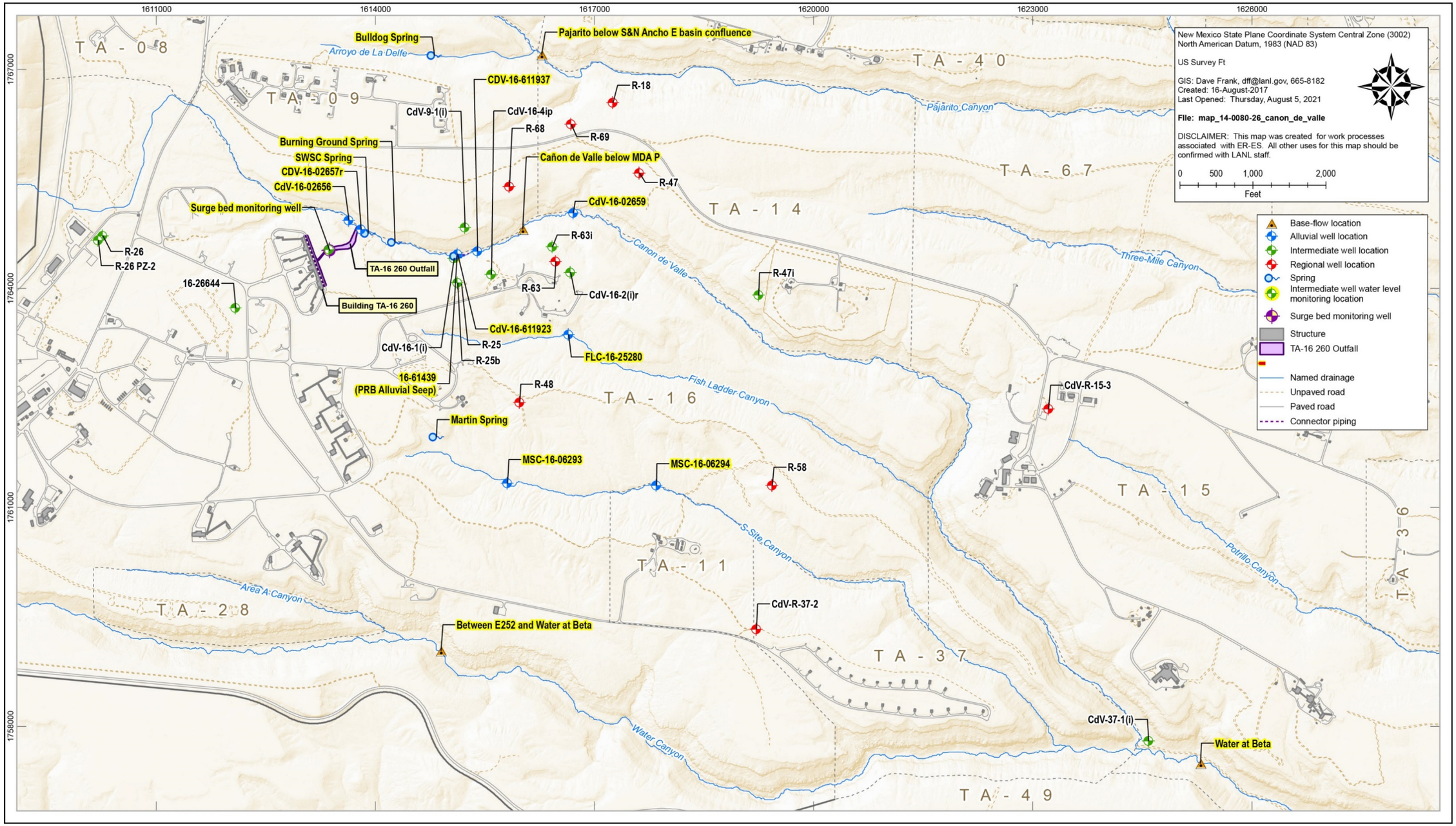
M Wall-PRB, As Published, GIS project folder: Q:\14-Projects\14-0080\project_data.gdb\line\wall_PRB

Connector piping, As Published, GIS project folder: Q:\14-Projects\14-0080\project_data.gdb\line\connector_piping

Tech areas; Los Alamos National Laboratory, Database Connections\GIS.PUB.PRD1.sde\PUB.Boundaries\PUB.tecareas

Tech Areas line; Los Alamos National Laboratory, Database Connections\GIS.PUB.PRD1.sde\PUB.Boundaries\PUB.tecareas_line

PUB.prs_all_reg_admin; Los Alamos National Laboratory, Database Connections\GIS.PUB.PRD1.sde\PUB.Regulatory\PUB.prs_all_reg_admin



Note: Yellow highlights indicate locations of interest in this report.

