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

EMLA-23-BF145-2-1

April 17, 2023

Mr. Rick Shean
Acting 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 2022 Monitoring Report and 2023 Monitoring Plan for Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project

Dear Mr. Shean:

Enclosed please find two hard copies with electronic files of the "2022 Monitoring Report and 2023 Monitoring Plan for Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project." Please note that the 2022 monitoring report and 2023 monitoring plan are combined in a single document for the 2023 submission. The annual monitoring report assesses overall performance of the mitigation efforts installed in the Los Alamos and Pueblo watershed since 2007. The evaluation of precipitation, stormwater discharge, and constituent concentrations obtained in 2022 were used to determine the effects of mitigations installed.

The objective of the monitoring plan is to evaluate the effects of mitigation measures undertaken in the Los Alamos and Pueblo watershed under the New Mexico Environment Department– (NMED-) approved "Interim Work Plan to Mitigate Contaminated Sediment Transport in the Los Alamos and Pueblo Canyons."

NMED approved the "2021 Monitoring Report for Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project" and the "2022 Monitoring Plan for Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project" on July 1, 2022.

Pursuant to Section XXIII.C of the Compliance Order on Consent, the U.S. Department of Energy Environmental Management Los Alamos Field Office (EM-LA); Newport News Nuclear BWXT-Los Alamos, LLC (N3B); and NMED met in a pre-submission review meeting on December 22, 2022, to discuss the 2022 monitoring report and the 2023 monitoring plan.

If you have any questions, please contact Amanda White at (505) 309-1366 (amanda.white@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: 2023.04.13 13:55:42 -06'00'

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

Enclosures:

1. Two hard copies with electronic files – 2022 Monitoring Report and 2023 Monitoring Plan for Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project (EM2023-0142)

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
Steven Lynne, Los Alamos County, Los Alamos, NM (2 copies)
Rick Carpenter, City of Santa Fe, NM
Aaron Rand, City of Santa Fe, NM
Nancy Long, BDD
Steve Yanicak, NMED-DOE-OB
Cheryl Rodriguez, EM-LA

cc (letter emailed):
Jennifer Payne, LANL
Stephen Hoffman, NA-LA
William Alexander, N3B
Daria Cuthbertson, N3B
Michael Erickson, N3B
Audrey Krehlik, N3B
Kim Lebak, N3B
Karly Rodriguez, N3B
Troy Thomson, N3B
Jennifer von Rohr, N3B
Amanda White, N3B
M. Lee Bishop, EM-LA
Michael Mikolanis, EM-LA

emla.docs@em.doe.gov
n3brecords@em-la.doe.gov
Public Reading Room (EPRR)
PRS website

April 2023
EM2023-0142

2022 Monitoring Report and 2023 Monitoring Plan for Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project

N3B Los Alamos

EM2023-0142

2022 Monitoring Report and 2023 Monitoring Plan for Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project

April 2023

Responsible program manager:

Printed Name	Signature	Title	Organization	Date
Amanda White	[signature]	Senior Manager	Water Program	4/10/2023

Responsible program director:

Printed Name	Signature	Title	Organization	Date
Michael Erickson	[signature]	Program Director	Water Program	4/10/2023

Responsible N3B representative:

Printed Name	Signature	Title	Organization	Date
Troy Thomson	[signature]	Program Manager	N3B Environmental Remediation Program	4/10/2023

Responsible DOE EM-LA representative:

Printed Name	Signature	Title	Organization	Date
Arturo Q. Duran	ARTURO DURAN Digitally signed by ARTURO DURAN Date: 2023.04.13 13:56:14 -06'00'	Compliance and Permitting Manager	Office of Quality and Regulatory Compliance	

EXECUTIVE SUMMARY

This thirteenth annual monitoring report provides a summary of analytical data, discharge measurements, geomorphic changes, vegetation changes, and precipitation data associated with stormwater samples collected from the Los Alamos/Pueblo (LA/P) watershed from May to November 2022. Monitoring objectives include collecting data to evaluate the effect of watershed mitigations installed in the LA/P watershed on stream flow and sediment and contaminant transport. Watershed mitigations evaluated include the Delta Prime (DP) Canyon grade-control structure (GCS) and associated floodplains; the Pueblo Canyon drop structure, willow planting, wetland, and GCS; the Los Alamos Canyon low-head weir and associated sediment detention basins; and the stormwater detention basins and vegetative buffer below the Solid Waste Management Unit 01-001(f) drainage in Los Alamos Canyon. Pursuant to Section VII of the 2005 Compliance Order on Consent (Consent Order), Los Alamos National Laboratory (the Laboratory) had implemented interim measures to reduce the migration of contaminants within the LA/P watershed. These mitigations have been implemented with the overall goals of minimizing the potentially erosive nature of stormwater runoff, enhancing deposition of sediment, and reducing access of contaminated sediments to stormwater. The submission of this annual report to the New Mexico Environment Department is in accordance with the 2016 Consent Order.

Gaging station and sampling locations within the LA/P watershed monitor the hydrology and sediment transport, including stations that bound the mitigation sites. Stage/discharge is monitored at 5-min intervals at 14 gaging stations, while stage is monitored at one gaging station. Precipitation data are collected across the Laboratory by means of 5 meteorological towers and an extended network of 14 precipitation gages. Sampling for analytical suites specific to each reach of the watershed is conducted using portable automated samplers. Sampling equipment and the extended rain gage network are deactivated during the winter months (December to April) and reactivated in the spring.

Attenuation of flow and associated sediment transport are primary goals of the sediment transport mitigation activities. Decreasing flow velocity allows for increased infiltration, thus reducing peak discharge, reducing the distance the flood bore travels downstream, and reducing the distance sediment and associated contaminants entrained in the stormwater travel downstream. The 2022 monitoring season is characterized by the United States Drought Monitor as a period that began in extreme drought in the LA/P watershed and surrounding areas, decreasing in severity during the season to severe drought in June, to moderate drought in July, and abnormally dry from August through the end of the year. Ten precipitation events generated sufficient flows above sampler trip levels to collect samples at gaging stations during the monitoring season. The 2022 monitoring data in the LA/P watershed indicate that, in general, the mitigations are performing as designed.

Prior to 2018, the method for detecting geomorphic change over the LA/P watershed was biennial aerial-based surveys, e.g., light detection and ranging (LiDAR), plus annual ground-based Global Positioning System survey methods. In 2018, the method was changed to triennial aerial-based LiDAR surveys. The initial triennial LiDAR survey was performed in 2018, and the second survey was performed in 2021. Comparison of the results of these surveys detected only minor geomorphic change in Pueblo, DP, and Los Alamos Canyons between 2018 and 2021, indicating that the watershed mitigations are performing as designed.

Prior to 2019, vegetation changes in the LA/P watershed were analyzed using ground-based survey methods. In 2019, this method was replaced by triennial aerial-based hyperspectral image collections (similar to LiDAR). The initial baseline hyperspectral imagery survey was performed in 2019, and the first triennial survey was performed 3 yr later, in 2022. Comparison of the data from these surveys revealed notable species composition change within the wetland, mostly as decreases in canary reed grass and willow populations and increases in a newly observed overstory species. The 2020–2021 drought and

grazing of feral cattle are believed to be the primary drivers of these changes. Additional evaluations of vegetation health, and height revealed minimal change, and the absence of any significant geomorphological change suggests that the wetland remains in a stable condition.