Figure 1.0-1 Long-Term Monitoring and Maintenance Plan locations

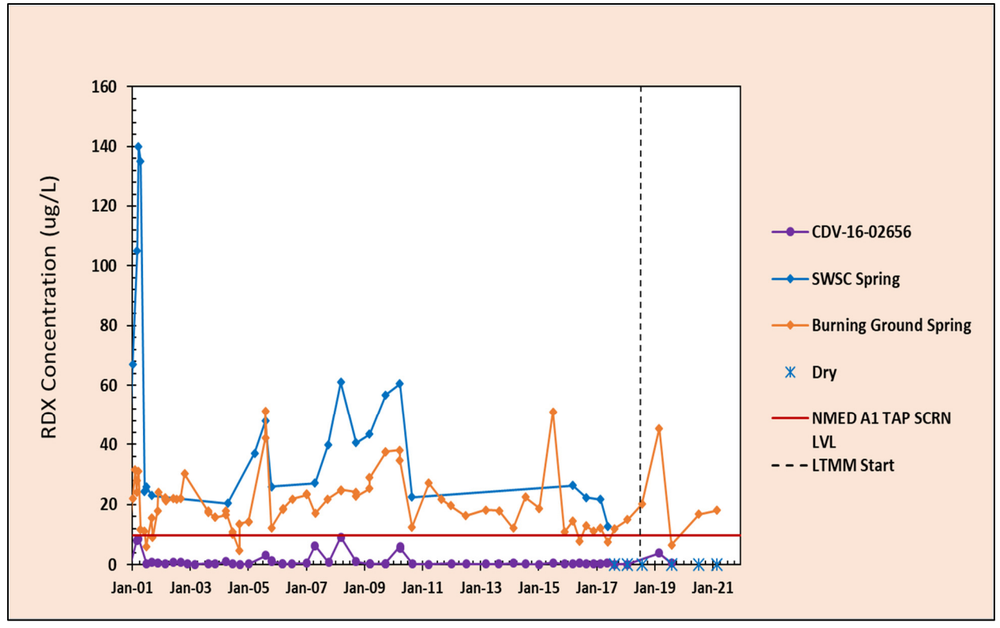


Figure 4.1-1 Cañon de Valle segment 1 RDX data record

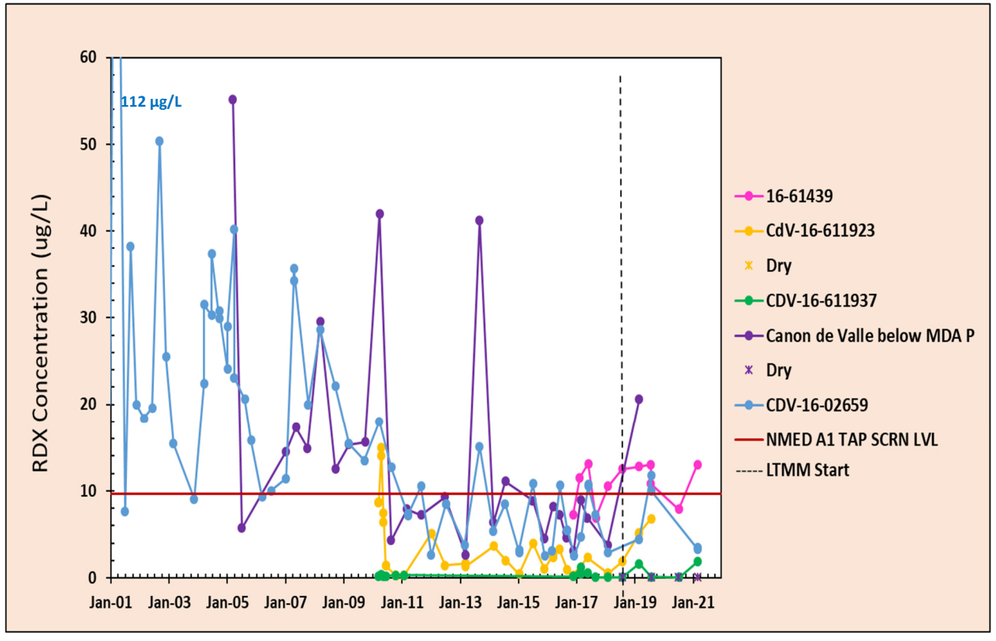


Figure 4.1-2 Cañon de Valle segment 2 RDX data record

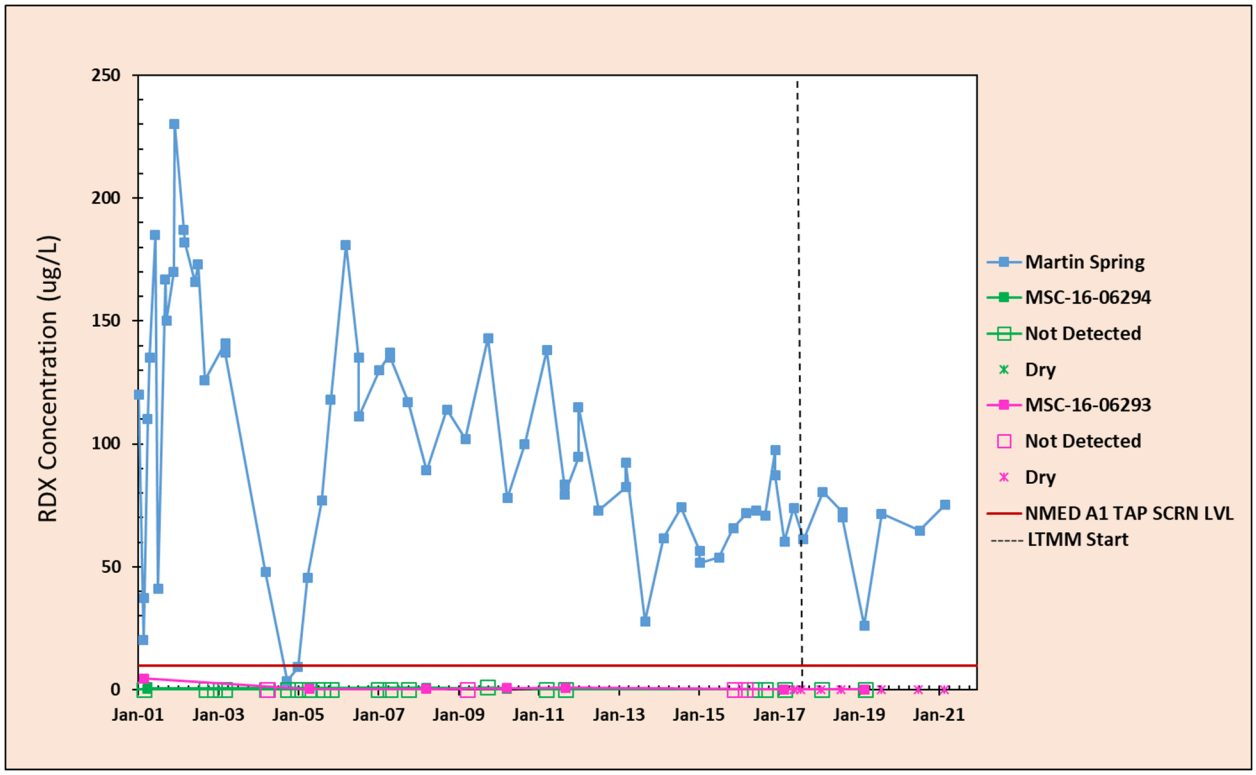


Figure 4.1-3 S-Site Canyon RDX data record

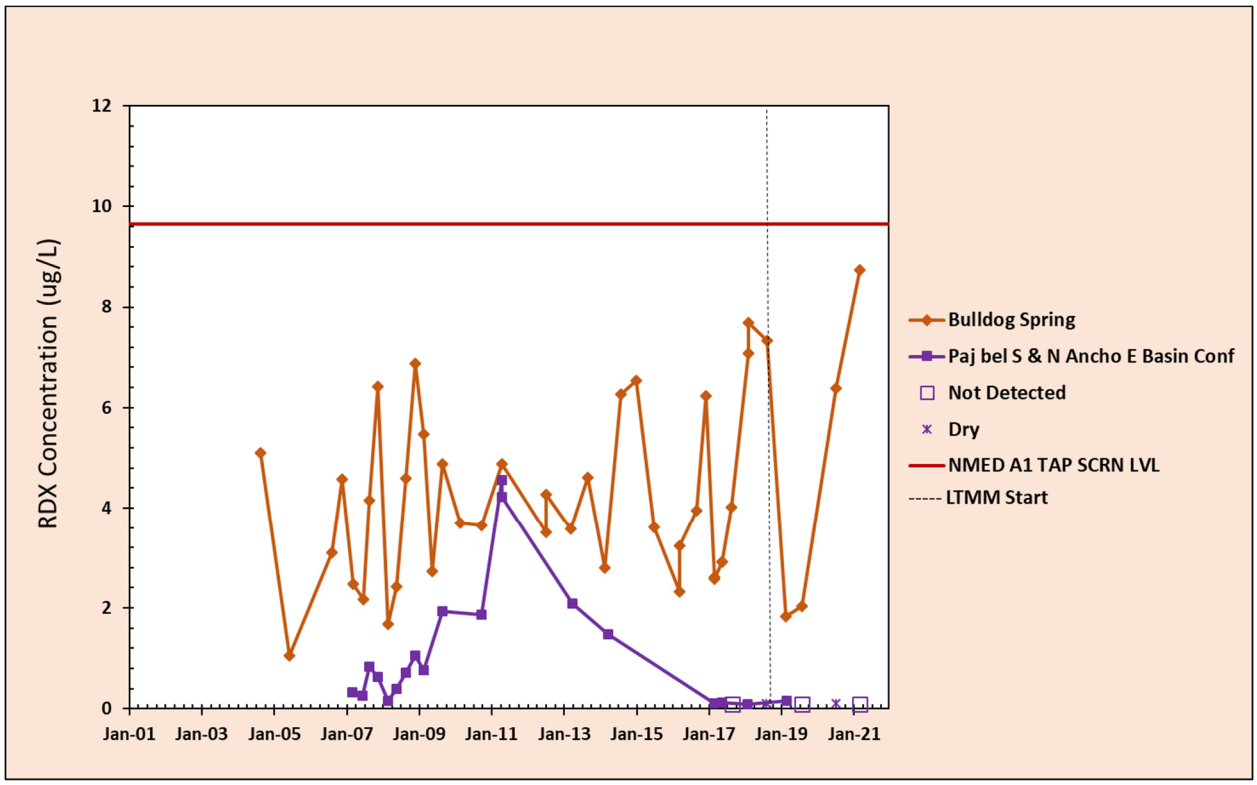


Figure 4.1-4 Pajarito Canyon RDX data record

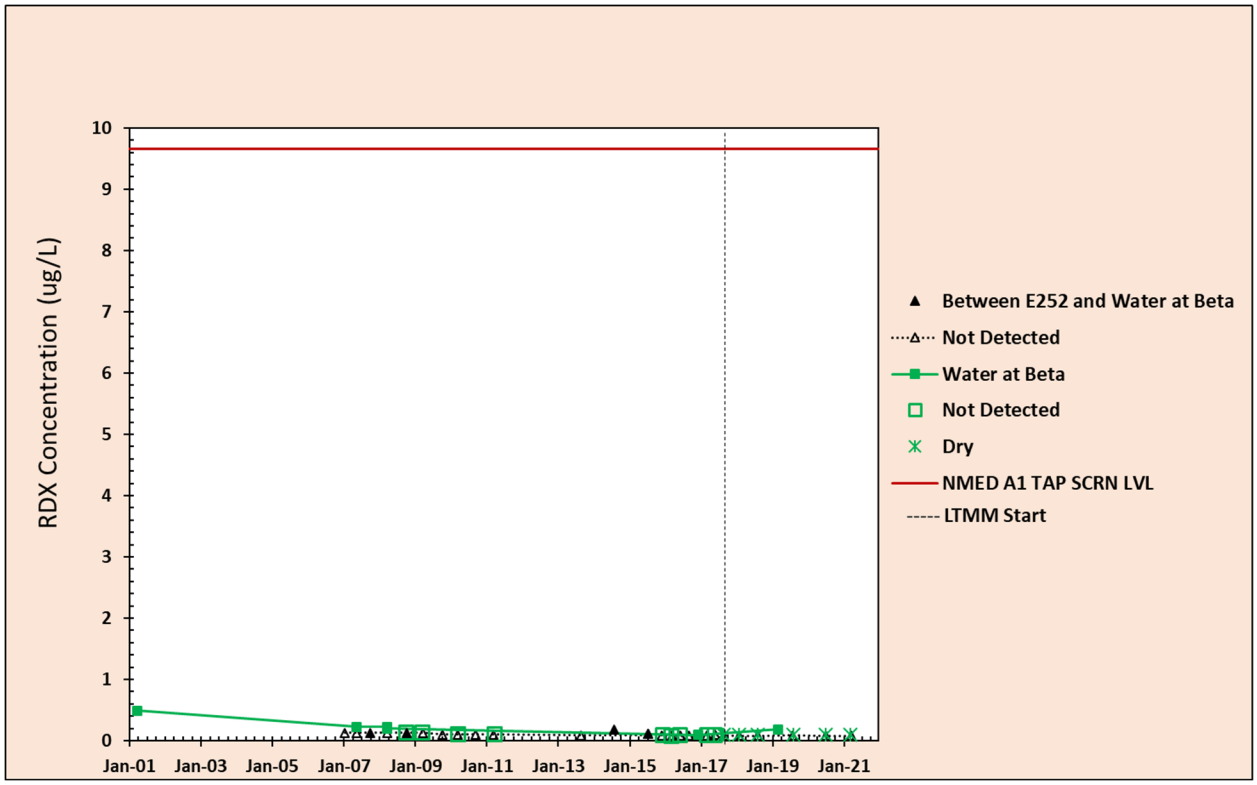


Figure 4.1-5 Water Canyon RDX data record

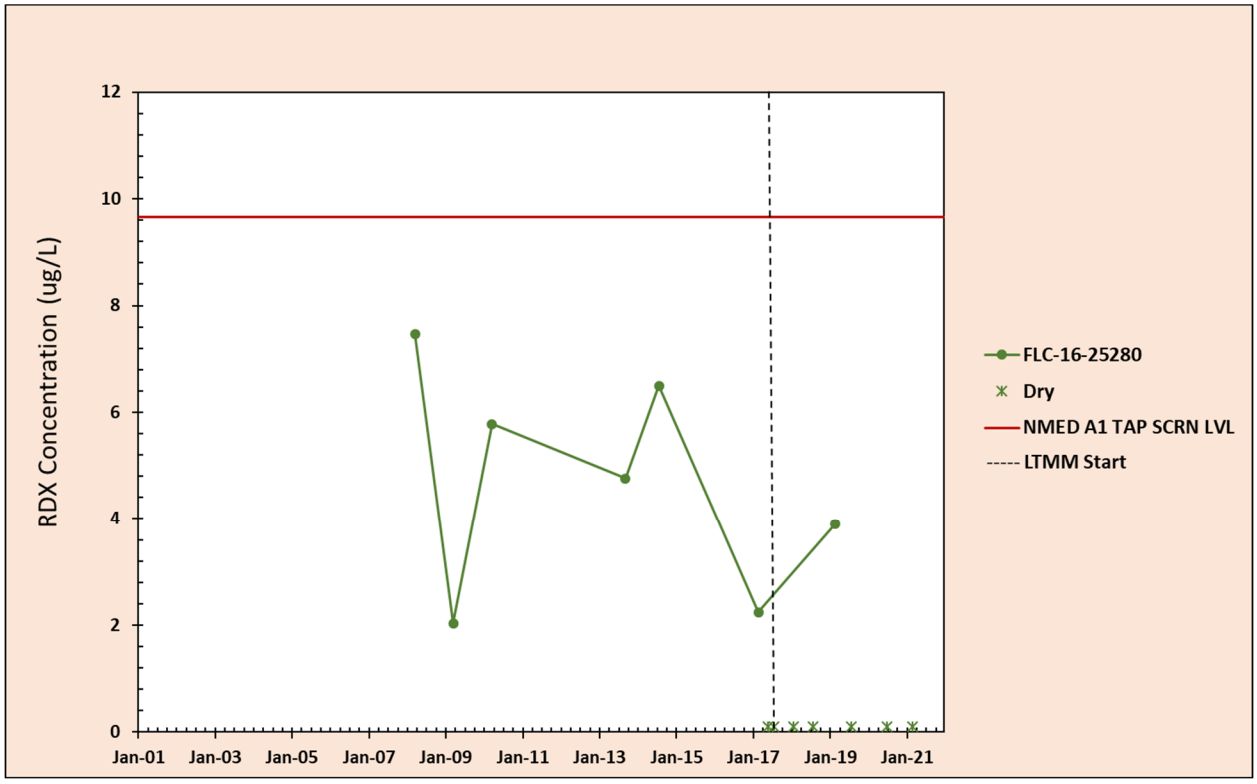


Figure 4.1-6 Fishladder Canyon RDX data record

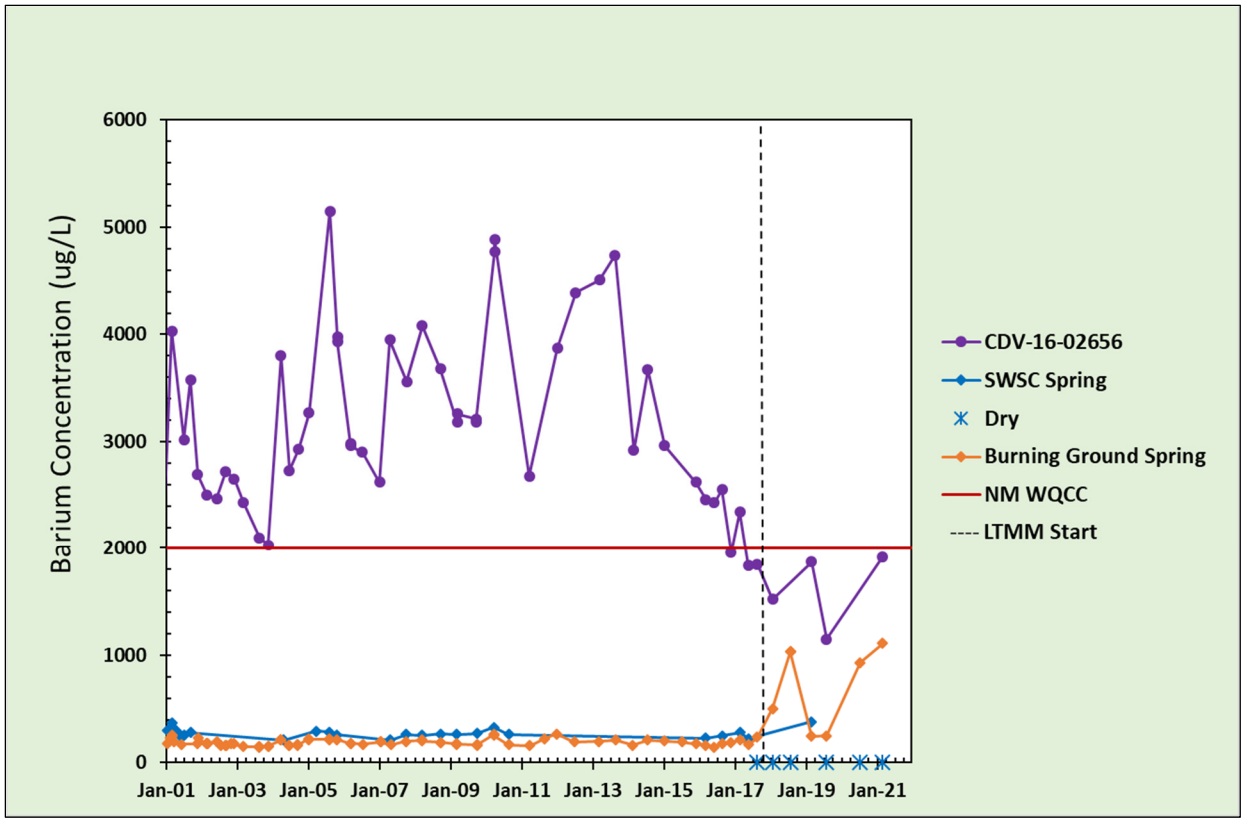


Figure 4.2-1 Cañon de Valle segment 1 barium data record

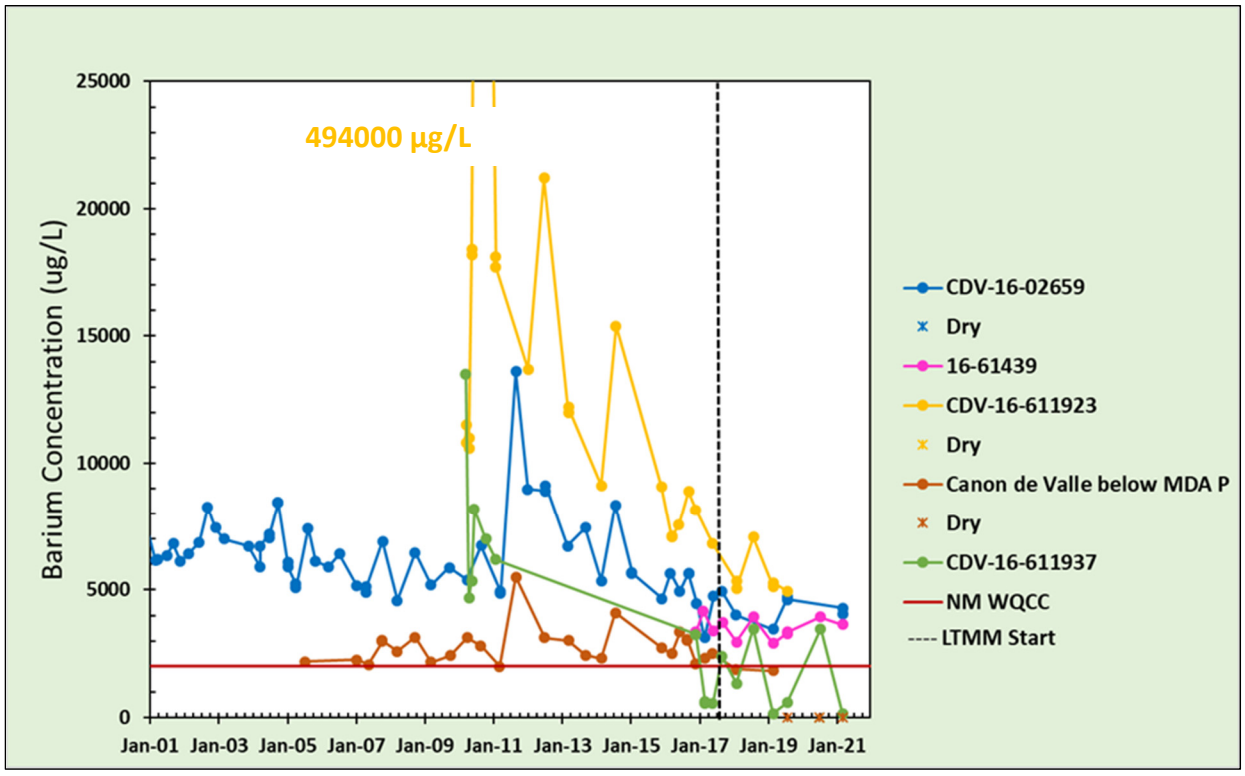


Figure 4.2-2 Cañon de Valle segment 2 barium data record

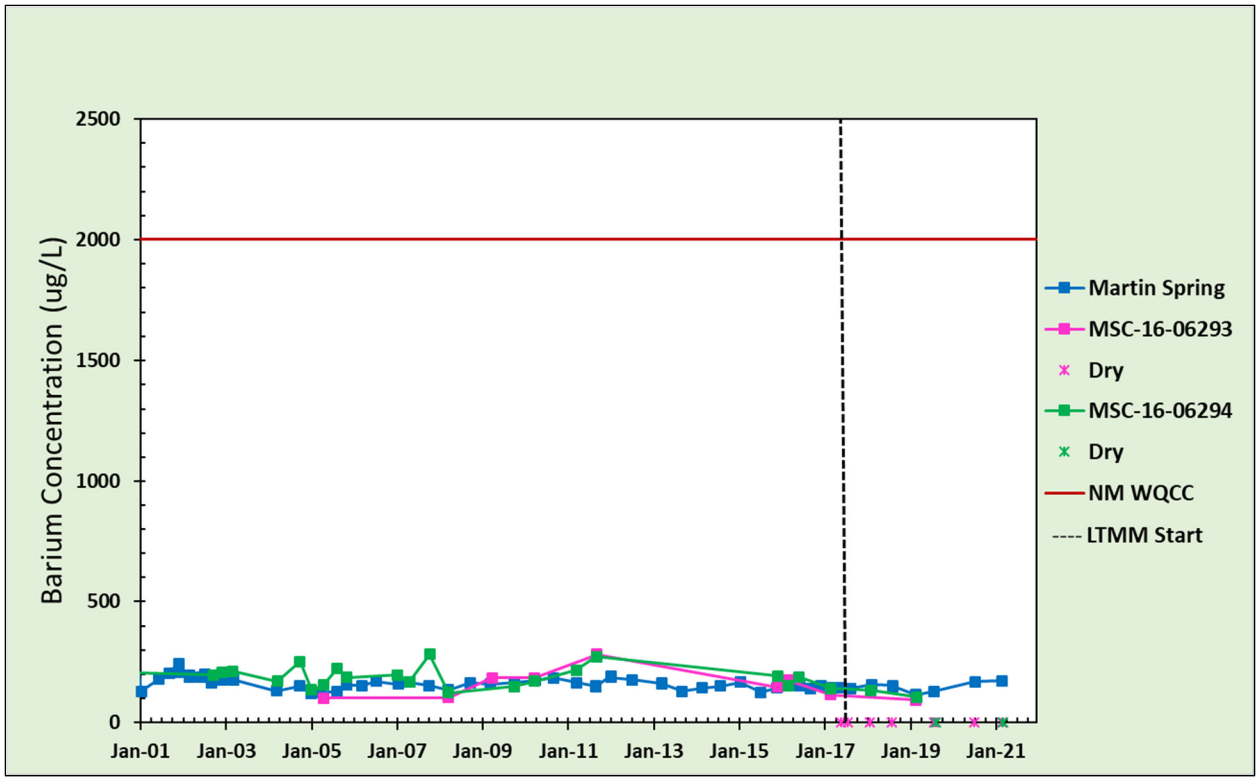


Figure 4.2-3 S-Site Canyon barium data record

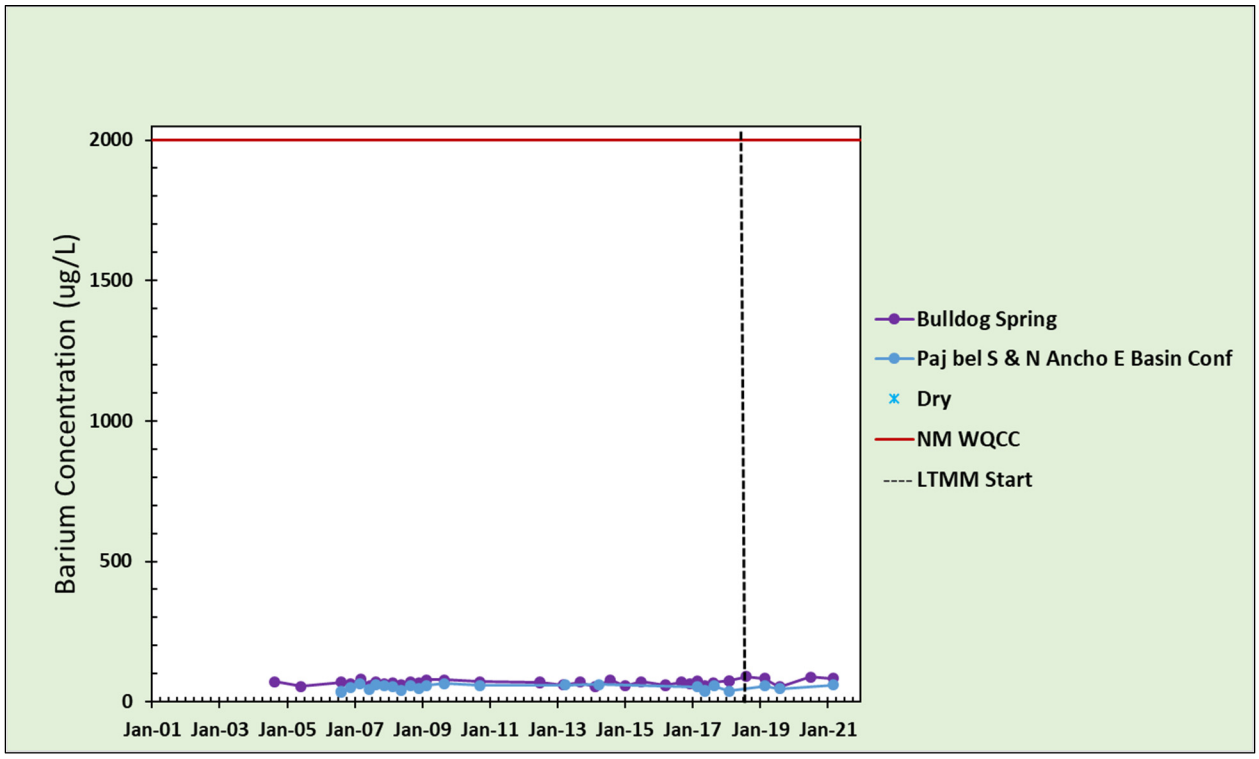


Figure 4.2-4 Pajarito Canyon barium data record

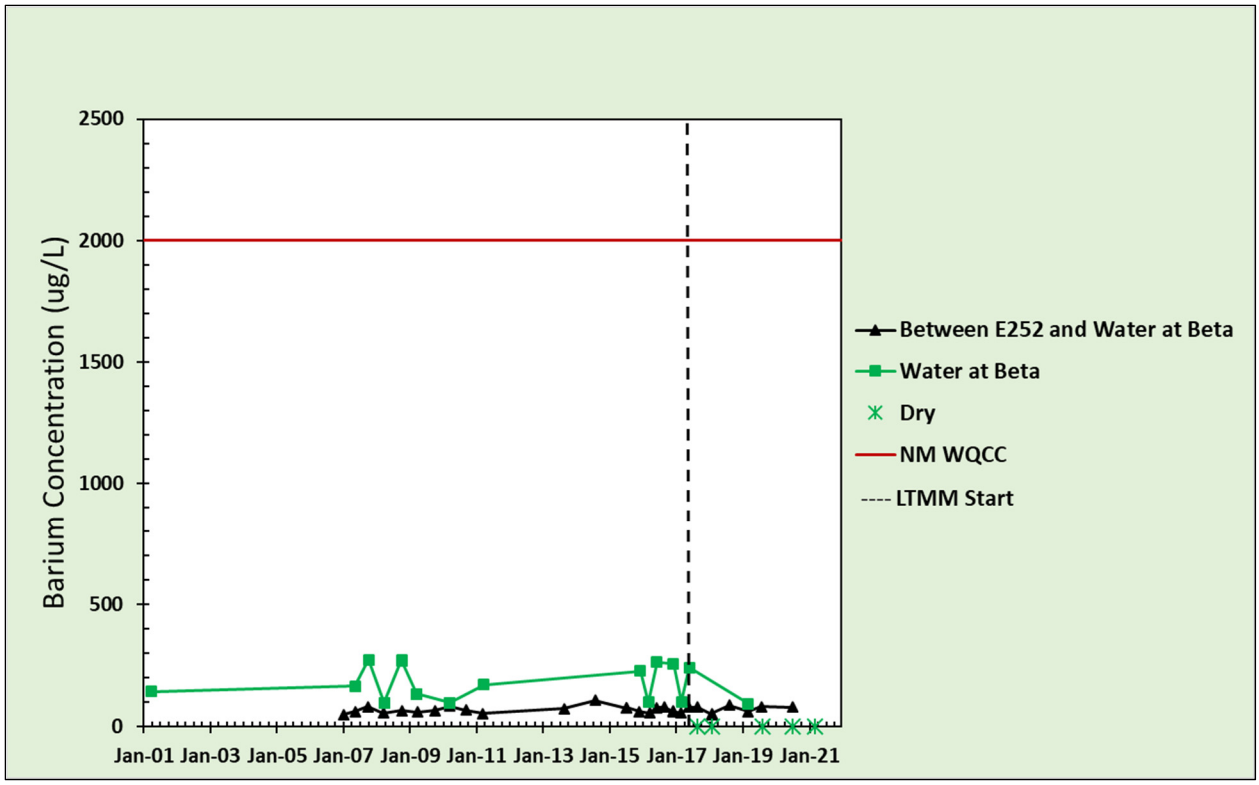


Figure 4.2-5 Water Canyon barium data record

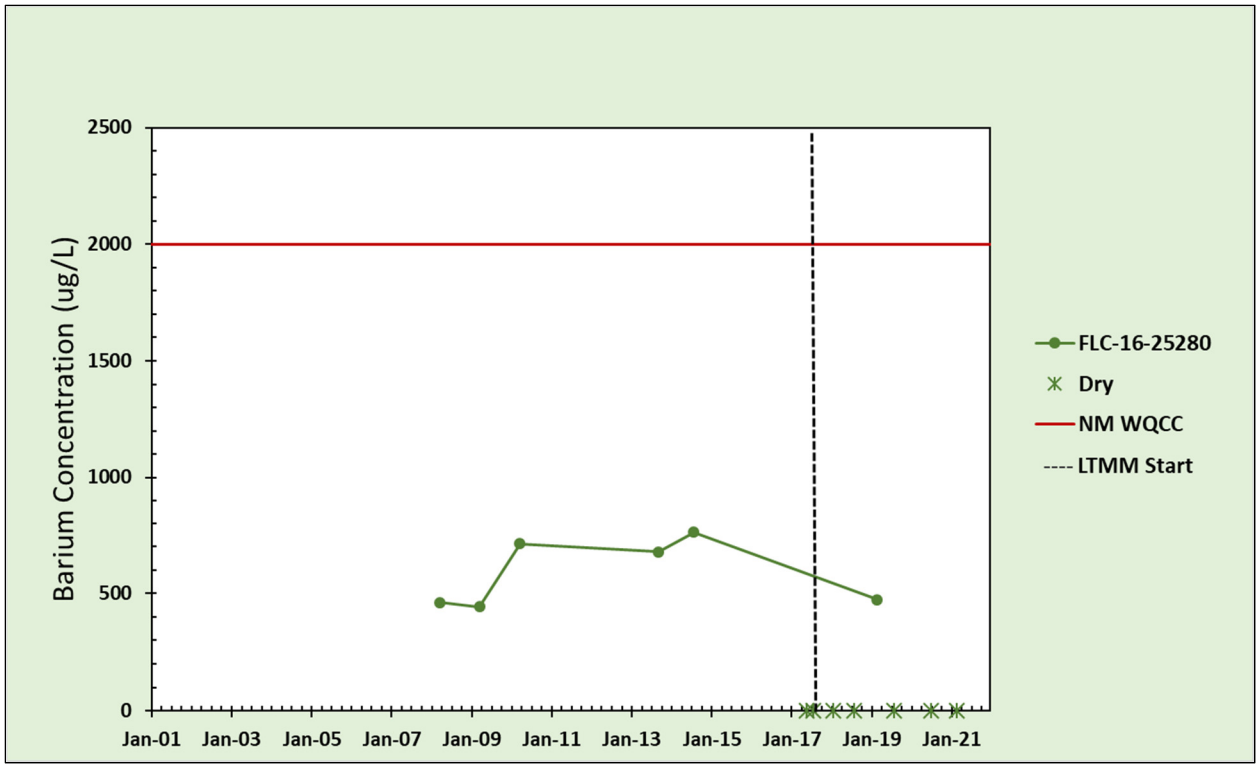


Figure 4.2-6 Fishladder Canyon barium data record

Table 2.1-1
Monitoring Locations, Analytes, and Frequency

Canyon	Location	Surface Water Body or Source Aquifer	Metals	VOCs	SVOCs	HEXMOD	Radionuclides	Low-Level Tritium	General Inorganics	15N/18O Isotopes in Nitrate	PFAS
Cañon de Valle 1	CDV-16-02656	Alluvial	S[a]	S	B[b]	S	B	NM[c]	S	NM	A[d]
	CDV-16-02657r	Alluvial	S	S	B	S	B	NM	S	NM	A
	SWSC Spring	Spring	S	S	B	S	B	NM	S	A	A
	Burning Ground Spring	Spring	S	S	B	S	B	A	S	A	A
Cañon de Valle 2	16-61439 (PRB Alluvial Seep)	Spring	S	S	B	S	B	NM	S	NM	A
	CDV-16-611923	Alluvial	S	S	B	S	B	NM	S	NM	A
	CDV-16-611937	Alluvial	S	S	B	S	B	NM	S	NM	A
	Cañon de Valle below MDA P	Base flow	S	S	B	S	B	NM	S	NM	A
	CDV-16-02659	Alluvial	S	S	B	S	B	NM	S	NM	A
S-Site Canyon	Martin Spring	Spring	S	S	B	S	B	A	S	A	A
	MSC-16-06293	Alluvial	S	S	B	S	B	NM	S	NM	A
	MSC-16-06294	Alluvial	S	S	B	S	B	NM	S	NM	A
Pajarito Canyon	Bulldog Spring	Spring	S	S	B	S	B	NM	S	A	A
	Pajarito below S&N Ancho E Basin Confluence	Base flow	S	S	B	S	B	NM	S	NM	A
Water Canyon	Between E252 and Water at Beta	Base flow	S	S	B	S	B	NM	S	NM	A
	Water at Beta	Base flow	S	S	B	S	B	NM	S	NM	A
Fishladder Canyon	FLC-16-25280	Alluvial	S	S	B	S	B	NM	S	NM	A
n/a[e]	Surge Bed Monitoring Well	Surge Bed (Intermediate)	S	S	S	S	NM	NM	S	NM	A

[a] S = Semiannual (two times per yr).

[b] B = Biennial (one time per 2 yr).

[c] NM = Not measured. This analytical suite is not scheduled to be collected for this type of water at locations assigned to this monitoring group.

[d] A = Annual.

[e] n/a = Not applicable.

Table 2.1-2
Long-Term Monitoring and Maintenance Plan Sampling Program Field Parameters

Watershed	Location	Sampling Date	Screen Top Depth (ft)	Dissolved Oxygen (mg/L)	Oxidation-Reduction Potential (mV)	pH (SU[a])	Specific Conductance (µS/cm)	Temperature (deg C)	Turbidity (NTU[b])	Comments
Cañon de Valle 1	CDV-16-02656	3/13/2021	3	4.46	137.4	6.67	320.6	4.7	4.99	
	CDV-16-02657r	3/13/2021	1.35	NS[c]	NS	NS	NS	NS	NS	Insufficient water for sampling
	SWSC Spring	3/13/2021	n/a[d]	NS	NS	NS	NS	NS	NS	Insufficient water for sampling
	Burning Ground Spring	3/13/2021	n/a	8.21	NM[e]	6.68	309.1	9.9	0.49	
Cañon de Valle 2	16-61439 (PRB Alluvial Seep)	3/15/2021	n/a	8.99	NM	6.33	274.2	6.4	9.49	
	CDV-16-611923	3/15/2021	3.2	NS	NS	NS	NS	NS	NS	Location dry
	CDV-16-611937	3/15/2021	3	1.49	96.4	5.88	199.9	3.5	17	
	Cañon de Valle below MDA P	3/15/2021	n/a	NS	NS	NS	NS	NS	NS	Insufficient water for sampling
	CDV-16-02659	3/15/2021	1.7	8.41	223.8	6.66	256.7	5.6	6.03	
S-Site Canyon	Martin Spring	3/10/2021	n/a	8.14	NM	6.84	433.4	7.4	3.76	
	MSC-16-06293	3/8/2021	2	NS	NS	NS	NS	NS	NS	Location dry
	MSC-16-06294	3/19/2021	2.5	NS	NS	NS	NS	NS	NS	Location dry
Pajarito Canyon	Bulldog Spring	3/16/2021	n/a	8.92	NM	7.51	316.7	7.6	6.43	
	Pajarito below S&N Ancho E Basin Confluence	3/16/2021	n/a	10.66	NM	6.62	231.7	6.7	2.46	
Water Canyon	Between E252 and Water at Beta	3/29/2021	n/a	10.24	NM	7.43	146	4	5.29	
	Water at Beta	3/19/2021	n/a	NS	NS	NS	NS	NS	NS	Location dry
Fishladder Canyon	FLC-16-25280	3/8/2021	n/a	NS	NS	NS	NS	NS	NS	Insufficient water for sampling

[a] SU = Standard unit.
[b] NTU = Nephelometric turbidity unit(s).
[c] NS = Not sampled.
[d] n/a = Not applicable.
[e] NM = Not measured. This analytical suite is not scheduled to be collected for this type of water at locations assigned to this monitoring group.

Table 2.2-1
RDX Concentrations in Groundwater, Surface Water, and Springs

Canyon	Location	Sample	Depth to Top of Screen (ft)	Sampling Date	Field Prep	Field QC[a] Type	Result (µg/L)	NMED Screening Level[b]	Comments
Cañon de Valle 1	CDV-16-02656	CAWA-21-218596	3	3/13/2021	UF[c]	REG[d]	0.4	9.66	
	CDV-16-02657r	NS[e]	1.35	3/13/2021	NS	NS	NS	9.66	Insufficient water for sampling
	SWSC Spring	NS	n/a[f]	3/13/2021	NS	NS	NS	9.66	Insufficient water for sampling
	Burning Ground Spring	CAWA-21-218378	n/a	3/13/2021	UF	REG	18.1	9.66	
Cañon de Valle 2	16-61439 (PRB Alluvial Seep)	CAWA-21-218389	n/a	3/15/2021	UF	REG	13	9.66	
	CDV-16-611923	NS	3.2	3/15/2021	NS	NS	NS	9.66	Location dry
	CDV-16-611937	CAWA-21-218614	3	3/15/2021	UF	REG	1.87	9.66	
	Cañon de Valle below MDA P	NS	n/a	3/15/2021	NS	NS	NS	9.66	Insufficient water for sampling
	CDV-16-02659	CAWA-21-218602	1.7	3/15/2021	UF	REG	3.34	9.66	
		CAWA-21-218616	1.7	3/15/2021	UF	FD[g]	3.44	9.66	
S-Site Canyon	Martin Spring	CAWA-21-218385	n/a	3/10/2021	UF	REG	75.2	9.66	
	MSC-16-06293	NS	2	3/8/2021	NS	NS	NS	9.66	Location dry
	MSC-16-06294	NS	2.5	3/19/2021	NS	NS	NS	9.66	Location dry
Pajarito Canyon	Bulldog Spring	CAPA-21-218370	n/a	3/16/2021	UF	REG	8.74	9.66	
	Pajarito below S&N Ancho E Basin Confluence	CAPA-21-218367	n/a	3/16/2021	UF	REG	0.0889 (ND[h])	9.66	
Water Canyon	Between E252 and Water at Beta	CAWA-21-219608	n/a	3/29/2021	UF	REG	0.08 (ND)	9.66	
	Water at Beta	NS	n/a	3/19/2021	NS	NS	NS	9.66	Location dry
Fishladder Canyon	FLC-16-25280	NS	n/a	3/8/2021	NS	NS	NS	9.66	Insufficient water for sampling

[a] QC = Quality control.
[b] NMED tap water screening levels are specified in the June 2019 Table A-1 of “Risk Assessment Guidance for Site Investigations and Remediation” (NMED 2019, 700550).
[c] UF = Unfiltered sample.
[d] REG = Regular sample.
[e] NS = Not sampled.
[f] n/a = Not applicable.
[g] FD = Field duplicate.
[h] ND = Not detected. The method detection limit is 0.087.

Table 2.2-2
Barium Concentrations in Groundwater, Surface Water, and Springs

Canyon	Location	Sample	Depth to Top of Screen (ft)	Sampling Date	Field Prep	Field QC[a] Type	Result (µg/L)	Screening Level[b]	Comments
Cañon de Valle 1	CDV-16-02656	CAWA-21-218595	3	3/13/2021	F[c]	REG[d]	1920	2000	
	CDV-16-02657r	NS[e]	1.35	3/13/2021	NS	NS	NS	2000	Insufficient water for sampling
	SWSC Spring	NS	n/a[f]	3/13/2021	NS	NS	NS	2000	Insufficient water for sampling
	Burning Ground Spring	CAWA-21-218377	n/a	3/13/2021	F	REG	1110	2000	
Cañon de Valle 2	16-61439 (PRB Alluvial Seep)	CAWA-21-218388	n/a	3/15/2021	F	REG	3650	2000	
	CDV-16-611923	NS	3.2	3/15/2021	NS	NS	NS	2000	Location dry
	CDV-16-611937	CAWA-21-218613	3	3/15/2021	F	REG	148	2000	
	Cañon de Valle below MDA P	NS	n/a	3/15/2021	NS	NS	NS	2000	Insufficient water for sampling
	CDV-16-02659	CAWA-21-218601	1.7	3/15/2021	F	REG	4290	2000	
		CAWA-21-218615	1.7	3/15/2021	F	FD[g]	4050	2000	
S-Site Canyon	Martin Spring	CAWA-21-218384	n/a	3/10/2021	F	REG	174	2000	
	MSC-16-06293	NS	2	3/8/2021	NS	NS	NS	2000	Location dry
	MSC-16-06294	NS	2.5	3/19/2021	NS	NS	NS	2000	Location dry
Pajarito Canyon	Bulldog Spring	CAPA-21-218369	n/a	3/16/2021	F	REG	82.8	2000	
	Pajarito below S&N Ancho E Basin Confluence	CAPA-21-218366	n/a	3/16/2021	F	REG	60.1	2000	
Water Canyon	Between E252 and Water at Beta	CAWA-21-218381	n/a	3/29/2021	F	REG	47	2000	
	Water at Beta	NS	n/a	3/19/2021	NS	NS	NS	2000	Location dry
Fishladder Canyon	FLC-16-25280	NS	n/a	3/8/2021	NS	NS	NS	2000	Insufficient water for sampling

[a] QC = Quality control.

[b] New Mexico Water Quality Control Commission groundwater standards.

[c] F = Filtered.

[d] REG = Regular sample.

[e] NS = Not sampled.

[f] n/a = Not applicable.

[g] FD = Field duplicate.

Table 2.2-3
Analytes Exceeding Screening Levels

Canyon	Location	Sample	Depth to Top of Screen (ft)	Sampling Date	Field QC[a] Type	Analyte	Result (µg/L)	Screening Level[b]	Field Prep Code
Cañon de Valle 2	CDV-16-611937	CAWA-21-218613	3	3/15/2021	REG[c]	Iron	1200	1000	F[d]
	CDV-16-611937	CAWA-21-218613	3	3/15/2021	REG	Manganese	321	200	F
S-Site Canyon	Martin Spring	CAWA-21-218384	n/a[e]	3/10/2021	REG	Boron	1270	750	F

[a] QC = Quality control.

[b] New Mexico Water Quality Control Commission groundwater standards.

[c] REG = Regular sample.

[d] F = Filtered.

[e] n/a = Not applicable.

Appendix A

Field Forms Associated with Sample Collection

March 2021 Field Forms

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03/29/2021 JM 3/29/21 Between E252 & Water Beta

Spring/Surface Water Sampling Field Data Sheet

Site name: Between E252 & Water Beta **Date:** 03/29/2021 **Onsite time:** 0920

Objective: Sample per reference doc. on pg. 3 **Weather:** Sunny, 40s

Sampling crew: B Morgan, J. Meyer, A. Vigil, D. Iramillo, M. Stastny

Two-minute safety drill: Hiking, uneven surfaces

Meters calibrated at (location) SMO **by** (whom) M. Stastny **at** (time) 0800

Multimeter number: 60 **Turbidimeter serial number:** 10610328 3

Sample Retrieval	**Date:** 03/29/2021	**Time:** 0930	**Method:** PP

Sample Event ID: 13528 **Sample ID Numbers:** CAWA-21- 218381, 219603, 218383

FIELD PARAMETERS

pH (su): 7.43	Sp. Cond. (µS/cm): 146.0	Turbidity (NTU): 5.29
Temperature (°C): 4.0	DO (mg/L): 10.24	Q (gpm): 34.11

Explanation of Q method, including calculations:

JM 3/29/21
1.8 / 0.18 GIT = 0.076 cfs x 448.83 = 34.11 gpm

Note: To convert cfs to gpm, multiply cfs by 448.83

SITE DESCRIPTION (circle all that apply)

Media type:	Spring			(Baseflow (persistent flow)	
Sample location:	Bank	Wading	Station Gage: at / above / below		
	(Midstream natural feature)	Other (specify):			
Description of Sampling Site:	Pool	(Riffle)	Eddy	Diffuse	Other
	Written description: Sampling midstream off bedrock slab				
Substrate:	(Bedrock)	Concrete	(Cobble)	(Gravel)	Sand	Mud
Stage Conditions:	Stable: (normal) / low / high	Falling	Rising	Other (specify):	
Hydraulic Event:	(Routine)	Snowmelt	Flood	Drought	Other (specify):
Stream Color:	Brown	(Clear)	Green	Blue	Gray	Other (specify):
Description of flow:	Turbulent	(Laminar)	Recirculating	Stagnant	Other
	Written description:				

Photos and GPS

GPS point #1:	Name: NA	Coordinates: NA			Units: NA
GPS point #2:	Name: ↓	Coordinates: ↓			Units: ↓
Photo #1:	Description: Source	Facing: W	Time: 0940	Taken by: J. Meyer	
Photo #2:	Description: Upstream	Facing: W	Time: ↓	Taken by: ↓	
Photo #3:	Description: Downstream	Facing: E	Time: ↓	Taken by: ↓	

Other notes: A.Vigil conducts HE spot test: Negative; D. Iramillo Presences, A. Vigil QAs

Offsite time: 1000 **Relinquish samples at SMO**, care of Kat Popova at (time) 1122

Objectives met? Yes

M 3/29/21

JM 3/29/21

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03/13/2021 Burning Ground Spring

JM 3/13/2021

Spring/Surface Water Sampling Field Data Sheet

Site name: Burning ground Spring **Date:** 03/13/2021 **Onsite time:** 0930

Objective: Sample per documentation on pg. 3 **Weather:** Sunny, 40s

Sampling crew: J. Meyer, K. Reid, D. Jaramillo, J. Anderson & NMED (Kevin B.)