Continued monitoring in 2023 is expected to confirm that the sediment-transport mitigations in the LA/P watershed are performing as designed.

CONTENTS

Figures

Tables

Appendices

1.0 INTRODUCTION

Los Alamos National Laboratory (LANL or the Laboratory) is a multidisciplinary research facility owned by the U.S. Department of Energy (DOE) and managed by Triad National Security, LLC. The Laboratory is located in north-central New Mexico approximately 60 mi northeast of Albuquerque and 20 mi northwest of Santa Fe. The Laboratory site comprises an area of approximately 36 mi^2, mostly on the Pajarito Plateau, which consists of a series of mesas separated by eastward-draining canyons. It also includes part of White Rock Canyon along the Rio Grande to the east.

This thirteenth annual monitoring report summarizes analytical data, discharge measurements, and precipitation data associated with stormwater collected from the Los Alamos and Pueblo (LA/P) watershed from May to November 2022; details geomorphic change between 2018 and 2022 at the sediment transport mitigation sites in the LA/P watershed; presents vegetative change between 2019 and 2022 in the Pueblo wetlands; and documents watershed mitigation inspections in 2022. Section 6 of this report is the LA/P watershed monitoring plan for calendar year 2023. The LA/P monitoring plan has previously been a separate document. Appendix A includes acronyms and abbreviations. Appendix B addresses geomorphic change between 2018 and 2022 and vegetation change between 2019 and 2022, and Appendix C provides photographic documentation of watershed mitigation inspections. Appendix D (on CD included with this document) presents analytical results and gaging station stage and discharge data. This monitoring was initially stipulated by the New Mexico Environment Department (NMED) approval with direction for the "Los Alamos and Pueblo Canyons Supplemental Investigation Report," which states that "The Permittees must install surface water monitoring stations below each newly-installed weir and develop a monitoring plan to evaluate each weir's effectiveness" (LANL 2005, 091818; NMED 2007, 098284). Subsequent proposed mitigation and monitoring efforts were identified and implemented per the approved "Interim Measure Work Plan to Mitigate Contaminated Sediment Transport in Los Alamos and Pueblo Canyons" (hereafter, the IMWP) (LANL 2008, 101714; NMED 2008, 103007) and the approved "Supplemental Interim Measures Work Plan to Mitigate Contaminated Sediment Transport in Los Alamos and Pueblo Canyons" (hereafter, the SIMWP) (LANL 2008, 105716; NMED 2009, 105014). Monitoring in 2022 was performed in accordance with the "2021 Monitoring Report and 2022 Monitoring Plan for Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project"

Monitoring objectives include collecting data to evaluate the effect of watershed mitigations installed in the LA/P watershed on stream flow and sediment transport; and to monitor the effect of watershed mitigations on contaminant transport within the LA/P watershed. The discussion of flow and analytical results for suspended sediment and constituent concentrations focuses on an evaluation of the overall performance of the watershed, with specific emphasis on the effects of the mitigations implemented per the IMWP and SIMWP. The discussion of geomorphic changes in Appendix B focuses on sediment stability and mobility in the watershed as a measure of the overall stability of the watershed and the performance of the sediment-mitigation structures. The discussion of vegetation change focuses on the Pueblo wetlands.

The NMED approval with modifications of the 2013 monitoring plan for sediment transport mitigation (LANL 2013, 243432; NMED 2013, 523106) also directed the Laboratory to monitor stormwater above and below the detention basins below the Solid Waste Management Unit (SWMU) 01-001(f) drainage in upper Los Alamos Canyon.

Watershed mitigations evaluated in this report include the following:

- the Delta Prime (DP) Canyon grade-control structure (GCS) and associated floodplains;
- the Pueblo Canyon drop structure, willow plantings, wetland, and GCS;

- the Los Alamos Canyon low-head weir and associated sediment detention basins; and
- the stormwater detention basins and associated vegetative buffer below the SWMU 01-001(f) drainage in Los Alamos Canyon.

Work began in 2014 to rehabilitate and mitigate damage to the Pueblo Canyon wetlands, GCS, and gaging station E060.1 from the September 2013 flooding. Work accomplished in 2014 included:

- planting willows below the wetlands;
- planting canary reed grass;
- installing piezometer transects to record water levels and willow performance;
- stabilizing the local banks; and
- undertaking Phase I post-flood mitigation activities at gaging station E060.1, including armoring of the north bank directly downstream of the flume and stabilizing select banks.

Work accomplished in 2015 included:

- installing a drop structure at the Pueblo Canyon wetland headcut;
- installing gaging station E059.8 equipped with a v-notch flume;
- undertaking Phase II of gaging station E060.1 post-flood mitigations, including redirecting the channel;
- installing spurs for bank protection;
- contouring the area around the gaging station;
- installing erosion protection measures at the downstream side of both the existing Pueblo Canyon GCS and gaging station E060.1; and
- constructing an access road.

Key constituents of concern in the watershed addressed in this monitoring report include radionuclides. Corrective actions at the Laboratory are subject to the 2016 Compliance Order on Consent (Consent Order). Information on radioactive materials and radionuclides, including the results of sampling and analysis of radioactive constituents, is voluntarily provided to NMED in accordance with DOE policy.

1.1 Project Goals and Methods

The mitigations specified in the IMWP and SIMWP have been implemented with the overall goal of minimizing the potentially erosive nature of stormwater runoff to enhance deposition of sediment and to reduce or eliminate the susceptibility of contaminated sediments to flood erosion. Figure 1.1-1 shows the location of the LA/P watershed with respect to Laboratory property, and Figure 1.1-2 shows the locations of the mitigation and monitoring stations, including stream gaging stations, in the LA/P watershed. Mitigation/rehabilitation measures performed in 2014 and 2015 in response to the September 2013 flood are discussed in this report because these measures have become integral to the LA/P watershed monitoring. In the Pueblo Canyon watershed, the central focus of the mitigations is to maintain a physically, hydrologically, and biologically functioning wetland that can reduce peak flows and trap suspended sediment because of the presence of thick wetland vegetation. Stabilization and enhancement of the wetland were partially addressed with the installation of a GCS designed to inhibit headcutting below the terminus of the wetland and to promote the establishment of additional riparian or wetland vegetation beyond the current terminus of the wetland. Mitigations in upper portions of Pueblo Canyon above the wetland are designed primarily to reduce the flood peaks and to enhance channel/floodplain interaction before floods reach the wetland. Gaging stations are situated within the watershed to monitor the overall hydrology and sediment transport along the length of the watershed, including stations that bound the wetland.