Two-minute safety drill: Uneven surfaces, weir hazard

Meters calibrated at (location) 50 SMO **by** (whom) Melissa Stastny **at** (time)

Multimeter number: 50 **Turbidimeter serial number:** CAWA-21-218378, 218379, 218380, 220513, 218377

Sample Retrieval **Date:** 0936 ↕ **Time:** 3/13/2021 **Method:** PP

Sample Event ID: 13528 **Sample ID Numbers:** 166103287

FIELD PARAMETERS

pH (su): 6.68	Sp. Cond. (µS/cm): 309.10	Turbidity (NTU): 0.49
Temperature (°C): 9.9	DO (mg/L): 8.21	Q (gpm): 5.08

Explanation of Q method, including calculations:

(1) $\frac{0.423\text{ gal}}{5\text{ sec}}$ (2) $\frac{0.423\text{ gal}}{5\text{ sec}}$ (3) $\frac{0.423\text{ gal}}{5\text{ sec}} \times \frac{60\text{ sec}}{1\text{ min}} = 5.08\text{ gpm}$

Note: To convert cfs to gpm, multiply cfs by 448.83

SITE DESCRIPTION (circle all that apply)

Media type:	(Spring) (circled)			Baseflow (persistent flow)		
Sample location:	Bank		Wading	Station Gage: at / above / below		
	(Midstream natural feature) (circled)		Other (specify):			
Description of Sampling Site:	(Pool) (circled)	Riffle	Eddy	Diffuse	Other	
	Written description:					
Substrate:	Bedrock	Concrete	(Cobble) (circled)	(Gravel) (circled)	(Sand) (circled)	(Mud) (circled)
Stage Conditions:	Stable (normal) (circled) / low / high		Falling	Rising	Other (specify):	
Hydraulic Event:	(Routine) (circled)	Snowmelt	Flood	Drought	Other (specify):	
Stream Color:	Brown	(Clear) (circled) Green	Blue	Gray	Other (specify):	
Description of flow:	Turbulent	(Laminar) (circled)	Recirculating	Stagnant	Other	
	Written description: Flow at source ~~Pool~~ pool JM 3/13/2021					

Photos and GPS

GPS point #1:	Name: NA	Coordinates: NA		Units: NA	
GPS point #2:	Name: ↓	Coordinates: ↓		Units: ↓	
Photo #1:	Description: Source	Facing: S	Time: 1003	Taken by: J. Meyer	
Photo #2:	Description: Above Source	Facing: S	Time: 1003	Taken by: ↓	
Photo #3:	Description: Below Source	Facing: N	Time: 1003	Taken by: ↓	

Other notes: J. Meyer Conducts HE spot test; results Negative; J. Anderson Preserves, J. Meyer QA's

Offsite time: 1015 **Relinquish samples at SMO**, care of Kat Pazoria **at** (time) 1300

Objectives met? Yes

JM 3/13/2021

BM 03/10/21

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Spring and Surface Water Sampling

Reference

Document No.: N3B-SOP-ER-3002
Revision: 0
Effective Date: 4/15/2019
Page: 15 of 18

ATTACHMENT 1
Page 1 of 1

Spring/Surface Water Sampling Field Data Sheet

Site name: Martin Spring **Date:** 03/10/2021 **Onsite time:** 0856

Objective: Sample documentation on p. 3 **Weather:** Sunny; High of 48°F

Sampling crew: A. Vigil, M. Stastny, B. Morgan

Two-minute safety drill: Steep slopes, slippery surfaces

Meters calibrated at (location) SMO **by** (whom) M. Stastny **at** (time) 07:00

Multimeter number: #50 **Turbidimeter serial number:** n/a

Sample Retrieval Date: 03/10/2021 **Time:** ~~0856~~ 0913 (BM 03/10/21) **Method:** Geo Pump

Sample Event ID: 13528 **Sample ID Numbers:** CAWA-21-218385; -218384; -218386; -218387

FIELD PARAMETERS

pH (su): 6.84 Sp. Cond. (µS/cm): 433.4 Turbidity (NTU): 3.76

Temperature (°C): 7.4 DO (mg/L): 8.14 Q (gpm): 0.24

Explanation of Q method, including calculations:

1st: 0.12 gal / 30 sec 2nd: 0.11 gal / 30 sec 3rd: 0.12 gal / 30 sec

$\frac{0.12+0.11+0.12}{3} = 0.12$ gal

$\frac{0.12 \text{ gal}}{30 \text{ sec}} \times \frac{60 \text{ sec}}{1 \text{ min}} = 0.24$ gpm

Note: To convert cfs to gpm, multiply cfs by 448.83

Taken w/ graduated cup

SITE DESCRIPTION (circle all that apply)

Media type: (Spring) Baseflow (persistent flow)

Sample location: Bank Wading Station Gage: at / above / below

Midstream natural feature (Other (specify): Weir (v-notch))

Description of Sampling Site: (Pool) Riffle Eddy Diffuse Other

Written description: Below Boulder @ source

Substrate: Bedrock Concrete Cobble Gravel (Sand) (Mud)

Stage Conditions: Stable: (normal) / low / high Falling Rising Other (specify):

Hydraulic Event: (Routine) Snowmelt Flood Drought Other (specify):

Stream Color: Brown (Clear) Green Blue Gray Other (specify):

Description of flow: Turbulent (Laminar) Recirculating Stagnant Other

Written description: n/a

Photos and GPS

GPS point #1: Name: n/a Coordinates: n/a Units: n/a

GPS point #2: Name: ↓ Coordinates: ↓ Units: ↓

Photo #1: Description: source Facing: N Time: 0943 Taken by: B. Morgan

Photo #2: Description: above source Facing: S Time: 0943 Taken by: ↓

Photo #3: Description: below source Facing: S Time: 0943 Taken by: ↓

Other notes: A. Vigil performs HE spot test; negative; Vigil preserves + M. Stastny QAs

Offsite time: 10:15 **Relinquish samples at SMO,** care of L. Tower at (time) 11:20

Objectives met? Yes

BM 03/10/21

03/15/2021 DM 3/15/2021 PRB-16-61439

Spring/Surface Water Sampling Field Data Sheet

Site name: PRB-16-61439 **Date:** 03/15/2021 **Onsite time:** 1115

Objective: Sample Per Applicable documentation **Weather:** Sunny, 40s

Sampling crew: J. Meyer, J. Anderson, D. Jaramillo

Two-minute safety drill: uneven surfaces, ice

Meters calibrated at (location) 50 SMO **by** (whom) J. Anderson **at** (time) 0810

Multimeter number: 50 **Turbidimeter serial number:** 16610 3287

Sample Retrieval	**Date:** 1146 03/15/2021	**Time:** 1146	**Method:** PP

Sample Event ID: 13528 **Sample ID Numbers:** CAWA-21-218388, -218389, -218390

FIELD PARAMETERS

pH (su): 6.33 Sp. Cond. (µS/cm): 274.20 Turbidity (NTU): 9.49

Temperature (°C): 6.4 DO (mg/L): 8.99 Q (gpm): 0.40

Explanation of Q method, including calculations:

① $\frac{750\,ml}{30\,sec}$ ② $\frac{750\,ml}{30\,sec}$ ③ $\frac{750\,ml}{30\,sec} \times \frac{1L}{1000\,mL} \times \frac{1gal}{3.785L} \times \frac{60\,sec}{1\,min} = 0.40$ gpm

Note: To convert cfs to gpm, multiply cfs by 448.83

SITE DESCRIPTION (circle all that apply)

Media type:	(Spring)			Baseflow (persistent flow)	
Sample location:	(Bank)	Wading	Station Gage: at / above / below		
	Midstream natural feature	Other (specify):			
Description of Sampling Site:	(Pool)	Riffle	Eddy	Diffuse	Other
	Written description: Source coming off rock above pool				
Substrate:	Bedrock	Concrete	(Cobble)	(Gravel)	(Sand) (Mud)
Stage Conditions:	Stable (normal) / low / high	Falling	Rising	Other (specify):	
Hydraulic Event:	(Routine)	Snowmelt	Flood	Drought	Other (specify):
Stream Color:	Brown	(Clear)	Green	Blue	Gray	Other (specify):
Description of flow:	Turbulent	(Laminar)	Recirculating	Stagnant	Other
	Written description: Seep low flow				

Photos and GPS

GPS point #1:	Name: NA	Coordinates: NA			Units: NA
GPS point #2:	Name: ↓	Coordinates: ↓			Units: ↓
Photo #1:	Description: Source		Facing: S	Time: 1144	Taken by: J. Meyer
Photo #2:	Description: Src upstream		Facing: S	Time: ↓	Taken by: ↓
Photo #3:	Description: downstream		Facing: N	Time: ↓	Taken by:

Other notes: D. Jaramillo conducts HE spot tes; Negative; J. Anderson Preserves; D Jaramillo QATS

Offsite time: 1247 **Relinquish samples at SMO**, care of Kurt Popova at (time) 1410

Objectives met? Yes

3/15/2021

3/13/2021 CdV-16-02656

MST 0700 B. Morgan Conducts H+S Tailgate @ SMO;
0730 M. Stastny calibrates YSI #60; see logbook TPMC-LA-16-043 for details
0933 Crew (B. Morgan, A. Vigil, M. Stastny) on site @ CdV-16-02656 w/ escort F. Munoz
2-min safety: wind creating changing conditions, hiking uneven terrain
weather: partly cloudy; 30s
Objective: purge + sample CdV-16-02656 per all applicable SOPs + ref. documents found on p. 3 of this logbook
0937 DTW = 7.76' BTOC AVG DTW = 7.67' BTOC
0940 DTW = 7.67' BTOC MTD = 11.05' BTOC
0943 DTW = 7.59' BTOC
WC = (TD-DTW) = 3.38'
2" ID 1CV = (0.163 gal/ft)(WC) = 0.55 gal
3 CV = 1.65 gal
0955 Pump on; water to surface @ 0.05 gpm (man. meas w/ graduated cup)
0956 Flow through cell full; Begin logging parameters on YSI #60 (file name: CdV 16 02656, data ID: MY2021 Q2), GW Sampling Log + iPad #1 (B. Morgan)
1009 Pause pump; prepare to sample
1012 Pump on; Begin Sampling (> 1 CV purged + parameters stable)
1045 Pause pump to allow for recharge
1048 Pump on; Resume Sampling
1050 Pause pump to allow for recharge
1058 Pump on; Resume sampling
1059 Pump off; (prioritized) sampling complete
note: K. Reid performs HE spot Test; negative
note: K. Reid preserves samples; J. Meyer QAs
Summary Objective met to purge + sample CdV-16-02656 per all applicable SOPs + ref. documents found on p. 3 of this logbook. See p. 54-56 for GW Sampling Log, Compliance checklist + GW Level Field Form
1120 Crew offsite
1300 Relinquish samples to SMO c/o K. Popova
Event ID: 13528
Sample IDs: CAWA-21-218595; -218596, -218597, -220514

BM 02.13.21

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BM 03/13/21

CdV-16-02656

Groundwater Sampling Log

IFWGMP MY: 2021 Q: 2	LSD: 7443.18 ft. msl	Well Diameter: 2 in.		Date: 03/13/2021
Watershed: Water/CdV	Water Level: NA ft. msl	Top of Screen: 5.30' BTOC ft. msl BM 03/13/21		Notes: I begins in screened interval
Well: CdV-16-02656	TD: =mTD = 11.05 BTOC ft. bgs BM 3/13/21	Bottom of Screen: 11.00' BTOC ft. msl BM 03/13/21		
Sampling Device: PP	DTW: 7.67 BTOC ft. bgs BM 3/13/21	Water Column: 3.38 ft.		
Measuring Point: BTOC	Drop Pipe: NA gal.	1CV: 0.55 gal.		Packer Pressure
Completion Depth: TD		3CV: 1.65 gal.		Before: psi
(* ft. BTOC/ BTIC / BGS/ MS L)		Note: MP height (stickup) of TOC/TIC for Alluvials 2.30 ft.		Actuation: psi
DTW = (LSD - Water Level) Water Column (TD - DTW) Drop pipe = (TD/Pump Intake x Drop Pipe Diameter Multiplier) 1CV = (Water Column x Well Diameter Multiplier) 3 CV = (1 CV x 3)				Opening: psi After: psi

TIME MST/ DST	pH SU	TEMP °C	SPEC COND µs/cm	DO mg/l	Turb NTU	HACH	ORP mV	Water Level* ft. BTOC	Discharge Rate (GPM)	NOTES
Stability:	≤ 0.2 STU variance		± 3% (>100) ± 6% (≤ 100)	≤ 0.3 mg/l variance	<10 or ± 10%	Yes or No				
0955	Pump on; water to surface @ Q = 0.05 gpm (min meas. w/ graduated cup)									
0956	7.86	5.3	312.2	5.66	16.04	N	67.7	7.96	0.05	clear, no odor
0957	7.05	5.0	312.0	4.64	7.84		90.4	8.14	0.05	checked Q; same rate
1002	6.83	4.9	312.0	4.75	7.68		109.0	8.25	0.05	clear, no odor
1005	6.72	4.8	316.7	4.70	5.59		126.4	8.48	0.07	checked Q; Q=0.07
1008	6.67	4.7	320.6	4.46	4.99		137.4	8.67	0.07	clear, no odor
~~10:08~~ 10:09	Pause Pump; Prepare to Sample									
10:12	Pump on; Begin Sampling									
10:45	Pause pump to allow recharge									
10:48	Pump on; Resume Sampling									
10:50	Pause pump to allow for recharge									
10:58	Pump on; Resume Sampling									
10:59	Pump off; (Prioritized) Sampling Complete									

BM 3/13/21

BM 03/13/2021

Yes in HACH column = HACH Turbidimeter # NA Used because NA

Contact Waste: 0.5 gal.	Drum#: Municipal	Final Water Level: 10.88 BTOC ft.	BM 03/13/21
*Purge Water: 0.78 BM 3/13/21 gal.	Drum#: 5-gal carboy; 2257	*Purge: Formation water purged prior to sampling (excluding drop pipe water and sampling water)	
Total Waste Water: ~~3.23~~ 3.30 gal.	Pending consolidation		

CdV-16-02656

Compliance Checklist

BM 03/13/21

Well Name: CdV-16-02656

Date: 03/13/21

Discharge Calculation Method	Calculated Volumes (gal)	Drop Pipe Volume (gal)	Purge Water Volume Purged (gal)	CV's Purged Before Sampling	Minimum Purge Met?	Comments
Flow Meter	Drop Pipe: NA	NA	0.78	1.42	(Y) N	none
Manual	3 CVs: 1.65					

Parameters collected at proper intervals? (HH:MM)	Stable for three consecutive readings? pH ≤ 0.2 STU Variance	Dissolved Oxygen ≤ 0.3 mg/l variance	Specific Conductivity ± 3 % (>100) ± 5 % (≤ 100)	Turbidity < 10 NTU or ± 10%	Comment:
10:02	6.83	4.75	312.0	7.68	
10:05	6.72	4.70	316.7	5.59	
10:08	6.67	4.46	320.6	4.99	
Calculations:	Highest: 6.83	Highest: 4.75	Median: 316.7	Median: 5.59	none
	Lowest: 6.67	Lowest: 4.46	Median + 3 %: 326.20	Median + NA%: <10	
	Difference: 0.16	Difference: 0.29	Median - 3 %: 306.70	Median - NA %: <10	
	(Y) N	(Y) N	(Y) N	(Y) N	(Y) N

SOP Requirements Met?	Comments:
(Y) N	None

BM 03/13/21

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Scanned into Here

16-02656

BM 03/13/21

Groundwater Level Field Form

PART 1: Well Site Information

Well Name:	Date:	Time onsite (MST):	Activity
CdV-16-02656	03/13/21	0933	manual V for sampling

Personnel:	Cable Length (ft):	Cable SN:
B Morgan, A. Vigil, M. Slattery	NA	NA

Telemetry: Yes / (No)	Full Transducer: Yes / (No)	Memory % remaining	Battery % remaining
NA	NA	↓	↓

Connect Time:	Transducer SN	Log Note Memory %	Log Note Battery %
NA	NA	↓	↓

Water Level (ft)	P (psi)	T (C)	Stop Test: Yes / No	Change Desiccant: Yes / No / NA
NA	NA	NA	↓	↓

Last Start Date	Data File Name:
NA	NA

PART 2: Manual Measurements

Measuring Point: TOC (top outer casing); TIC (inner) — Stick-up Measured on Site ☐ — Previous MP Used ☒

Time (MST):	0937	Water Level Meter Serial No:	782342	Notes:
BM 3/13/21 BTOC DTW (ft bMP):	7.74	Measurements in feet		V Begins in screened interval
Time (MST):	0940	LSD ft.	7443.18 msl	
BM 3/13/21 BTOC DTW (ft bMP):	7.67	MP Height ft.	+ 2.30	
Time (MST):	0943	MP Elevation =	7445.48	
BM 3/13/21 BTOC DTW (ft bMP):	7.59	DTW:	- 7.67	
Time (MST):	0944	Groundwater Elevation (GWE) Reference Level	7437.81' msl	
BM 3/13/21 BTOC TD (ft bMP):	11.05			Zip Tie on Keltm's Grip: NA

PART 3: Replacement Transducer

Transducer SN:	Calibration Date:	New LT PSI Rating:	Manufacture Date:
NA	NA	NA	NA
Memory % remaining: ↓	Battery % remaining: ↓		

Transducer Performance and Programming

PART 4: Transducer Error\Drift Acceptance

WL (transducer reading) (ft):	
GWE from MM:	
Difference in value:	
Error tolerance of transducer:	
Notes:	

☐ Within Error Tolerance
☐ Outside Error Tolerance

15 PSI=0.03ft 30 PSI=0.07 ft 100 PSI=0.23 ft 500 PSI=1.16 ft

PART 5: Programming & Final Readings

		Time (MST):	Reading
Programming Time:			
New Test Name:			
Reference Level:			
Current Depth:			
Meas. Interval:			
Start Date:			
Start Time:			
Synch Clocks: Yes / No			
			QA Date and Initial

BM 03/13/21

BM 03/13/21

N3B Los Alamos

N3B-Form-6156

Groundwater Level Field Form

Groundwater Level Field Form

PART 1: Well Site Information

Well Name:	Date:	Time onsite (MST):	Activity:	
CdV-16-02657c	03/13/2021	0919	bw sampling	
Personnel: J. Meyer, J. Anderson, K. Reid, D. Jaramillo			Cable Length(ft):	Cable SN:
Telemetry: Yes \ No	Pull Transducer: Yes \ No		Memory % remaining	Battery % remaining:
Connect Time:	Transducer SN	JM 3/13/2021	Log Note Memory %:	Log Note Battery %:
Water Level (ft):	F (psi):	T (C):	Stop Test: Yes \ No	Change Desiccant: Yes \ No \ NA
Last Start Date:	Data File Name:			

PART 2: Manual Measurements

Measuring Point: TOC (top outer casing); TIC (inner); Stick-up Measured on Site ☐ Previous MP Used ☒