In DP and Los Alamos Canyons, mitigations included stabilizing and partially burying the channel and adjacent floodplains in upper DP Canyon, which is a source of contaminants entrained in frequent floods that originate from a portion of the Los Alamos townsite. A GCS was installed with a height that encourages channel aggradation, thus reducing the potential for erosion of contaminated sediment deposits in adjacent banks during floods. Channel aggradation should also encourage the spreading of floodwaters, thereby reducing peak discharge because of transmission loss within the reach and thus enhancing sediment deposition. Lower flood peaks should also reduce the erosion of contaminated sediment deposits downcanyon of the DP GCS. Mitigations in Los Alamos Canyon several kilometers below the DP Canyon confluence involve removing accumulated sediment behind the Los Alamos Canyon low-head weir to increase the residence time of floodwaters and to enhance settling of suspended sediment and associated contaminants. Sediment removal in Los Alamos Canyon was performed in April 2014 but not in 2015–2022 because not enough sediment has accumulated to warrant its removal.

Additional mitigations were implemented in Los Alamos Canyon under a separate administrative requirement (LANL 2008, 104020; NMED 2009, 105858) to address PCB contamination associated with SWMU 01-001(f). The mitigation actions at that location involved removing contaminated sediment from the hillslope and constructing detention basins and a willow-planted vegetation buffer at the bottom of the associated hillside drainage to promote the settling of PCB-contaminated sediments in runoff from the upgradient PCB-contaminated hillslope drainage. In addition, a pipeline was installed in 2015 under the National Pollutant Discharge Elimination System (NPDES) Permit NM0030759 (the Individual Permit) to divert townsite runoff around SWMU 01-001(f).

Inspections of all watershed mitigations are performed biannually and after significant flow events (greater than 50 cubic feet per second [cfs] at locations with gaging stations or greater than 0.5 in. in 30 min at locations without gaging stations). These inspections are completed to ensure the watershed mitigations are functioning properly and to identify if maintenance may be required. Appendix C contains photographs and descriptions of each inspection and associated information.

2.0 MONITORING IN THE LA/P WATERSHED

2.1 Discharge and Precipitation Measurements and Sampling Activities

Discharge was measured and surface-water sampling was attempted at 13 gaging stations in the LA/P watershed in 2022. Gaging stations with concrete, trapezoidal, supercritical-flow flumes are designated as follows:

- Los Alamos below Low Head Weir (E050.1),
- Pueblo below Grade Control Structure (E060.1),
- DP below Grade Control Structure (E039.1), and
- Los Alamos above Low Head Weir (E042.1).

Nine other gaging stations that complete the monitoring network in the LA/P watershed are designated as

- Pueblo above Acid (E055),
- South Fork Acid Canyon (E055.5),
- Acid above Pueblo (E056),
- Los Alamos below Ice Rink (E026),
- Los Alamos above DP Canyon (E030),
- DP above TA-21 (E038),
- E059.5 Pueblo below LAC WWTF (E059.5),
- E059.8 Pueblo below Wetlands (E059.8), and
- DP above Los Alamos Canyon (E040).

Two gaging stations measure stage but did not have surface-water sampling planned in 2022:

- Guaje at NM-502 (E099 stage and discharge measurement)
- Lower Los Alamos Canyon at Rio Grande (E110.7 stage measurement only)

Figure 1.1-2 shows the locations of stream gaging stations and watershed mitigations within the Laboratory's property boundary and on adjacent land owned by the County of Los Alamos.

Stage was monitored at each LA/P gaging station at 5-min intervals in the LA/P watershed. Sutron 9210 data loggers stored each recorded stage measurement as it was made. For all stations but E110.7, discharge was computed for each 5-min stage measurement using rating curves for each individual gaging station. Shaft-encoder float sensors installed in stilling wells were used to measure water levels at E050.1 and E060.1. Self-contained bubbler pressure sensors (Sutron Accubar) were used to measure water levels at E059.5 and to provide backup sensing for E050.1 and E060.1. Radar sensors were used to measure water levels at E026, E030, E038, E039.1, E040, E042.1, E055, E055.5, E056, E059.8, E099, and E110.7 and to provide backup sensing at E050.1 and E060.1.

A complete record of 5-min stage measurements for the monitoring period from June 1 to October 31, 2022, exists at E026, E030, E038, E039.1, E040, E042.1, E050.1, E055, E055.5, E056, E059.5, E059.8, E060.1, and E099. A record of 5-min stage measurements at E110.7 exists from July 27 to October 31, 2022. E110.7 was built in June and July 2022, and began reporting July 27, 2022. Appendix D (on CD included with this document) contains the 5-min gaging station stage and discharge data for the LA/P watershed.

Programs that monitor stormwater at the Laboratory use precipitation data collected at the Laboratory's meteorological towers. Figure 2.1-1 shows total precipitation for each month from 2015 to 2022, and Figure 2.1-2 shows total precipitation for each month in 2022. Both figures depict total precipitation averaged over Laboratory sites and in relation to historic totals, annual heterogeneity, and increase in precipitation, which occurs during the summer monsoon. In addition, a seasonal, extended rain gage network is deployed from April to November to coincide with stormwater monitoring periods. Stormwater monitoring stations are assigned to individual rain gages by means of a Geographic Information System (GIS) using the method of Thiessen polygons. Figure 2.1-3 presents rain gages, meteorological towers, Thiessen polygons, and the drainage area for each stream gaging station associated with the LA/P watershed.

Sampling was planned using ISCO 3700 portable automated samplers. Two ISCO samplers were installed at each of the following locations: E038, E039.1, E042.1, E050.1, E059.5, E059.8, and E060.1. At these locations, one sampler was configured with a 24-bottle carousel to monitor primarily suspended sediment, and the second sampler was configured with a 12-bottle carousel to monitor inorganic and organic chemicals and radionuclides. At the remaining locations, a single ISCO sampler was installed, configured with a 12-bottle carousel to monitor suspended sediment, inorganic and organic chemicals, and radionuclides. Sampler intake lines were set above the bottom of the channel or flume and were placed perpendicularly to the direction of flow. Trip levels (in discharge) and the dates during which the trip levels were active are presented in Table 2.1-1.

Sampling equipment at gaging stations in the LA/P watershed was shut down during the winter months and reactivated in May. Automated samplers were inspected at least monthly during the 2022 monitoring season while samplers were active. Gaging station equipment was inspected at least monthly in 2022. Inspection occurred weekly throughout the year for gaging station equipment at E050.1, E060.1, E099, and E110.7. Equipment found to be damaged or malfunctioning was repaired within 13 business days after the problem was discovered. Equipment at the 14 LA/P gaging stations was connected via telemetry to a base station, allowing real-time access to stage measurements and battery state of charge. Inspectors reviewed telemetry daily to ensure gaging stations were functioning correctly, and gaging stations and samplers were inspected in the field when telemetry readings indicated discharge had occurred or equipment problems existed. Additionally, flumes at E039.1, E042.1, E050.1, and E060.1 were inspected for sedimentation after each discharge event.