Time (MST):	0920	Water Level Meter Serial No: 781968		Notes: Dry
DTW (ft bMP):	7.22' BTIC	Measurements in feet		
Time (MST):		LSD ft.	7430.22' msl	
DTW (ft bMP):		MP Height ft.	+ 3.64	
Time (MST):	JM 3/13/2021	MP Elevation	= 7433.86' msl	
DTW (ft bMP):		DTW:	- 7.22' BTIC	
Time (MST):		Groundwater Elevation (GWE) Reference Level	7426.64	
TD (ft bMP):				Zip Tie on Keltim's Grip: N/A

PART 3: Replacement Transducer

Transducer SN:		Calibration Date:		New LT PSI Rating:	Manufacture Date:
Memory % remaining:		Battery % remaining:			

Transducer Performance and Programming

PART 4: Transducer Error\Drift Acceptance		PART 5: Programming & Final Readings			
WL (transducer reading) (ft):	JM 3/13/2021	Programming Time:		Time (MST):	Reading
GWE from MM:		New Test Name:			
Difference in value:		Reference Level:	JM 3/13/2021		
Error tolerance of transducer:		Current Depth:			
Notes:		Meas. Interval:			
☐ Within Error Tolerance		Start Date:			
☐ Outside Error Tolerance		Start Time:			
15 PSI-0.03ft 30 PSI-0.07 ft 100 PSI-0.23 ft 500 PSI-1.16 ft.		Synch Clocks: Yes \ No			
					QA' Date and Initial

N3B-Form-6156, Rev. 0
Effective Date: 6/20/19
Implementing Procedures: N3B-SOP-ER-3001; N3B-SOP-ER-6001

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03/15/2021 CdV-16-02659

DST 0700 B. Morgan conducts H+S Tailgate @ SMO

0700 M. Stastny calibrates YSI #60 @ SMO, see logbook TPMC-LA-16-043 for details

1144 Crew (B. Morgan, A. Vigil, M. Stastny) onsite @ CdV-16-02659 w/ escort M. Livesay and K. Reid

note Delayed start due to burning activities @ Burning Grounds per TA-16 ACO

2-min safety: changed conditions due to winds overnight; ICE!

weather: sunny 40-50s

Objective: Purge + sample CdV-16-02659 per all applicable SOPs + ref. documents found on p. 3 of this logbook

1146 DTW = 8.50' BTOC water level meter SN: 782342

1149 DTW = 8.50' BTOC MTD = 10.89' BTOC

WC = TD - DTW = 2.39'

4" ID 1 CV = (0.653 gal/ft) WC = 1.56 gal

3 CV = 4.68 gal

1156 Pump on; water to surface @ Q = 0.07 gpm (man meas w/ graduated cup)

1157 Flow through cell full; Begin logging parameters on YSI #60 (file name: cdv 16 02659 MY2021 Q2); GW sampling Log + iPad #1 (B. Morgan)

1222 Pause Pump; Prepare to sample

1223 Pump on; Begin Sampling > 1 CV purged + parameters stable

Sampling Complete; Pump off

Summary Objective met to purge + sample CdV-16-02659 per all applicable SOPs + ref documents. See p. 61-63 for GW Sampling Log, Compliance checklist + GW Level Field Form

note: K. Reid performs HE Spot Test; negative

note: K. Reid preserves Samples; B. Morgan QAS

1325 Crew offsite

1555 Relinquish samples to SMO c/o K. Popova

Event ID: 13528

Sample IDs: CAWA-21-218601; -218602; -218615; -218603; -218614

BM 07/15/21

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Groundwater Sampling Log

IFWGMP MY: 2021 Q: 2	LSD: 7300.50 ft. msl	Well Diameter: 4.0 in.		Date: 03/15/2021
Watershed: Water/CdV	Water Level: NA ft. msl	Top of Screen: 4.94 ft. msl BTOC		Notes: V begins in Screened interval
Well: CdV-16-02659	TD: =mTD= 10.89 ft bgs BTOC	Bottom of Screen: 9.94 ft. msl BTOC		
Sampling Device: PP	DTW: 8.50 ft. bgs BTOC	Water Column: 2.39 ft.		
Measuring Point: BTOC	Drop Pipe: NA gal.	1CV: 1.56 gal.		Packer Pressure NA
Completion Depth: mTD		3CV: 4.68 gal.		Before: psi
(* ft. BTOC/ BTIC / BGS/ MS L)		Note: MP height (stickup) of TOC/TIC for Alluvials 3.24 ft.		Actuation: psi
DTW = (LSD - Water Level) Water Column (TD - DTW) Drop pipe = (TD/Pump intake x Drop Pipe Diameter Multiplier) 1CV = (Water Column x Well Diameter Multiplier) 3 CV = (1 CV x 3)				Opening: psi After: psi

TIME MST/ DST	pH SU	TEMP °C	SPEC COND µs/cm	DO mg/l	Turb NTU	HACH	ORP mV	Water Level* ft. BTOC	Discharge Rate (GPM)	NOTES
Stability:	≤ 0.2 STU variance		± 3% (>100) ± 8% (≤ 100)	≤ 0.3 mg/l variance	<10 or ± 10%	Yes or No				
1156	Pump on; water to surface @ Q = 0.07 gpm									
1157	7.70	6.3	260.2	8.52	3.03	N	202.8	8.58	0.07	clear, no odor
1200	6.85	5.6	256.4	8.50	3.08		219.3	8.58	0.07	checked Q; same discharge rate
1203	6.70	5.5	256.6	8.47	3.17		221.9	8.58	0.07	clear, no odor
1206	6.63	5.5	256.4	8.45	3.27		222.7	8.58	0.07	↓
1209	6.64	5.6	256.6	8.43	3.84		222.1	8.58	0.08	checked Q; discharge rate inc. to 0.08 gpm
1212	6.63	5.6	256.5	8.42	4.67		223.1	8.58	0.08	clear, no odor
1215	6.65	5.5	256.6	8.42	4.82		223.1	8.58	0.08	↓
1218	6.65	5.5	256.5	8.42	4.95		223.4	8.58	0.08	↓
1221	6.66	5.6	256.7	8.41	6.03	↓	223.8	8.58	0.08	↓
1222	Pause Pump; Prepare to Sample									
1223	Pump on; Begin Sampling									
1312	Pump off; Sampling Complete									

Yes in HACH column = HACH Turbidimeter # NA Used because NA

Contact Waste: 1.0 gal.	Drum#: Municipal		Final Water Level: 8.58 BTOC ft.
*Purge Water: ~~1.87 1.81~~ 1.48 gal.	Drum#: 5-gal carboy; 2258		*Purge: Formation water purged prior to sampling (excluding drop pipe water and sampling water)
Total Waste Water: 6.35 gal.	Pending Consolidation		

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BM 03/15/21

Compliance Checklist

Well Name: CdV-16-02659

Date: 03/15/2021

Discharge Calculation Method	Calculated Volumes (gal)	Drop Pipe Volume (gal)	Purge Water Volume Purged (gal)	CV's Purged Before Sampling	Minimum Purge Met?	Comments
Flow Meter	Drop Pipe: NA	NA	1.88 ~~1.87~~ ~~1.81~~ BM 3/15/21	1.21 ~~1.20~~ ~~1.16~~ BM 3/15/21	(Y) N	none
Manual	3 CVs: 4.68					

Parameters collected at proper intervals? (HH:MM)	Stable for three consecutive readings? pH ≤ 0.2 STU Variance	Dissolved Oxygen ≤ 0.3 mg/l variance	Specific Conductivity ± 3 % (>100) ± 5 % (≤ 100)	Turbidity < 10 NTU or ± 10%	Comment:
12:15	6.65	8.42	256.6	4.82	none
12:18	6.65	8.42	256.5	4.95	
12:21	6.66	8.41	256.7	6.03	
Calculations:	Highest: 6.66	Highest: 8.42	Median: BM 3/15/21 ~~256.7~~ 256.6	Median: 4.95	
	Lowest: 6.65	Lowest: 8.41	Median + 3 % 264.30	Median + NA % < 10	
	Difference: 0.01	Difference: 0.01	Median - 3 % 248.90	Median - NA % < 10	
(Y) N	(Y) N	(Y) N	(Y) N	(Y) N	

SOP Requirements Met?	Comments:
(Y) N	none

BM 03/15/21

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BM 03/15/21

Groundwater Level Field Form

PART 1: Well Site Information

Well Name:	Date:	Time onsite (MST):	Activity
CdV-16-02659	03/15/21		Manual ☑ Measurement

Personnel	Cable Length (ft):	Cable SN:
B. Morgan, A. Vigil, M. Stastny, K. Reid	NA	NA

Telemetry: Yes / (No)	Full Transducer: Yes / (No)	Memory % remaining	Battery % remaining
NA			

Connect Time:	Transducer SN	Log Note Memory %	Log Note Battery %:
	NA		

Water Level (ft):	F (psi):	T (C):	Stop Test: Yes / No	Change Desiccant: Yes / No / NA
	NA	NA		

Last Start Date:	Data File Name:
	NA

PART 2: Manual Measurements

Measuring Point: (TOC) top outer casing; TIC (inner); Stick-up Measures on Site ☐ Previous MP Used ☒

Time (MST):	1149 1146	Water Level Meter Serial No:	782342	Notes:
BM 03/15/21 DTW (ft bMP): KTOC	8.50	Measurements in feet		☑ Begins in screened interval
Time (MST):	1149	LSD ft:	7300.50	
BM 3/15/21 DTW (ft bMP): BTOC	8.50	MP Height ft:	+ 3.24	
Time (MST):		MP Elevation:	= 7303.74	
DTW (ft bMP):		DTW: BM 3/15/21	- 8.50	
Time (MST):	1149	Groundwater Elevation (GWE) Reference Level:	7295.24	
MTD (ft bMP):	10.89			Zip Tie on Keltm's Grip: NA

PART 3: Replacement Transducer

Transducer SN:		Calibration Date:	New LT PSI Rating:	Manufacture Date:
Memory % remaining:		Battery % remaining:		

Transducer Performance and Programming

PART 4: Transducer Error\Drift Acceptance

WL (transducer reading) (ft):	
GWE from MM:	
Difference in value:	
Error tolerance of transducer:	
Notes:	

☐ Within Error Tolerance

☐ Outside Error Tolerance

15 PSI=0.03ft 30 PSI=0.07 ft 100 PSI=0.23 ft 500 PSI=1.16 ft

PART 5: Programming & Final Readings

Programming Time:		Time (MST):	Reading:
New Test Name:			
Reference Level:			
Current Depth:			
Meas. Interval:			
Start Date:			
Start Time:			

Synch Clocks Yes / No

QA Date and Initial

BM 03/15/21

BM 03/15/21

N3B Los Alamos

N3B-Form-6156

Groundwater Level Field Form

Groundwater Level Field Form

PART 1: Well Site Information

Well Name: CdV-16-611923	Date: 03/15/2021	Time onsite (MST): 1100	Activity: GW sampling
Personnel: J. Meyer, D. Jaramillo, J. Anderson			Cable Length (ft): / Cable SN:
Telemetry: Yes \ No	Pull Transducer: Yes \ No		Memory % remaining: / Battery % remaining:
Connect Time:	Transducer SN:		Log Note Memory %: / Log Note Battery %:
Water Level (ft): JM	P (psi):	T (C):	Stop Test: Yes \ No / Change Desiccant: Yes \ No \ NA
Last Start Date: 3/15/21	Data File Name:		

PART 2: Manual Measurements

Measuring Point: TOC (top outer casing) / TIC (inner) — Stick-up Measured on Site ☐ — Previous MP Used

Time (MST): 1110	Water Level Meter Serial No.: 781968		Notes: Dry water level is 0.05' from sump
DTW (ft bMP): 8.15' btIC	Measurements in feet		
Time (MST): 1113	LSD ft:	7376.43	
DTW (ft bMP): 8.15' btIC	MP Height ft:	- 0.00	
Time (MST): 1116	MP Elevation:	= 7376.43	
DTW (ft bMP): 8.15' btIC	DTW:	- 8.15' btIC	
Time (MST): JM	Groundwater Elevation (GWE) Reference Level:	7368.28	
TD (ft bMP): 3/15/2021			Zip Tie on Keith's Grip: N/A

PART 3: Replacement Transducer

Transducer SN:	Calibration Date:	New LT PSI Rating:	Manufacture Date:
Memory % remaining:	Battery % remaining:		

Transducer Performance and Programming

PART 4: Transducer Error\Drift Acceptance		PART 5: Programming & Final Readings			
WL (transducer reading) (ft):		Programming Time:		Time (MST):	Reading
GWE from MM:		New Test Name:			
Difference in value:		Reference Level: JM 3/15/2021			
Error tolerance of transducer:		Current Depth:			
Notes:		Meas. Interval:			
☐ Within Error Tolerance		Start Date:			
☐ Outside Error Tolerance		Start Time:			
15 PSI-0.03ft 30 PSI-0.07 ft 100 PSI-0.23 ft 500 PSI-1.16 ft		Synch Clocks: Yes \ No			
					QA: Date and Initial

N3B Los Alamos

N3B-Form-6156

Groundwater Level Field Form

Groundwater Level Field Form

PART 1: Well Site Information

Well Name:	Date:	Time onsite (MST):	Activity:	
MSC-16-06294	03/19/21	1055	GW Sampling	
Personnel: J. Meyer, K. Reid, J. Anderson			Cable Length(ft):	Cable SN:
Telemetry: Yes \ No	Pull Transducer: Yes \ No		Memory % remaining	Battery % remaining:
Connect Time:	Transducer SN		Log Note Memory %	Log Note Battery %:
Water Level (ft):	Psi:	T (C):	Stop Test: Yes \ No	Change Desiccant Yes \ No \ NA
Last Start Date:	Data File Name:			

PART 2: Manual Measurements

Measuring Point: TOC (top outer casing); (TIC (inner)) Stick-up Measured on Site ☐ Previous MP Used ☑

Time (MST):	1058	Water Level Meter Serial No: 782342		Notes: Dry
DTW (ft bMP):	10.55 bHC	Measurements in feet		
Time (MST):	10~~58~~ 1101	LSD ft.	7288.44	
DTW (ft bMP):	10.55 bHC	MP Height ft.	-3.07	
Time (MST):	1104	MP Elevation	=7285.37	
DTW (ft bMP):	10.55	DTW:	- 10.55	
Time (MST):	1105	Groundwater Elevation (GWE) Reference Level	7274.82	
TD (ft bMP):	11.11			Zip Tie on Kelem's Grip: N/A

PART 3: Replacement Transducer

Transducer SN:		Calibration Date:	New LT PSI Rating:	Manufacture Date:
Memory % remaining:		Battery % remaining:		

Transducer Performance and Programming

PART 4: Transducer Error\Drift Acceptance		PART 5: Programming & Final Readings			
WL (transducer reading) (ft):		Progamming Time:		Time (MST):	Reading
GWE from MM:		New Test Name:			
Difference in value:		Reference Level:	JM 3/19/21		
Error tolerance of transducer:		Current Depth:			
Notes:		Meas. Interval:			
☐ Within Error Tolerance		Start Date:			
☐ Outside Error Tolerance		Start Time:			
15 PSI=0.03ft 30 PSI=0.07ft 100 PSI=0.23 ft 500 PSI=1.16 ft		Synch Clocks Yes \ No			
					QA Date and Initial

N3B-Form-6156, Rev. 0
Effective Date: 6/20/19
Implementing Procedures: N3B-SOP-ER-3001; N3B-SOP-ER-6001

03/15/2021 CdV-16-611937

note: see p. 60 of this logbook for morning activities

DST 1346 crew onsite @ CdV-16-611937

2-min Safety: hiking uneven terrain

Weather: partly cloudy, 40s

Objective: purge + sample CdV-16-611937 per applicable ref. documents + SOPs found on p. 3 of this logbook.

1349 DTW = 6.22' bTIC WL SN: 782342

1352 DTW = 6.22' bTIC mTD = 11.58 ft bTIC

WC = TD - DTW = 5.36'

2" ID 1 CV = (0.163 gal/ft)(WC) = 0.87 gal

3 CV = 2.62 gal

1359 Pump on; water to surface @ Q = 0.08 gpm (man. meas. w/ graduated cup)

1400 Flow through cell full; Begin logging parameters on YSI #60, (file name: cdv 16 611937, MY2021 Q2), GW sampling Log

BM 3/15/21 1419 ~~1421~~ Pause pump; prepare to sample (> 1 CV purged, parameters stable)

1421 Pump on; Begin sampling

note: K. Reid preserves samples, M. Stastny QAs

note: A. Vigil performs HE spot test; negative

Summary: Objective met to purge + sample CdV-16-611937 per all applicable ref. documents + SOPs found on p. 3 of this logbook. See p. 66-68 for GW Sampling Log, Compliance Checklist + GW Level Field Form.

1502 crew off site

1555 Relinquish Samples to SMO c/o K. Popova

Event ID: 13528

SampleIDs: CAWA-21-218613; -218614; -218617

BM 03/15/21

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BM 03/15/21

Groundwater Sampling Log

IPWGMP MY: 2021 Q: 2	LSD: 7359.59 ft. msl	Well Diameter: 2 in.	Date: 03/15/2021
Watershed: Water/CdV	Water Level: NA ft. msl	Top of Screen: 7356.59 (6.0' BTIC) ft. msl	Notes: II begins in screened interval
Well: CdV-16-611937	TD: =mTD = 11.58 ft. bgs BTIC	Bottom of Screen: 7351.59 (11.0' BTIC) ft. msl	
Sampling Device: PP	DTW: 6.22 ft. bgs BTIC	Water Column: 5.36 ft.	
Measuring Point: LSD	Drop Pipe: NA gal.	1CV: 0.87 gal.	Packer Pressure NA
Completion Depth: TD		3CV: 2.62 gal.	Before: psi
(* ft. BTOC/ BTIC / BGS/ MS L)		Note: MP height (stickup) of TOC/TIC for Alluvials 3.0 ft.	Actuation: psi
			Opening: psi
DTW = (LSD - Water Level) Water Column (TD - DTW) Drop pipe = (TD/Pump intake x Drop Pipe Diameter Multiplier) 1CV = (Water Column x Well Diameter Multilier) 3 CV = (1 CV x 3)			After: psi

TIME MST/DST	pH SU	TEMP °C	SPEC COND µs/cm	DO mg/l	Turb NTU	HACH	ORP mV	Water Level* ft. BTIC	Discharge Rate (GPM)	NOTES
Stability:	≤ 0.2 STU variance		± 3% (>100) ± 6% (≤ 100)	≤ 0.3 mg/l variance	<10 or ± 10%	Yes or No				
1359	Pump on; Water to Surface @ Q = 0.08 gpm									
1400	7.22	5.9	206.3	3.52	43.69	N	85.9	6.51	0.08	cloudy brownish color, no odor
1403	6.07	4.7	202.5	2.01	26.37		114.9	6.60	0.08	
1406	5.92	4.2	202.0	1.87	21.01		123.0	6.67	0.09	checked Q, discharge rate inc. to 0.09 gpm
1409	5.91	3.8	203.8	1.97	18.60		129.2	6.72	0.09	slightly cloudy, brownish color, no odor
1412	5.90	3.6	201.6	1.44	16.50		127.5	6.75	0.09	
1415	5.90	3.6	201.0	1.54	16.93		113.5	6.77	0.09	
1418	5.88	3.5	199.9	1.49	17.00		94.4	6.79	0.09	
1419	Pause pump for prep to sample									
1421	Pump on; Begin Sampling									
1451	Pump off; Sampling Complete									
			BM 03/15/21							

Yes in HACH column = HACH Turbidimeter # NA Used because NA

Contact Waste: 1.0 gal. BM 3/15/21	Drum#: Municipal		Final Water Level: 6.73 bTIC ft.
*Purge Water: BM 3/15/21 0.66 1.65 gal.	Drum#: 5 gal carboy: 2259		*Purge: Formation water purged prior to sampling (excluding drop pipe water and sampling water)
Total Waste Water: 4.44 4.43 gal. BM 07/15/21	Pending Consolidation		

Compliance Checklist

Bm 03/15/21

Well Name: CdV-16-411937

Date: 03/15/21

Discharge Calculation Method	Calculated Volumes (gal)	Drop Pipe Volume (gal)	Purge Water Volume Purged (gal)	CV's Purged Before Sampling	Minimum Purge Met?	Comments
Flow Meter	Drop Pipe: NA	NA	1.65 ~~1.66~~ Bm 3/15/21	1.90 ~~1.91~~ Bm 3/15/21	(Y) N	Additional CV purged to reach stability (turb)
Manual	3 CVs: 2.62					

Parameters collected at proper intervals? (HH:MM)	Stable for three consecutive readings? pH ≤ 0.2 STU Variance	Dissolved Oxygen ≤ 0.3 mg/l variance	Specific Conductivity ± 3 % (>100) ± 5 % (≤ 100)	Turbidity < 10 NTU or ± 10%	Comment:
1412	5.90	1.44	201.6	16.50	none
1415	5.90	1.54	201.0	16.93	
1418	5.88	1.49	199.9	17.00	
Calculations:	Highest: 5.90	Highest: 1.54	Median: 201.0	Median: 16.93	
	Lowest: 5.88	Lowest: 1.44	Median + 3 % 207.03	Median + 10 % 18.62	
	Difference: 0.02	Difference: 0.10	Median - 3 % 194.97	Median - 10 % 15.23	
Y N	Y N	(Y) N	(Y) N	(Y) N	

SOP Requirements Met?	Comments:
(Y) N	none

4/15/21

Bm 03/15/21

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Groundwater Level Field Form

PART 1: Well Site Information

Well Name:	Date:	Time onsite (MST):	Activity
Cdv-16-611937	3/15/2021	1346	Manual V measurement

Personnel	Cable Length(ft):	Cable SN:
B. Morgan, A. Vigil, K. Reid, M. Stastny	NA	NA

Telemetry: Yes / No	Full Transducer: Yes / No	Memory % remaining	Battery % remaining
NA	NA		

Connect Time:	Transducer SN	Log Note Memory %	Log Note Battery %:
	NA		

Water Level (ft):	F (psi):	T (C):	Stop Test: Yes / No	Change Desiccant Yes / No / NA
	NA	NA		

Last Start Date	Data File Name:
	NA

PART 2: Manual Measurements

Measuring Point: TOC (top outer casing); TIC (inner) — Stick-up Measured on Site ☐ — Previous MP Used ☒

Time (MST):	1349	Water Level Meter Serial No: 782342	Notes: V Begins in screened interval
BM 3/15/21 DTW (ft bMP):	6.22	Measurements in feet	
Time (MST):	1352	LSD ft: 7359.59	
BM 3/15/21 DTW (ft bMP):	6.22	MP Height ft.: + 3.00	
BM 3/15/21 Time (MST):	~~1352~~ NA	MP Elevation: = 7362.59	
DTW (ft bMP):	NA	DTW: - 6.22	
Time (MST):	1352	Groundwater Elevation (GWE) Reference Level: 7356.37	
BM 3/15/21 TD (ft bMP):	11.58		Zip Tie on Keltm's Grip: NA

PART 3: Replacement Transducer

Transducer SN	Calibration Date	New LT PSI Rating	Manufacture Date:

Memory % remaining:	Battery % remaining:

Transducer Performance and Programming

PART 4: Transducer Error\Drift Acceptance

WL (transducer reading) (ft):	
GWE from MM:	
Difference in value:	
Error tolerance of transducer:	
Notes:	

☐ Within Error Tolerance
☐ Outside Error Tolerance

BM 3/15/21

15 PSI=0.03ft 30 PSI=0.07ft 100 PSI=0.23ft 500 PSI=1.16ft

PART 5: Programming & Final Readings

		Time (MST):	Reading
Programming Time:			
New Test Name:			
Reference Level:			
Current Depth:			
Meas. Interval:			
Start Date:			
Start Time:			

Synch Clocks Yes / No

QA Date and Initial

BM 03/15/21

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03/13/2021 16-612309 (Surge Bed Monitoring Well)

MSR 0902 Crew on site @ 16-612309

0907 DTW = 22.84 BTOC (DRY TD)

note Location dry to total depth + well canceled due to insufficient water (CANW)

0920 crew off site 16-612309

note See p. 53 for morning activities

BM 03/13/21

16-612309

BM 03/13/21

Groundwater Level Field Form

PART 1: Well Site Information

Well Name:	Date:	Time onsite (MST):	Activity
16-612309 (surge bed monitoring well)	03/13/21	0902	Manual V for sampling

Personnel: B Morgan, A. Vigil, M Stactny, P. Munoz

Cable Length (ft):	Cable SN:
NA	NA

Telemetry: Yes / (No)	Full Transducer: Yes / (No)	Memory % remaining:	Battery % remaining:
NA	NA	NA	NA

Connect Time:	Transducer SN	Log Note Memory %:	Log Note Battery %:
NA	NA	NA	NA

Water Level (ft):	Psi:	TIC:	Stop Test: Yes / (No)	Change Desiccant: Yes / (No):
NA	NA	NA		NA

Last Start Date:	Data File Name:
NA	NA

PART 2: Manual Measurements

Measuring Point: TOC (top outer casing); TIC (inner); Stick-up Measured on Site ☐; Previous MP Used ☑

Time (MST):	0907	Water Level Meter Serial No: 782342	Notes: none, well is DRY to TD.
DTW (ft bMP):	DRY	Measurements in feet	
Time (MST):		LSD ft: 7533.65' msl	
DTW (ft bMP):		MP Height ft: + 2.83'	
Time (MST):		MP Elevation: = 7536.48' msl	
DTW (ft bMP):		DTW: - 22.84 (dry TD)	
Time (MST):	0907	Groundwater Elevation (GWE) Reference Level: DRY TD at 7513.64' msl	
TD (ft bMP):	22.84 TIC		Zip Tie on Keltm's Grip: NA

PART 3: Replacement Transducer

Transducer SN:		Calibration Date:	New LT PSI Rating:	Manufacture Date:
Memory % remaining:		Battery % remaining:		

Transducer Performance and Programming

PART 4: Transducer Error\Drift Acceptance

WL (transducer reading) (ft):	
GWE from MM:	
Difference in value:	
Error tolerance of transducer:	
Notes:	

☐ Within Error Tolerance
☐ Outside Error Tolerance

BM 03/13/21

15 PSI-0.03' 30 PSI-0.07' 100 PSI-0.23' 500 PSI-1.16 ft

PART 5: Programming & Final Readings

		Time (MST):	Reading
Programming Time:			
New Test Name:			
Reference Level:			
Current Depth:			
Meas. Interval:			
Start Date:			
Start Time:			

Synch Clocks Yes / No

QA Date and Initial: 03/13/21 [illegible]

BM 03/13/21

JA 3/14/2021

03/2021/16 Pad. Below S+N Ancho E Basin Confluence

Spring/Surface Water Sampling Field Data Sheet

Site name: Pad. below S+N Ancho E Basin **Date:** 03/16/2021 **Onsite time:** 1100

Objective: Sample per applicable SOPs + Documents **Weather:** Sunny, 40s

Sampling crew: J. Meyer, D Jaramillo, J. Anderson, NMED Kevin B.

Two-minute safety drill: Hiking Hazards, wildlife

Meters calibrated at (location) 50 SMO **by** (whom) J. Anderson **at** (time) 0800

Multimeter number: 50 **Turbidimeter serial number:** 16610 3287

Sample Retrieval **Date:** 03/16/2021 **Time:** 1120 **Method:** PP

Sample Event ID: 13528 **Sample ID Numbers:** CARA - 21-218366, 218367, 218368

FIELD PARAMETERS

pH (su): 6.62 Sp. Cond. (µS/cm): 231.70 Turbidity (NTU): 2.46

Temperature (°C): 6.7 DO (mg/L): 10.66 Q (gpm): 4.49

Explanation of Q method, including calculations: 3" modified Parshall flume 0.05 GHT

0.010 cfs = 0.010 cfs x 449.83 = 4.49 gpm Note: To convert cfs to gpm, multiply cfs by 448.83

SITE DESCRIPTION (circle all that apply)

Media type: Spring Baseflow (persistent flow)

Sample location: Bank Wading Station Gage: at / above / below

Midstream natural feature Other (specify):

Description of Sampling Site: Pool Riffle Eddy Diffuse Other

Written description: NA

Substrate: Bedrock Concrete Cobble Gravel Sand Mud

Stage Conditions: Stable, normal / low / high Falling Rising Other (specify):

Hydraulic Event: Routine Snowmelt Flood Drought Other (specify):

Stream Color: Brown Clear Green Blue Gray Other (specify):

Description of flow: Turbulent Laminar Recirculating Stagnant Other

Written description: Stream Flow / Algea Rich

Photos and GPS

GPS point #1: Name: NA Coordinates: NA Units:

GPS point #2: Name: ↓ Coordinates: ↓ Units:

Photo #1: Description: Source Facing: N Time: 1125 Taken by: J. Meyer

Photo #2: Description: Upstream Facing: W Time: ↓ Taken by: ↓

Photo #3: Description: Downstream Facing: SE Time: ↓ Taken by: ↓

Other notes: HE Spot test: Negative ; J. Anderson Preserves ; J. Meyer QA's

Offsite time: 1150 **Relinquish samples at SMO**, care of Kat Paqua at (time) 1430

Objectives met? Yes

JA 3/16/21

86

03/16/2021

JM 3/16/2021

Bulldog Spring

03/

Spring/Surface Water Sampling Field Data Sheet

Site name: Bulldog Spring **Date:** 03/16/2021 **Onsite time:** 1200

Objective: Sample per ref. docs + SOPs on pg. 3 **Weather:** Sunny, 40s

Sampling crew: J. Meyer, D. Scramillo, J. Anderson, NMED Kevin B.

Two-minute safety drill: Uneven surfaces; Radio

Meters calibrated at (location) SMO **by** (whom) J. Anderson **at** (time) 0800

Multimeter number: 50 **Turbidimeter serial number:** 16 610 3287

Sample Retrieval	**Date:** 1227 03/16/2021	**Time:** 1227	**Method:** PP

Sample Event ID: 13528 **Sample ID Numbers:** CAPA-21-218369, 218370, 218371, 218372

FIELD PARAMETERS

pH (su): 7.51	Sp. Cond. (µS/cm): 316.70	Turbidity (NTU): 6.43
Temperature (°C): 7.6	DO (mg/L): 8.92	Q (gpm): 0.13

Explanation of Q method, including calculations:

① 250mL / 30sec ② 250mL / 30sec ③ 250mL / 30sec × 60sec / 1min × 1gal / 3.785L × 1000mL / 1L = 0.13 gpm

Note: To convert cfs to gpm, multiply cfs by 448.83

SITE DESCRIPTION (circle all that apply)

Media type: (Spring) Baseflow (persistent flow)

Sample location: Bank Wading Station Gage: at / above / below

Midstream natural feature Other (specify):

Description of Sampling Site: (Pool) Riffle Eddy Diffuse Other

Written description: Pool below Source

Substrate: Bedrock Concrete Cobble (Gravel) (Sand) Mud

Stage Conditions: Stable: normal / low / high Falling Rising Other (specify):

Hydraulic Event: (Routine) Snowmelt Flood Drought Other (specify):

Stream Color: Brown (Clear) Green Blue Gray Other (specify):

Description of flow: Turbulent (Laminar) Recirculating Stagnant Other

Written description: NA

Photos and GPS

GPS point #1:	Name: NA	Coordinates: NA			Units: NA
GPS point #2:	Name: ↓	Coordinates: ↓			Units: ↓
Photo #1:	Description: Source		Facing: SW	Time: 1244	Taken by: J. Meyer
Photo #2:	Description: Up above Source		Facing: SW	Time: ↓	Taken by: ↓
Photo #3:	Description: Below source		Facing: SE	Time: ↓	Taken by: ↓

Other notes: HE Spot test Negative J. Anderson Preserves

Offsite time: 1321 **Relinquish samples at SMO**, care of Kat Pofahl at (time) 1430

Objectives met? Yes

JM 3/16/2021

Appendix B

Analytical Suites and Results
(on CD included with this document)

Appendix C

Inspection Forms

Cap and BMP Inspection Forms

Inspection Report
Corrective Measures at Consolidation Unit 16-021(c)-99

Date/Time: 9-17-2020

Report Number: 6

Weather: 55°F clear

Personnel: Caleb Craft
Ashley Kowalewska
Robert Seminario

Low-Permeability Cap Inspection

	Yes	No	Comments
Is there evidence of new settlement?		X	
Is there evidence of cracking?		X	
Is there evidence of erosion/rutting?		X	
Is there evidence of ponding?		X	
Is there evidence of burrowing animals?		X	
Is there evidence of undesirable vegetative growth?		X	
Are the slopes adequate for surface water drainage?	X		
Is there evidence of soil movement/slope instability? (example: cracks in the soil running parallel to the slope or soil sloughing)		X	- 2 ponderosa pines growing

Are there any additional conditions during the inspections that require attention?

Signature: Ashley Kowalewska

N3B Los Alamos

Inspection Report
Corrective Measures at Consolidation Unit 16-021(c)-99

Date/Time: 04/08/2021 / 4:30 pm

Report Number: 7

Weather: Partly cloudy 66° F

Personnel: M. Adam Ullom

Low-Permeability Cap Inspection

	Yes	No	Comments
Is there evidence of new settlement?		X	
Is there evidence of cracking?		X	
Is there evidence of erosion/rutting?		X	
Is there evidence of ponding?		X	
Is there evidence of burrowing animals?		X	
Is there evidence of undesirable vegetative growth?		X	Removed small Ponderosa saplings from Site.
Are the slopes adequate for surface water drainage?		X	
Is there evidence of soil movement/slope instability? (example: cracks in the soil running parallel to the slope or soil sloughing)		X	

Are there any additional conditions during the inspections that require attention?

N/A

N3B Los Alamos

Signature: M. Adam Ullom, CISec

N3B Los Alamos

Work Order BMP-87277

Ind Permit BMP Insp & Maint
Printed 8/4/2021 - 12:10 PM

Maintenance Details

Requested: 7/21/2021 9:36:16 AM
Procedure: Post Storm Control Measures Inspection Form (N3B-SOP-5002 CMI)
Last PM: 6/30/2021
Project: IP Rain Event on July 20, 2021 (P-BMP-6088)

Target: 8/3/2021
Priority/Type: Normal / Inspection

IP
RG257
V006
CDV-SMA-2

Contact:
Phone:

Reason: IP Rain Event on July 20, 2021

Special Instructions: Route 4, V006-13-0006-177-CDV2-R8.

Tasks

#	Description	Meas.	No	Yes
CONTROL MEASURE REVIEW				
20	**Established Vegetation [V00602040013]** Is BMP Operating effectively on arrival? If no, describe existing or installed backup control.		☐	☑
30	**Established Vegetation [V00602040013]** Is maintenance, modification, repair, or replacement recommended or conducted at inspection? If yes, identify maintenance type (repair, replacement, or modification) and describe the maintenance recommendation.		☒	☐
40	**Earthen Berm [V00603010006]** Is BMP Operating effectively on arrival? If no, describe existing or installed backup control.		☐	☑
50	**Earthen Berm [V00603010006]** Is maintenance, modification, repair, or replacement recommended or conducted at inspection? If yes, identify maintenance type (repair, replacement, or modification) and describe the maintenance recommendation.		☒	☐
60	**Earthen Berm [V00603010007]** Is BMP Operating effectively on arrival? If no, describe existing or installed backup control.		☐	☑
70	**Earthen Berm [V00603010007]** Is maintenance, modification, repair, or replacement recommended or conducted at inspection? If yes, identify maintenance type (repair, replacement, or modification) and describe the maintenance recommendation.		☒	☐
80	**Earthen Berm [V00603010008]** Is BMP Operating effectively on arrival? If no, describe existing or installed backup control.		☐	☑
90	**Earthen Berm [V00603010008]** Is maintenance, modification, repair, or replacement recommended or conducted at inspection? If yes, identify maintenance type (repair, replacement, or modification) and describe the maintenance recommendation.		☒	☐
100	**Earthen Berm [V00603010009]** Is BMP Operating effectively on arrival? If no, describe existing or installed backup control.		☐	☑
110	**Earthen Berm [V00603010009]** Is maintenance, modification, repair, or replacement recommended or conducted at inspection? If yes, identify maintenance type (repair, replacement, or modification) and describe the maintenance recommendation.		☒	☐
120	**Earthen Berm [V00603010010]** Is BMP Operating effectively on arrival? If no, describe existing or installed backup control.		☐	☑
130	**Earthen Berm [V00603010010]** Is maintenance, modification, repair, or replacement recommended or conducted at inspection? If yes, identify maintenance type (repair, replacement, or modification) and describe the maintenance recommendation.		☒	☐
140	**Rip Rap [V00604060003]** Is BMP Operating effectively on arrival? If no, describe existing or installed backup control.		☐	☑
150	**Rip Rap [V00604060003]** Is maintenance, modification, repair, or replacement recommended or conducted at inspection? If yes, identify maintenance type (repair, replacement, or modification) and describe the maintenance recommendation.		☒	☐
160	**Rock Check Dam [V00606010002]** Is BMP Operating effectively on arrival? If no, describe existing or installed backup control.		☐	☑
170	**Rock Check Dam [V00606010002]** Is maintenance, modification, repair, or replacement recommended or conducted at inspection? If yes, identify maintenance type (repair, replacement, or modification) and describe the maintenance recommendation.		☒	☐

180	**Rock Cap [V00608020012]** Is BMP Operating effectively on arrival? If no, describe existing or installed backup control.		☐	☑
190	**Rock Cap [V00608020012]** Is maintenance, modification, repair, or replacement recommended or conducted at inspection? If yes, identify maintenance type (repair, replacement, or modification) and describe the maintenance recommendation.		☒	☐

MAP REVIEW

210	Have you changed the location of a BMP on the Site Map?		☒	☐
220	Have you ammended the Site Map in any other way?		☒	☐

SMA and SITE REVIEW

240	Is there evidence of floatable waste, floatable garbage, or floatable debris within the SMA that could be discharged to receiving waters?		☒	☐
250	Is there evidence of dust generation or evidence of off-site vehicle tracking of raw, final, or waste materials or sediments?		☒	☐
260	Is there evidence of the introduction of raw, final, or waste material to the SMA?		☒	☐
270	Has there been a significant increase in erosion potential at the SMA since the last inspection?		☒	☐
280	**Industrial or sanitary wastewater treatment at 16-260 [16-021(C)]** Has there been an increase in erosion potential at the Site since the last inspection?		☒	☐

Labor

Labor	Work Date	Reg Hrs	OT Hrs	Other Hrs
Jonathan Romero	7/22/2021	1	0	0
Shendo, Maurice	7/22/2021	1	0	0

Labor Report

Completed: 7/22/2021 8:20:52 AM

Report:

Images

Appendix D

Surge Bed Monitoring Well Transducer Data
(on CD included with this document)

Appendix E

Mann-Kendall Trend Analysis

Analytical data used for statistical analysis at Technical Area 16 (TA-16 260) monitoring group locations were pulled from the Environmental Information Management (EIM) database as described below.