2.2 Sampling at the Detention Basins below the SWMU 01-001(f) Drainage

In 2022, one sample was collected with an automated sampler above two constructed detention basins below the SWMU 01-001(f) drainage at location CO111041. No samples were collected downgradient of the detention basins at the culvert at the terminus of the vegetative buffer below the lower basin (CO101038) because the detention basins would have to be near capacity to collect a sample. Sampling locations and stormwater control features at the detention basins below the SWMU 01-001(f) drainage are identified in Figure 2.2-1. No physical evidence of stormwater flow across the lower basin spillway was observed during post-storm inspections in 2022.

2.3 Sampling at the Gaging Stations in the LA/P Watershed

During the 2022 monitoring period (May 1 to approximately October 31), sample-triggering discharge occurred twenty-eight times. Table 2.3-1 shows precipitation totals and maximum daily discharge for storms that triggered sample attempts during the season. Table 2.3-2 indicates operational issues with sampling during the 2022 monitoring year. Table 2.3-3 shows the number of storm events that exceeded trip levels in comparison with samples collected. Samples were collected for 86% of storm events with measured discharge above trip levels. As shown in Table 2.3-4, silting from flow events at E040 on June 28 and August 11 and 23, 2022, interfered with the sampling tubing and point of zero flow (PZF) plate, and were repaired on July 6, August 23, and September 13, 2022, respectively. Because of the silting, the level of flow could not be accurately measured, and the trip level was inaccurate until sediment and silt were removed from the PZF plate; samples could also not be collected due to buried sample tubing. A dead battery at E056 on October 16, 2022, prevented data collection and transmittal until the battery was replaced on October 18, 2022. Table 2.3-5 shows the number of working days between sample collection time and sample retrieval time. All samples in 2022 were retrieved within one business day of sample collection.

No precipitation events exceeding a sample-triggering discharge occurred before May 1, 2022, or after October 31, 2022. A sampling event is defined as the collection of one or more samples from a specific gaging station during a specific runoff event. Reasons that stormwater was not collected during particular storm events are categorized and presented in Table 2.3-2. Deviations from the monitoring plan are explained more fully in section 2.5.

2.4 Samples Collected in the LA/P Watershed

Sample suites presented in the monitoring plan vary according to the monitoring location and are based on key indicator constituents as well as on requirements stipulated by NMED and per the 2017 memorandum of understanding between DOE and the Buckman Direct Diversion Board (BDDB) (DOE and BDD Board 2017, 602995) for a given portion of the watershed. Planned analyses were prioritized in the order presented in Table 2.4-1. Suspended sediment analyses were planned using American Society for Testing and Materials (ASTM) method D3977-97 from an entire sample, and were reported using the designation “suspended sediment concentration” (SSC). Analyses were planned using the analytical methods presented in Table 2.4-2. Table 2.4-1 presents the prioritization matrix that was used to guide the submission of analyses during 2022. Except at E050.1 and E060.1, where all events are monitored for all parameters, if four runoff events (defined as resultant flow of more than 1 cfs per sampling event at a particular gaging station, when 24-hr total precipitation at the associated precipitation gage exceeds 0.1 in.) have been sampled at a gaging station during the monitoring year, subsequent events with discharge less than the largest discharge of the sampled storm events will not be analyzed.

Analyses planned and analyses performed may differ during the year for several reasons, including the following:

1. Incomplete sample volumes were collected.
    a. Minimum volumes are required to obtain specified detection limits. If the volumes were insufficient, select analyses were not performed.
    b. Lowest-priority analyses are omitted when incomplete volumes are collected.
2. Samples are collected in glass or polyethylene bottles.
    a. Organic chemical analyses are conducted on samples collected in glass bottles. If insufficient volume was collected in glass bottles, analyses were not performed.
    b. Boron was analyzed as an addition to the target analyte list (TAL) metals suite, and samples were collected in polyethylene bottles. If insufficient volume was collected in polyethylene bottles, boron analyses were not ordered.

2.5 Deviations from Monitoring Plan

Instances when the stage or discharge could not be correctly measured because of damage or silting that occurred are documented in Table 2.3-4.

Battery voltage, stage, and sensor function at each active gaging station were remotely monitored daily. An on-site inspection was performed if any malfunction or sample collection event was observed. Samplers and monitoring equipment were physically inspected at least monthly during the year.

3.0 WATERSHED HYDROLOGY

The topography, geology, geomorphology, and meteorology of the LA/P watershed are quite complex and include mesas, canyons, and large elevation gradients; alluvium, volcanic tuff, pumice, and basalt; ephemeral and intermittent streams, evolving stream networks (both laterally and vertically), and sediment-laden stream discharge; winter snowfall that can create spring snowmelt; intense summer monsoonal rainfall and occasional late-summer to fall tropical storm activity; and severe spatial variability of rainfall. Consequently, monitoring of the LA/P watershed runoff is also complex and challenging.

3.1 Drainage Areas and Impervious Surfaces

The drainage area specific to each gaging station (i.e., not nested) was developed using the ArcHydro Data Model in ArcGIS, and these drainage areas are presented in Figure 2.1-3. Model inputs were developed using an elevation grid created from 1-ft light detection and ranging (LiDAR) images (a digital elevation model [DEM] from 2014) and manual site-specific controls based on field assessments. Each drainage area defines the area that drains to the particular gaging station from either the next upstream gaging station or the headwaters of the watershed.

The impervious surface area was derived from Los Alamos County's roads and structures GIS layers. Roads, parking lots, and structures were considered impervious, and the total impervious area was computed for each watershed. The total impervious area was then divided by the total area of each watershed to compute the percentage of impervious surface area. The following assumptions were made in determining the percentage of impervious surface area: because the GIS layers for roads/parking lots and structures were developed in 2009, newer impervious surfaces will not have been captured, and other impervious surfaces such as sidewalks and rock outcroppings may not have been included in the calculations. A significant factor in the frequency of discharge at each gaging station is the ratio of pervious to impervious surface area discharging to the gaging station or within the canyon drainage (Table 3.1-1).

3.2 Water and Sediment Transmission

Figure 3.2-1 is a flow diagram of the LA/P watershed showing each gaging station and the location of sediment transport mitigation sites. Figure 3.2-2 shows box-and-whisker plots of SSC for DP, Los Alamos, Acid, and Pueblo Canyons from up- to downstream over the 10 yr of monitoring from 2013 to 2022 (excluding 2020 when no samples were collected). As expected, Los Alamos Canyon had high concentrations of suspended sediment from the large flood in 2013 which resulted from the impact of the 2011 Las Conchas fire in the upper watershed. Large post-fire runoff events have tapered off since the fire, and SSC magnitudes have returned to pre-fire levels in the majority of the Canyons (upper DP, Pueblo, Acid, and in upper Los Alamos Canyon).

Sampled SSC levels in 2022 were slightly higher in Acid, lower Los Alamos, and lower DP Canyons than in previous years, and similar/slightly lower in Pueblo and upper LA and DP canyons. The higher magnitude of storm events in 2022 could also contribute to the increased SSC values, especially in the lower parts of the canyons where flows were higher than during the recent drought years. Lower SSC levels in the upper canyons and the decreasing magnitude of SSC as flows move downstream of control structures are also evidence that the sediment transport mitigations are performing as designed to manage the magnitude of SSC.

Historical observations show that SSC in Los Alamos Canyon generally decreases from E026 to E050.1, particularly after flowing through the lower Los Alamos Canyon sediment detention basins and low-head weir (between E042.1 and E050.1). SSC then increases greatly after the Guaje Canyon confluence

(E099) and decreases slightly at E109.9. Gaging station E109.9 was decommissioned after the September 2013 flood. A new flow/no-flow gaging station, E110.7, was installed in July 2022. Sampling has not been performed at E099 since 2014 because Guaje Canyon watershed is not impacted by the Laboratory. Therefore, sampling is not required as part of the LA/P monitoring efforts.

In DP Canyon, SSC generally decreases from E038 to E039.1. This is most likely because of the large percentage of impervious area in the E038 watershed, causing high-velocity, high-erodibility flows that scour the channel between the townsite and E038; while downstream, the DP Canyon floodplain area and GCS decrease the flow velocity before it reaches E039.1, causing sediment to drop out. SSC seems to increase between E039.1 and E040 (lower DP) below the floodplain area and wetlands even with decreasing flows, which is most likely due to increased impervious land cover and surfaces below the DP floodplain controls. With large storm events, DP Canyon flows join Los Alamos Canyon to increase the flow velocity and SSC measured at E042.1, while the downstream lower Los Alamos sediment detention basins and low-head weir remove sediment, reducing the SSC at E050.1. In 2022, DP Canyon samples were collected at E038 on June 27 and July 27 and at E039.1 on June 26 and 27, July 27, and August 23. A sample was collected at E040 on June 26 and 27. The July 27 storm events did not result in sample collection at E040, due to equipment malfunction. A storm event was sampled at E042.1 on July 27, but not at any other stations in Upper Los Alamos Canyon. On July 27, August 6, and August 23 flows at E050.1 resulted in sample collection, while storm events on June 27 and July 31 did not, due to equipment malfunctions and lack of prolonged trip level exceedance.

In DP Canyon, greater-than-50-cfs surveys were performed for storm events that exceeded flows of 50 cfs. Inspections are performed to document erosion or deposition occurring above, below, and at the gaging station; monitor any significant geomorphic changes to the channel; and note any erosional and sedimentational damages or changes to the channel. Any significant issues are noted, and estimates of peak flow levels and documentation of high water marks are performed. Two greater-than-50-cfs storm events occurred followed by inspections in DP canyon. The first event occurred at E038 and E039.1 on June 27, 2022; no substantial changes were noted. The second event occurred on July 27, 2022 at E038 and E039.1 (both had significant level events), and at E040, no substantial changes occurred during this event at any of the three locations.

In Acid Canyon, SSC historically decreases slightly from E055.5 to E056, likely because of the largely impervious area associated with E055.5 and the largely pervious area associated with E056. In 2022, flow was not large enough to sample at E055.5. Samples were collected at E056 on July 27. Samples were collected at the gaging station in upper Pueblo Canyon, above the confluence with Acid Canyon at E055, on June 26 and August 5. Storm events did not result in sample collection at E055 on June 27 and July 27 because a previous sample had not yet been collected and sampler trigger criteria had not been met.

Gaging station E059.5 is located in lower Pueblo Canyon below the confluence with Acid Canyon and after other inputs from other tributaries. In 2022, the trip level at E059.5 was adjusted throughout the season as base flow changed. Five samples were collected at E059.5, on June 25 and 27, July 26 and 27, and August 11. Storm events on June 26, July 31, and August 5 did not result in sample collection due to the previous sample not yet having been collected and equipment malfunction. From E059.8 to below the GCS at E060.1, SSC increased significantly in 2015. Between 2016 and 2020, and again in 2022, flows were not large enough to collect a sample at E060.1. A sample was collected at E059.8 on July 31, 2022.

Hydrographs for runoff events with flows that exceeded sample trip levels in 2022 are presented in Figure 3.2-3 for Los Alamos, DP, and Acid/Pueblo Canyons from upstream to downstream. Table 3.2-1 summarizes the flood bore transmission downstream across the major sediment transport mitigation structures, including travel time of flood bore from upstream to downstream gaging station, peak discharges of the flood bore at the gaging station, and the percent reduction in peak discharge between the stations for every sampled runoff event in 2022. The flood bore is defined as the leading edge of the storm hydrograph as it transmits downstream, and peak discharge is the maximum 5-min instantaneous flow rate measured during a flood. Peak discharge is related to stream power, and in ephemeral streams in semiarid climates, the greater the stream power, the greater the erosive force, and hence the greater the sediment transport (Bagnold 1977, 111753; Graf 1983, 111754; Lane et al. 1994, 111757). As flood bores move from up- to downstream, peak discharge can either increase by means of alluvial groundwater and/or tributary contributions or decrease because of transmission losses (infiltration).

Figure 3.2-4 shows the hydrograph and sedigraph for gaging stations E038, E039.1, E042.1, E050.1, E059.5, and E059.8. Figure 3.2-5 shows the hydrograph and sedigraph for E038 and E039.1, and E042.1 and E050.1, when samples were collected from the same storm event. These figures are from events that sampled through all or most of the duration of a runoff event plotted as time after the peak. Typically, SSC decreases through the hydrograph as energy dissipates and is highly correlated with discharge. The E059.5 hydrograph and sedigraph during the June 25 and June 27, and E059.8 during July 31 runoff events show that SSC did not significantly decrease on the trailing limb of the storm event. These were either low magnitude, or back to back events resulting in long-duration storm events where sampling finished before peak flows had subsided.

Figure 3.2-6 shows the relationship between SSC-based sediment yield and runoff volume during the past 10 yr of monitoring, 2013 to 2022 (excluding 2020 when no samples were collected). Figure 3.2-7 shows the linear relationship between sediment yield and peak discharge during the past 10 yr of monitoring, which is not as robust/strong as the relationship between sediment yield and runoff volume as shown in Figure 3.2-6. Table 3.2-2 presents the 2013 through 2022 sediment yield and runoff values shown in Figures 3.2-6 and 3.2-7. Although SSC and instantaneous discharge are not always highly correlated (because of localized precipitation, sediment availability, or antecedent conditions), the linear relationship between sediment yield and runoff volume is well established (Onodera et al. 1993, 111759; Nichols 2006, 111758; Mingguo et al. 2007, 111756).

The runoff volume for each event was computed as follows:

$$V = \sum_{i=0}^{n} Q(t_i)(t_{i+1} - t_i), \qquad \textbf{Equation 1}$$

where n = the number of instantaneous discharge measurements taken throughout the runoff event,

t_i = the time at which an instantaneous discharge measurement is taken, and

$Q(t_i)$ = the discharge (ft^3/s) at time t_i (multiplied by 60 to convert from ft^3/s to ft^3/min).