The following data were included:

- Regular (REG) and field duplicate (FD) results
- Sample type WG (groundwater) results
- Best value Y (yes) results

The following data were excluded:

- Laboratory quality assurance/quality control (QA/QC) results, field trip blank (FTB), field blank (FB), performance equipment blank (PEB), and equipment rinsate blank (EQB) results
- Results that are not representative or are of questionable representativeness as qualified by sample type W (i.e., waste characterization sampling of development purge water, aquifer testing, or sampling qualified as reducing conditions)
- Sample type WS (base-flow) results
- Best value N (no) results
- Data that are R-qualified (results rejected and thus unusable because of analytical problems and/or noncompliance with QA/QC criteria during independent validation)

If a regular sample and FD sample were collected during the same sampling event at a specific location, an average of the results was calculated and used in statistical analysis. No other results were averaged and therefore, seasonality is not included in the analysis.

Mann-Kendall trend analysis of Royal Demolition Explosive (RDX) and barium trends was performed, as appropriate, using the statistical program ProUCL Version 5.1.002 (EPA 2015, 601724; EPA 2015, 601725). The Mann-Kendall analysis is a nonparametric test in which the probability distribution of the data is not assumed and therefore is valid for any probability distribution. The analysis does not require a time or event interval, and the concentrations are ordered by measurement dates and assigned a generated index. The Mann-Kendall test statistic, M-K test value (S), compares sample concentrations with each subsequent measurement, and all distinct pairs of data are considered. The tabulated critical levels, tabulated *p*-values, determine the lowest value for which the null hypothesis would be rejected using the sample results. Statistical significance of an increasing or decreasing trend is determined by comparing the M-K test value (S) with the tabulated *p*-value; however, the test does not determine the magnitude of the trend. The Mann-Kendall trend analysis was performed using a confidence level of 95%. This user-defined level is the most commonly used as well as the default setting within ProUCL Version 5.1.002.

The trend analysis was performed using the statistical methods described in the ProUCL technical guidance (EPA 2015, 601724) and in Chapter 14 of the “ProUCL Version 5.1 User Guide” (EPA 2015, 601725). Figures E-1 through E-6 present the analysis results.

REFERENCES

The following reference list includes documents cited in this report. Parenthetical information following each reference provides the author(s), publication date, and ERID, ESHID, or EMID. ERIDs were assigned by Los Alamos National Laboratory's (the Laboratory's) Associate Directorate for Environmental Management (IDs through 599999); ESHIDs were assigned by the Laboratory's Associate Directorate for Environment, Safety, and Health (IDs 600000 through 699999); and EMIDs are assigned by Newport News Nuclear BWXT-Los Alamos, LLC (IDs 700000 and above).

EPA (U.S. Environmental Protection Agency), October 2015. "ProUCL Version 5.1.002 Technical Guide," Statistical Software for Environmental Applications for Data Sets with and without Nondetect Observations, EPA/600/R-07/041, Office of Research and Development, Washington, D.C. (EPA 2015, 601724)

EPA (U.S. Environmental Protection Agency), October 2015. "ProUCL Version 5.1.002 User Guide," Statistical Software for Environmental Applications for Data Sets with and without Nondetect Observations, EPA/600/R-07/041, Office of Research and Development, Washington, D.C. (EPA 2015, 601725)