The mass of sediment for each runoff event was computed by

$$M = \sum_{j=0}^{m} Q(t_j)(t_{j+1} - t_j)\, SSC(t_j), \qquad \textbf{Equation 2}$$

where m = the number of SSC samples taken throughout the storm event,

t_j = the time, j, at which an SSC sample is taken,

$Q(t_j)$ = the discharge (ft^3/s) at time t_j interpolated from the instantaneous discharge measurements taken at time t_j (multiplied by 60 to convert from ft^3/s to ft^3/min), and

$SSC(t_j)$ = SSC (mg/L) at time t_j (multiplied by 28.3×10^{-6} to convert from mg/L to kg/ft^3).

. The relationship between discharge and SSC is further discussed in section 4.2 of this report.

3.3 Geomorphic Changes and Vegetation Health

In 2018 and 2021, LiDAR surveys provided a detailed representation of land and surface features for both Los Alamos and Pueblo Canyon watersheds. Geomorphic change was identified by comparing LiDAR-derived Digital Elevation Models (DEMs) for both years. Results of the analysis revealed minimal geomorphic change within the LA/P watersheds, at the sediment transport mitigation sites, and within the Pueblo wetland area, demonstrating relatively stable conditions. Further details of the geomorphic change analysis can be found in Appendix B.

Airborne hyperspectral imagery was collected for the Pueblo wetland area on September 3 and 4, 2022. The imagery was ground-truthed to known locations of target vegetative species (reed canary grass, willows, and cattails) to define a spectral signature library and guide a vegetation Supervised Classification algorithm. The resulting vegetation classification, as well as Normalized Difference Vegetation Index (NDVI), and LiDAR-derived vegetation height and density data, were analyzed and compared to historical data to reveal notable vegetation change within the wetland. Details and possible drivers of vegetation change are discussed further in Appendix B.

Moving forward, aerial-based vegetation surveys will be conducted in the same year as aerial-based LiDAR surveys, with the next round currently scheduled for the fall of 2025. One significant storm event occurred on July 27, 2022 in DP Canyon where flows at E038 and E039.1 were greater than 200 cfs. Post storm event inspections indicated that no substantial geomorphic changes were noted from this event.

3.4 Impact and Efficiency of Watershed Mitigations

Below is a discussion of each watershed mitigation and the impact and efficiency of that system.

DP Canyon: In 2022, sampling was performed in DP Canyon on June 27 and July 27 above the GCS and upstream wetland (E038). Sampling below the GCS and upstream wetland (E039.1) was performed on June 26 and 27, July 27, and August 23 (Table 2.3-1). SSC analyses performed from samples collected during these runoff events allow direct evaluation of the effect of the GCS and upstream wetland on flow and sediment transport (Figures 3.4-1 and 3.2-5). Sample collection began within 5 min of the flow exceeding the sample trip levels. Sample trip levels at each gaging station are presented in Table 2.1-1 and 2.3-3. On June 27, 2022, at E038 and E039.1, the runoff event had calculated sediment yields of 3.4 yd^3 and 1.2 yd^3 respectively. On July 27, 2022 at E038 and E039.1, the runoff event had calculated sediment yields respectively, of 13.2 yd^3 and 4.8 yd^3 (Table 3.2-2). On June 26, 2022, at E039.1, the runoff event had a calculated sediment yield of 0.3 yd^3 (E038 did not sample on June 26). On August 23, 2022 at E039.1, the runoff event had a calculated sediment yield of 0.6 yd^3 (E038 did not sample on August 23). The sediment yield was reduced by 65% and 64% between these two stations, or from above to below the GCS/wetland, for the June 27 and July 27 events, respectively.

Statistics over the past 10 yr of monitoring from 2013 to 2022 (excluding 2020 when no samples were collected) are also useful in assessing performance of sediment transport mitigations performance. Figure 3.4-1 shows box-and-whisker plots for E038 and E039.1 for SSC and peak discharge. These plots show major reductions in SSC and slight reduction (depending on the year) in mean peak discharge (i.e., erosive force) over the 10 yr, which is consistent with the goals of the sediment transport mitigation activities. In 2022, the average peak discharge values from runoff events in DP Canyon were similar to prior years, and the sampled SSC values were slightly lower than recent years. Decreasing SSC values in 2022 indicate a stable system. Lowered sample trip levels in 2021 (same used in 2022) due to drought conditions prior to this summer, may also have contributed to the small decrease in SSC for sampled storm events. Where initial sampled storms were smaller in magnitude with below average erosive force and stream power to carry sediment, with this data decreasing the average SSC sampled storm events over the summer. Trip levels were increased over the summer after initial samples were collected.

Decreasing stormwater velocity allows increased infiltration, thus reducing peak discharge, as well as the distance traveled downstream by the flood bore and by sediment and associated contaminants entrained in the stormwater. Increasing infiltration reduces peak discharge but can also decrease the total volume of stormwater. In 2022, the peak discharge decreased in eight of ten measureable runoff events between E038 and E039.1, with an average decrease of 38% relative percent difference (RPD), and increased in two of ten runoff events, with an increase of 10% RPD (Table 3.2-1). The lower than normal peak discharge decrease RPD is mainly due to the above average precipitation after a multi-year drought, and also very large storm events causing above-average peak flows in DP canyon.

Pueblo Canyon: In 2022, SSC analysis was performed on the June 25 and 27, July 27, and August 11 runoff events in Pueblo Canyon above the drop structure (E059.5). These runoff events on June 25 and 27, July 27, and August 11 at E059.5 had calculated sediment yields of 0.3 yd^3, 0.5 yd^3, 7.6 yd^3, and 2.4 yd^3 respectively (Table 3.2-2). SSC analysis was also performed on the August 31 runoff event below the drop structure (E059.8), giving a calculated sediment yield of 0.1 yd^3 (Table 3.2-2). Sample collection began within 5 min of the flow exceeding the sample trip levels except at E060.1, where a liquid-level actuator is used to trigger sample collection. Sample trip levels and the changes throughout the monitoring season at each gaging station are presented in Table 2.1-1 and 2.3-3. However, no SSC data was collected below the wetland and GCS (E060.1) at any of these events (Table 2.3-1). Therefore, statistics over the past 10 yr of monitoring must be used to assess performance. Figure 3.4-1 shows box-and-whisker plots for E059.5, E059.8, and E060.1 for SSC and peak discharge. These plots indicate that mean peak discharge and SSC were effectively attenuated through the Pueblo Canyon wetland, resulting in little to no transport from the upper Pueblo/Acid watershed into lower Los Alamos Canyon. This is consistent with the goals of the sediment transport mitigation activities.

In 2022, the peak discharge decreased in all ten measurable runoff events between E059.5 and E059.8, with an average decrease of 99% RPD. The peak discharge between E059.8 and E060.1 decreased in nine of ten measureable runoff events (one peak-discharge event occurred at lower station before peak flow occurred at upper station due to a localized precipitation event) with an average decrease of 99% RPD (Table 3.2-1).

The discharge magnitude is being reduced through this area, which is a primary goal of the mitigations. Discharge is being reduced so significantly that no samples were collected at E060.1 in 2013 or 2016 through 2020 and now 2022. One sample was collected in 2021 because a liquid-level actuator is used (versus a sample trip level of 5 cfs), and the stormwater runoff was very localized and not representative of flow through the channel. In addition, SSC magnitude was reduced through the mitigation structures in 2015 and 2021.

Los Alamos Canyon: In 2022, SSC analysis was performed in Los Alamos Canyon on July 27 below the lower Los Alamos sediment detention basins and above and below the low-head weir at E042.1 and E050.1 (Table 2.3-1). Sampling was also performed below the low-head weir at E050.1 on August 23. The runoff event on July 27 had calculated sediment yields of 18.7 yd^3 at E042.1 and 1.04 yd^3 at E050.1. The runoff event on August 23 at E050.1 had a calculated sediment yield of 0.02 yd^3 (Table 3.2-2). Sample collection began within 5 min of the flow exceeding the sample trip levels, except at E050.1 where a liquid-level actuator was used to trigger sample collection. Sample trip levels at each gaging station are presented in Table 2.1-1 and 2.3-3. Figure 3.4-1 shows box-and-whisker plots for SSC and peak discharge at E042.1 and E050.1. These plots show major reductions in SSC and peak discharge, particularly in the post–Las Conchas fire years of 2012 and 2013; thus, the weir is performing as designed.

In 2022, peak discharge decreased in seven of nine measureable runoff events (one peak discharge event occurred at lower station before peak flow occurred at upper station due to a localized precipitation event) between E042.1 and E050.1, with an average decrease of 93% RPD. In one of nine measureable runoff events between E042.1 and E050.1, the peak discharge increased with an average increase of 100% RPD (Table 3.2-1), which could be due to a localized storm event resulting in flow at E050.1. Sediment trapping efficiency is expected to be higher in smaller events and events early in the season before the detention basins have filled with water. Flow is reduced through the weir and the upstream sediment detention basins, allowing sediment to settle out of suspension; thus, this mitigation feature is performing as designed.

The discharge magnitude is being reduced through this area, which is a primary goal of the mitigations. The SSC values in 2022 were slightly higher than, or similar to, the values seen in recent years below the low head weir, while they are higher values above the low head weir. This is likely due to the higher flows and increase in storm events this year, and the efficiency of the sediment control working as it should. Minor reductions in peak discharge occurred in 2013, 2016, 2018 and 2019, and 2021 and 2022 (a large event on July 27, 2022 had large reductions); while minor increases in peak discharge occurred in 2014, 2015, and 2017.

4.0 ANALYTICAL RESULTS

Appendix D (on CD included with this document) contains the analytical results for the LA/P watershed.

Analytical results meet the Newport News Nuclear BWXT-Los Alamos, LLC (N3B) minimum data quality objectives as outlined in N3B-PLN-SDM-1000: “Sample and Data Management Plan.” N3B-PLN-SDM-1000 sets the validation frequency criteria at 100% Level 1 examination and Level 2 verification of data, and at 10% minimum Level 3 validation of data. A Level 1 examination assesses the completeness of the data as delivered from the analytical laboratory, identifies any reporting errors, and checks the usability of the data based on the analytical laboratory’s evaluation of the data. A Level 2 verification evaluates the data to determine the extent to which the laboratory met the analytical method and the contract-specific quality control and reporting requirements. A Level 3 validation includes Levels 1 and 2 criteria and determines the effect of potential anomalies encountered during analysis and possible effects on data quality and usability. A Level 3 validation is performed manually with method-specific data validation procedures. Laboratory analytical data are validated by N3B personnel as outlined in N3B-PLN-SDM-1000; N3B-AP-SDM-3000, “General Guidelines for Data Validation”; N3B-AP-SDM-3014, “Examination and Verification of Analytical Data”; and additional method-specific analytical data validation procedures. All associated validation procedures have been developed, where applicable, from the U.S. Environmental Protection Agency (EPA) QA/G-8, “Guidance on Environmental Data Verification and Data Validation,” the U.S. Department of Defense/Department of Energy “Consolidated Quality Systems Manual for Environmental Laboratories,” the EPA “National Functional Guidelines for Data Validation,” and the American National Standards Institute/American Nuclear Society 41.5, “Verification and Validation of Radiological Data.”

4.1 Analytes Exceeding Comparison Values

The watershed mitigations in the LA/P watershed have been constructed to mitigate the transport of contaminated sediments, and the analytical results from monitoring are presented and evaluated within this context. The mitigation actions were not undertaken with the objective of reducing concentrations of waterborne contaminants to specific levels, and the analytical results are therefore not compared with water-quality standards or other criteria for that purpose, nor for the purpose of evaluating compliance with regulatory requirements. For this report, monitoring results are compared with water-quality standards at the request of NMED.

The New Mexico Water Quality Control Commission Standards for Interstate and Intrastate Surface Waters (20.6.4 New Mexico Administrative Code [NMAC]) establish surface-water criteria. Surface waters within Pueblo and Acid Canyons are unclassified, nonperennial waters of the state under 20.6.4.98 NMAC, with segment-specific designated uses of livestock watering, wildlife habitat, marginal warm-water aquatic life, and primary contact. The criteria applicable to the marginal warm-water aquatic life designation include both acute and chronic aquatic life criteria and the human health–organism only (HH-OO) criteria. Surface waters within Los Alamos Canyon and DP Canyon at E038 and E039.1 are classified as ephemeral and intermittent waters of the state under 20.6.4.128 NMAC, with segment-specific designated uses of livestock watering, wildlife habitat, limited aquatic life, and secondary contact. The criteria applicable to the limited aquatic life designation include the acute aquatic life criteria and the HH-OO criteria but do not include the chronic aquatic life criteria.

Water-quality criteria for total and total recoverable pollutants are compared with unfiltered surface water sample concentrations. The water-quality criterion for total recoverable aluminum is for stormwater samples filtered with a 10-µm pore size. Other water-quality criteria are for dissolved concentrations of pollutants, which are compared with stormwater samples filtered with a 0.45-µm pore size. Acute and chronic aquatic life criteria for dissolved cadmium, chromium, copper, lead, manganese, nickel, and zinc, and acute aquatic life criteria for dissolved silver, are calculated based on the hardness of each sample. Concurrent hardness values in the LA/P watershed range from 11.4 mg/L to 72 mg/L (averaging 29 mg/L) of calcium carbonate ($CaCO_3$) calculated from calcium and magnesium values for stormwater collected in 2022. Hardness-dependent metals criteria are strongly influenced by the hardness value used in the calculation, i.e., a low hardness value results in a low metals criterion and a high hardness value results in a high metals criterion. The water-quality criterion for dioxins is the sum of the dioxin toxicity equivalents expressed as 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD). In 2022, all sample pH values were between 6.5 and 9.0 Standard Units, so the hardness-dependent total recoverable aluminum criteria were applied instead of the dissolved aluminum criteria. Table 4.1-1 presents the comparison of detected analytical results from 2022 with the water-quality criteria.