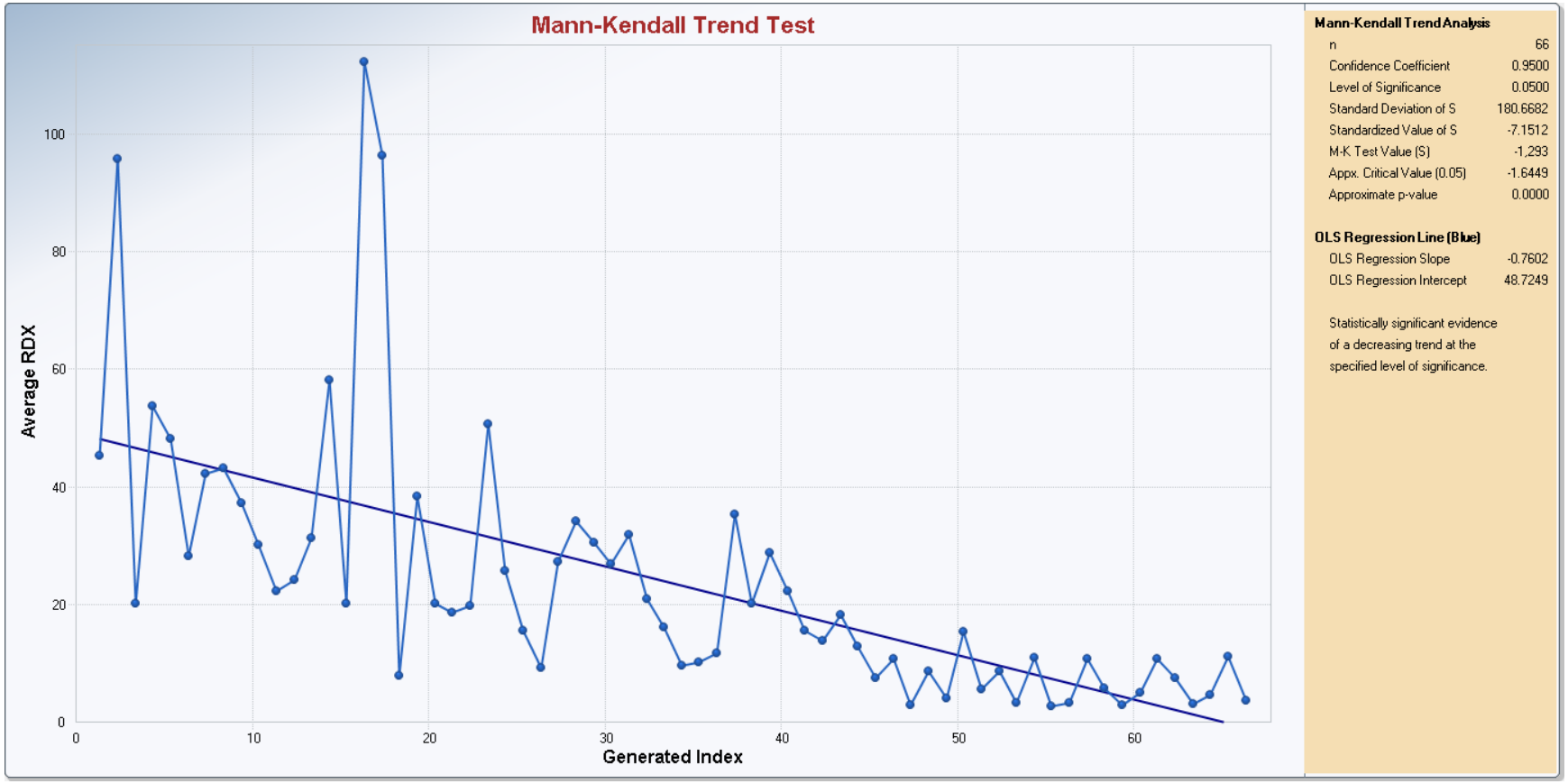


Figure E-1 CdV-16-02659 RDX Mann-Kendall trend analysis results

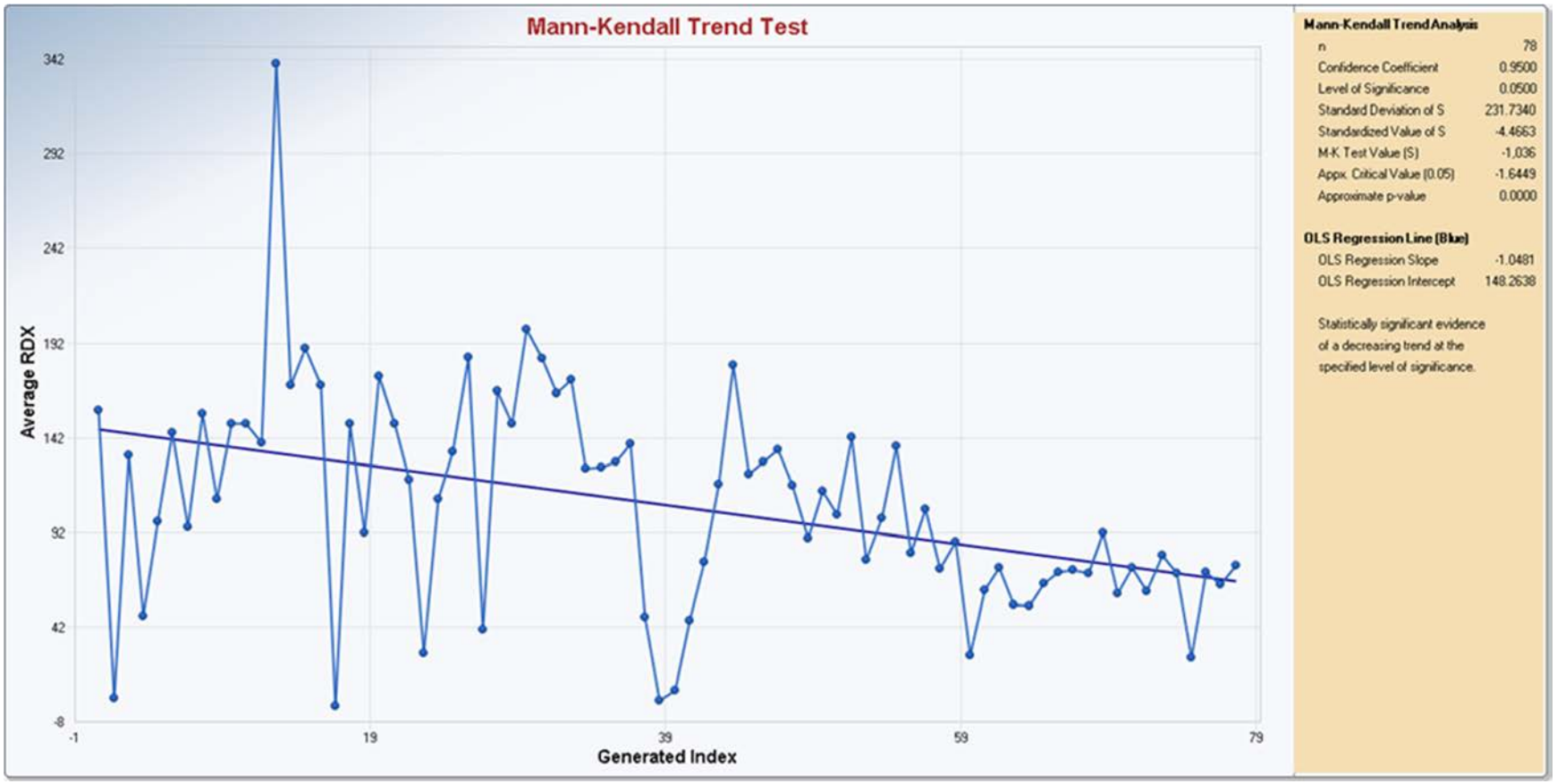


Figure E-2 Martin Spring RDX Mann-Kendall trend analysis results

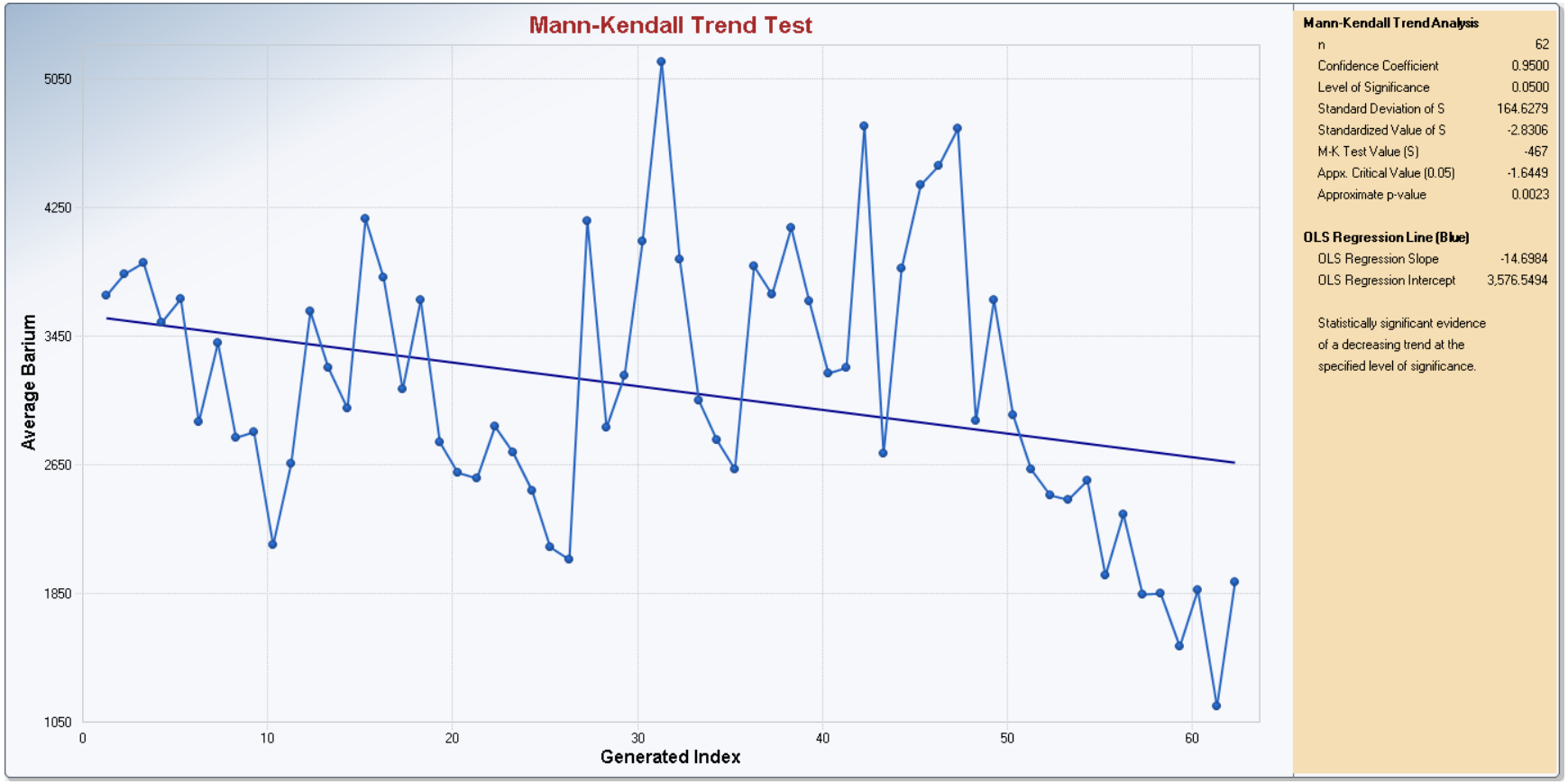


Figure E-3 CdV-16-62656 barium Mann-Kendall trend analysis results

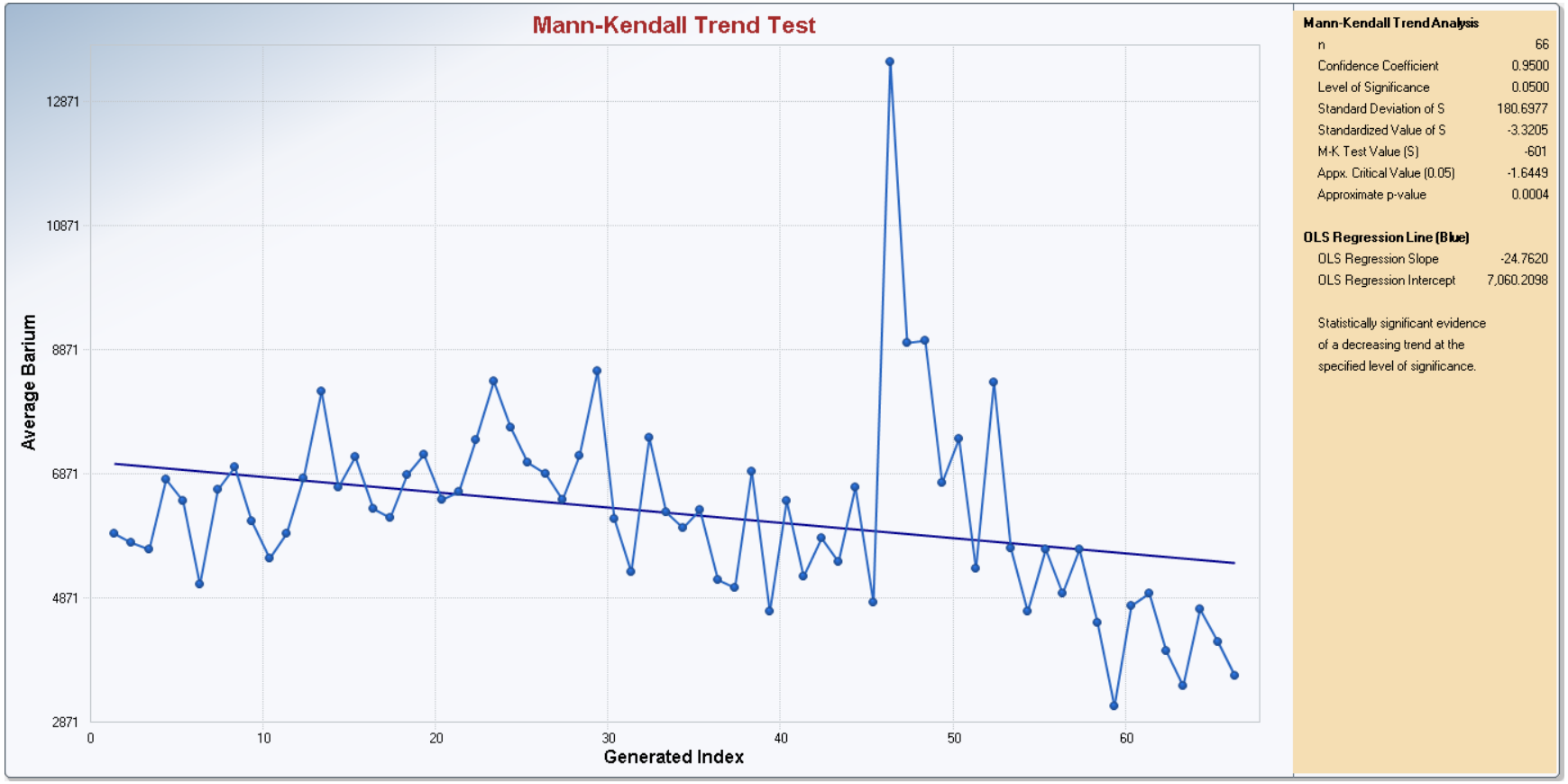


Figure E-4 CdV-16-02659 barium Mann-Kendall trend analysis Results

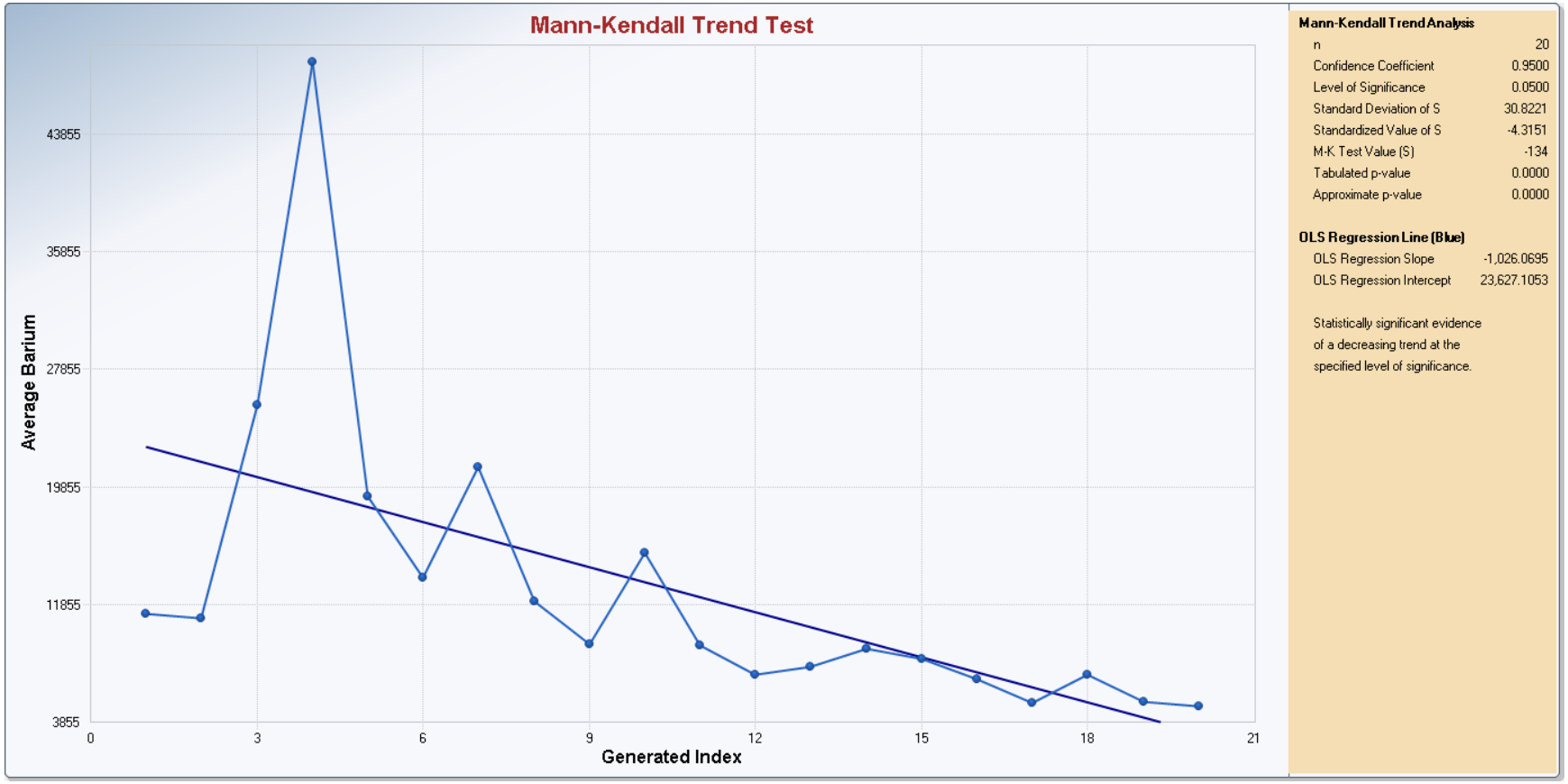


Figure E-5 CdV-16-611923 barium Mann-Kendall trend analysis results

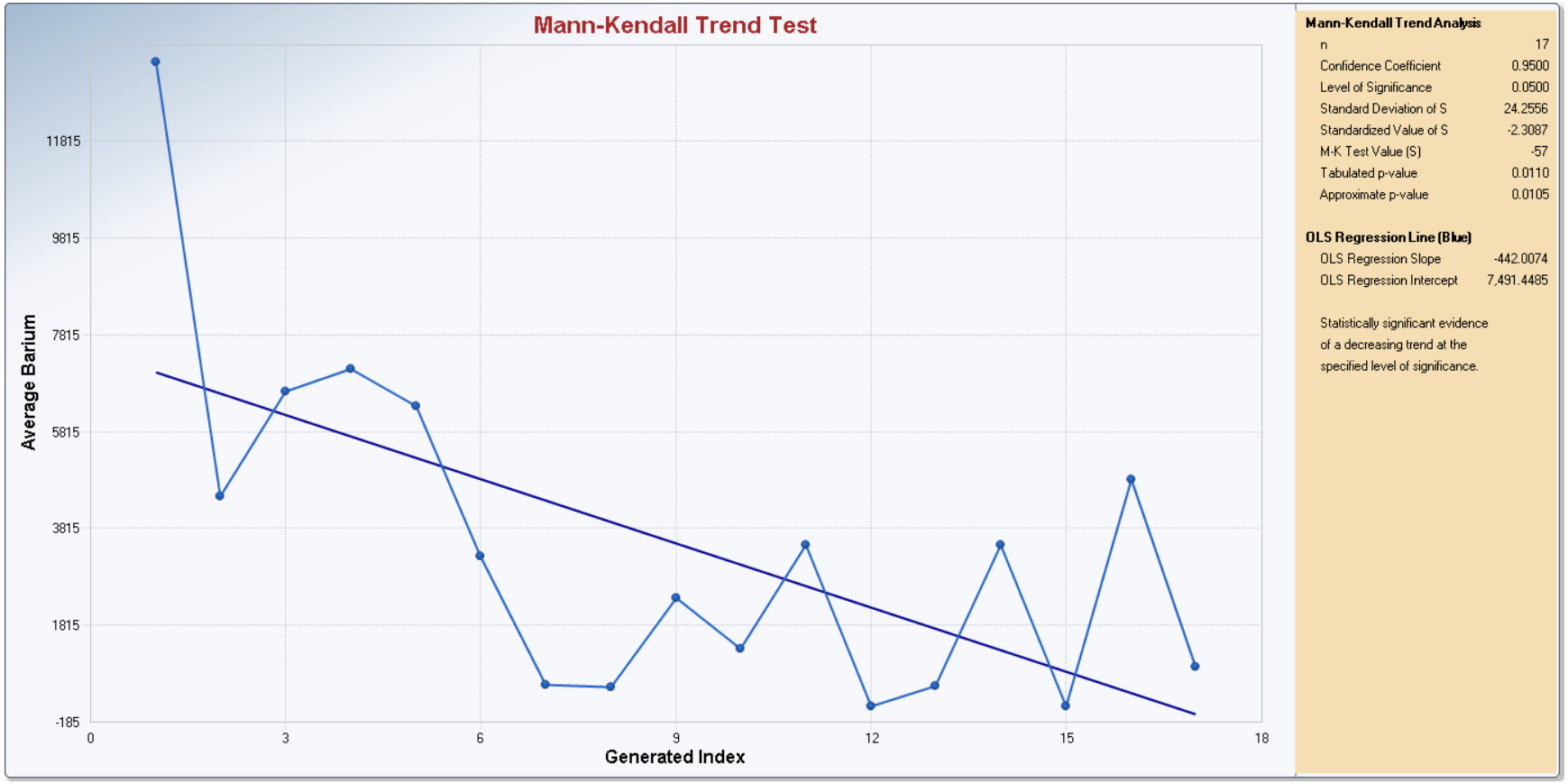


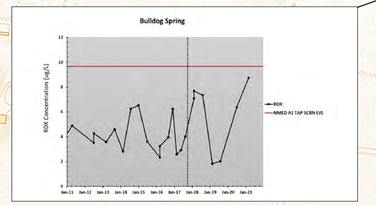
Figure E-6 CdV-16-611937 barium Mann-Kendall trend analysis results

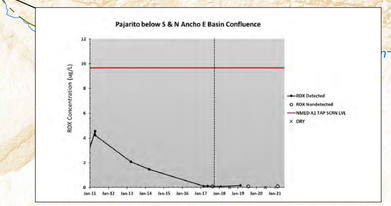
1612000 1613000 1614000 1615000 1616000 1617000 1618000 1619000 1620000 1621000

1767000 1766000 1765000 1764000 1763000 1762000

Pajarito below S&N Ancho E basin confluence

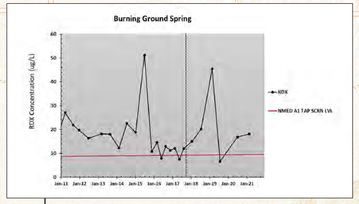
Bulldog Spring

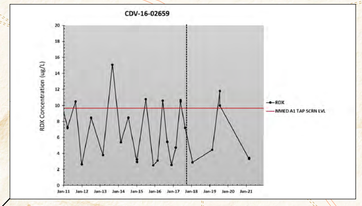


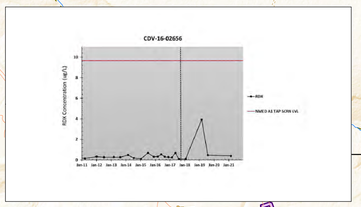


Arroyo de La Delfe

T A - 0 9







CdV-16-02656

SWSC Spring

Burning Ground Spring

CdV-16-611923

16-61439 (PRB Alluvial Seep)

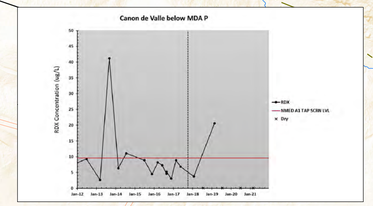
CDV-16-611937

CdV-16-02659

Cañon de Valle below MDA P

Three-Mile Canyon

T A - 1 4



Canon de Valle

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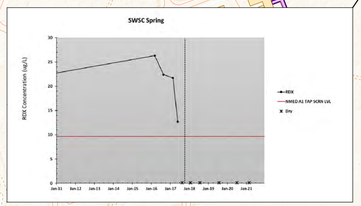
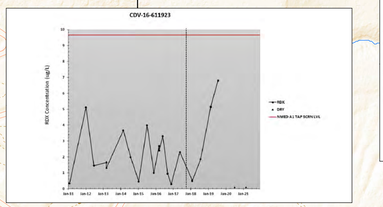
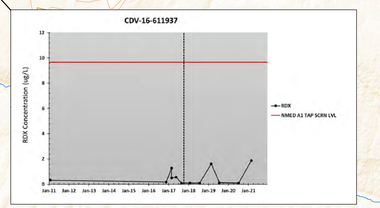
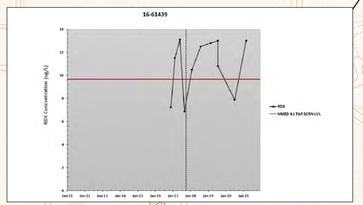


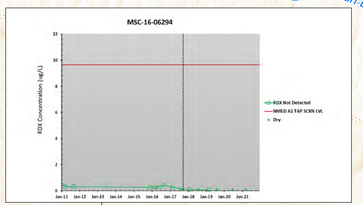




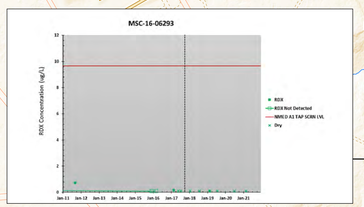


T A - 1 6

Fish Ladder Canyon



Martin Spring



S-Site Canyon

MSC-16-06293

MSC-16-06294

New Mexico State Plane Coordinate System Central Zone (3002)
North American Datum, 1983 (NAD 83)

US Survey Ft

GIS: Dave Frank, david.frank@em-la.doe.gov, 551-2945
Created: 22-August-2018
Last Opened: Wednesday, May 18, 2022

File: map_14-0080-50_canon_de_valle_RDX_april_2022

DISCLAIMER: This map was created for work processes associated with the LLCC. All other uses for this map should be confirmed with N3B staff.

0 250 500 1,000
Feet

Plate 1 RDX concentrations across the canyons

- Base-flow location
- Alluvial well location
- Spring
- PRB cutoff wall
- Connector piping
- Drainage channel
- TA boundary
- Unpaved road
- Paved road
- Structure
- TA-16 260 Outfall

Note: all data points represent post 2011 remediation activities

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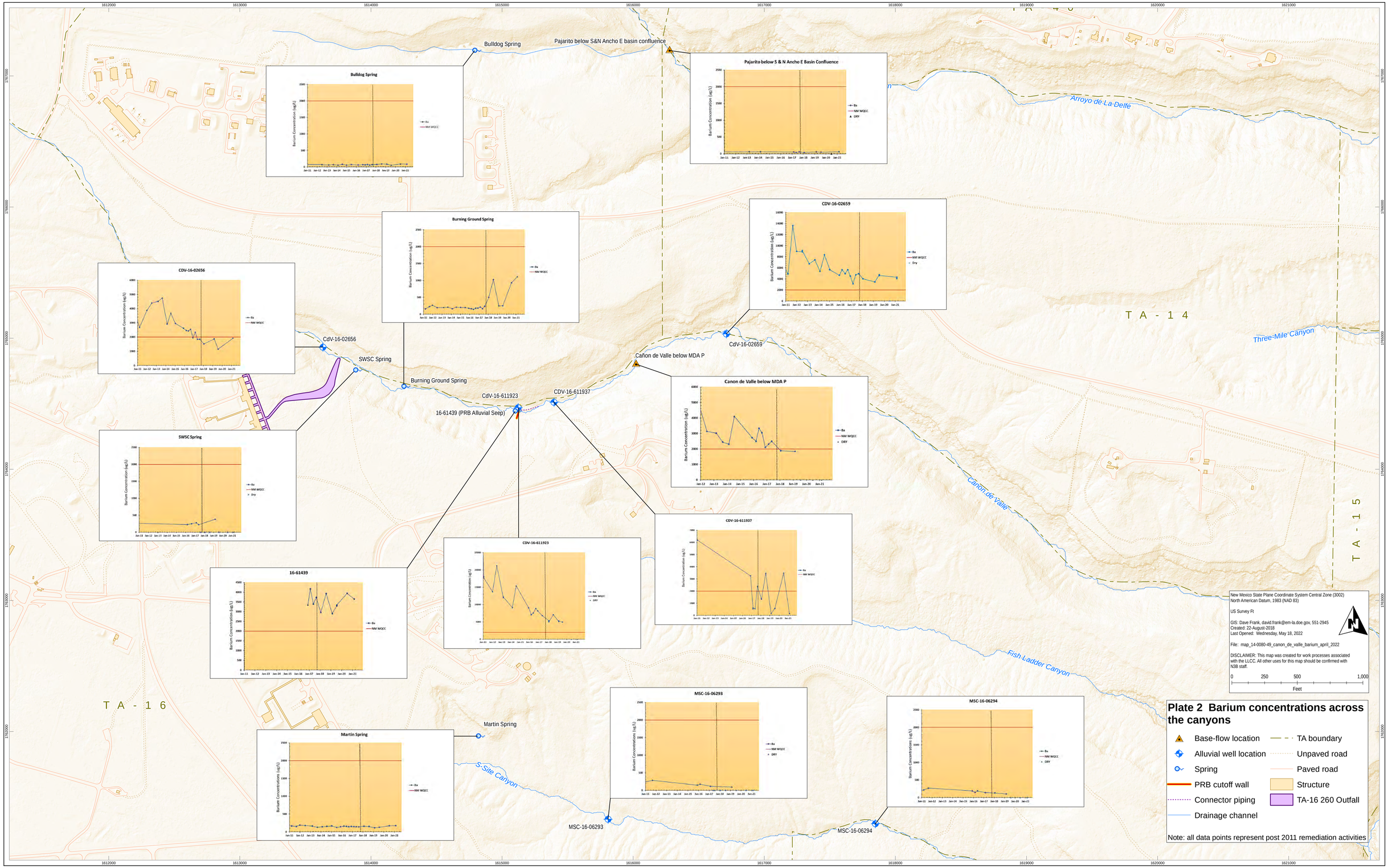

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