The Los Alamos County townsite routes most of its stormwater and entrained pollutants into Los Alamos and Pueblo Canyons. Stormwater pollutant loading to receiving waters is derived from the decay of buildings, parking lots, roads, and automobile traffic emissions, all of which occur in a developed urban landscape and are common to urban developed landscapes throughout the developed world (Tsihrintzis and Hamid 1997, 602314; Göbel et al. 2007, 252959). Many of the structures and impervious surfaces within the Los Alamos County townsite are older and have weathered over the years, continuing to shed metals and organic compounds to Los Alamos and Pueblo Canyons adjacent to the townsite. In addition, pollutants have accumulated in sediments in canyon bottoms over time and are mobilized during storm flow events. They are commonly detected throughout the gaging station network adjacent to and downstream of the Los Alamos townsite.

A large portion of townsite runoff is routed to DP canyon, the south fork of Acid Canyon, and upper Pueblo Canyon. Most of the exceedances observed in 2022 are metals and PCBs detected at gaging stations located directly downstream from these routing pathways.

In 2022, aluminum was measured in nineteen stormwater samples collected from nine sampling locations, with seventeen aluminum exceedances of NMED's hardness-dependent acute and/or chronic aquatic life screening criteria in stormwater with results ranging from 221 to 14,800 µg/L. The result from the sample collected at E059.5 on June 25, was below the detection limit. The average detected aluminum value from eighteen 10-µm filtered aluminum samples (excluding the value from E059.5 on June 25) was 4,199 µg/L. Hardness-dependent water-quality criteria range from 70 to 2,123 µg/L.

Because hardness in stormwater runoff is typically very low, the corresponding calculated aluminum water-quality criterion is low, resulting in a greater number of exceedances. Aluminum in stormwater is representative of the natural background composition of the Bandelier Tuff (LANL 2013, 239557). On the Pajarito Plateau, much of the sediment-bound aluminum is associated with poorly crystalline silica-rich glass of Bandelier Tuff. As the tuff weathers, the glass particles and associated aluminum form sediment that accumulates, is entrained, and is then transported by stormwater runoff. In addition, aluminum is generally not problematic in runoff from developed urban landscapes on a national scale and is not associated with current or historical industrial processes within the Los Alamos County townsite.

Copper was detected in 19 stormwater samples collected from 9 sampling locations, with an average of 2.84 µg/L dissolved copper. Six of the copper results, at 4 sites (E038, E055, E056, and E059.5), exceeded water-quality criteria. The hardness-dependent aquatic life screening criteria range between 1.40 and 9.86 µg/L. To put this into perspective, the copper acute aquatic-life criteria threshold in the NPDES Individual Permit (NM0030759) is 4.3 µg/L calculated with a hardness of 30 mg/L $CaCO_3$. Copper is a component of brake pads and roofing materials, and is a common constituent in stormwater emanating from urban environments in both dissolved and colloidal form (TCD Environmental 2004, 602305). Consequently, copper exceedances are likely due to runoff from the impervious developed landscape within the Los Alamos townsite.

There were 8 dioxin exceedances out of 19 samples in 2022. The New Mexico HH-OO criterion for dioxin is 5.1E-08 µg/L. The dioxin criteria apply to the sum of the dioxin toxicity equivalents expressed as 2,3,7,8-TCDD dioxin. The average value of the eighteen detected-dioxin results in 2022 is 1.44 E-06 µg/L. For six of these detections, the dioxin concentration is driven by PCBs, as certain PCB congeners are included in the sum of dioxin toxicity equivalents expressed as 2,3,7,8-TCDD dioxin. Dioxins and furans were measured only at E042.1 and E050.1

Fourteen gross-alpha concentrations were observed above the 15-pCi/L screening level threshold out of twenty-two samples in 2022. The exceedances range from a minimum of 19.6 pCi/L to a maximum concentration of 426 pCi/L. The average detected gross alpha value (excluding values below the minimum detectable activity) was 74.1 pCi/L. Gross alpha is strongly correlated with SSC and is associated with the decay of naturally occurring uranium and thorium in the Bandelier Tuff (LANL 2013, 239557). Although there have been discharges of legacy radionuclide pollutants in the past at select locations within the Laboratory, the alpha activity of those constituents when measured by alpha spectroscopy contributes an insignificant amount of activity to the gross-alpha activity values (McNaughton et al. 2012, 254666).

Iron was detected in all 19 samples in 2022, with 9 of these samples screened to the chronic acquatic-life screening criteria based on location. The average detected iron result was 19,407 µg/L.

Lead was measured in 19 samples collected from 9 sampling locations, with 8 results that were below the detection limit. Of the 11 detections, 6 samples, at E055, E056, and E059.5, exceeded the chronic acquatic-life criteria. The average detected lead value (excluding values below the method detection limit) was 1.05 µg/L. The hardness-dependent aquatic life screening criteria range between 0.22 and 28.5 µg/L. Lead was a common component of house paint, building siding, and automobile fuel, and is commonly found in stormwater runoff from urban landscapes such as the Los Alamos County townsite on a national scale (Davis and Burns 1999, 602303; Göbel et al. 2007, 252959).

No manganese exceedances were detected in nineteen samples collected in 2022. Four results were below the detection limit; the average detected manganese result from the remaining 15 samples was 7.25 µg/L.

The one mercury exceedance out of 19 samples in 2022 was 0.966 µg/L from the E056 sample on July 27, 2022. The New Mexico wildlife habitat screening criterion for mercury is 0.77 µg/L.

There were no exceedances of radium-226 and radium-228 out of two samples collected at E050.1 on July 27 and August 23. New Mexico livestock-watering screening criteria for radium-226 and radium-228 is 30 pCi/L. The average value of the two radium-226 and radium-228 results in 2022 is 6.46 pCi/L.

Selenium was measured in 19 samples from 9 sampling locations, with 3 locations (E050.1, E042.1, and E055) where selenium exceeded water quality criteria, and eight results that were below the detection limit. The New Mexico wildlife-habitat screening criterion for selenium is 5.0 µg/L. The average of the three exceedances was 16.2 µg/L, while the average of all detected selenium values was 6.80 µg/L.

There were no zinc exceedances out of 19 samples in 2022. Two samples were below the detection limit; the average result from the 17 samples where zinc was detected was 16.5 µg/L.

Total PCB concentrations ranged from 0.00016 to 0.234 µg/L, and 17 of 19 samples exceeded the most sensitive screening level (HH-OO threshold of 0.00064 µg/L). The average PCB concentration in 2022 was 0.047 µg/L, which is greater than the urban runoff PCB median value of 0.012 µg/L, as reported in the 2012 PCB report presenting PCB concentrations in Los Alamos County stormwater runoff (LANL 2012, 219767). In addition to electrical transformer cooling fluids, PCBs were commonly used as stabilizing agents in paints, caulking, oils, hydraulic fluid, road paint, pigments, plastics, and a host of other industrial materials. The ubiquitous distribution of PCBs in an urban setting, in addition to atmospheric deposition and very low screening levels, accounts for the relatively high number of detections and exceedances in surface and stormwater emanating from developed urban landscapes in Los Alamos County (LANL 2012, 219767). In addition, PCBs have been archived in sediment and organic material that is occasionally released from the terrestrial inventory and transported in stormwater flow events to canyon bottoms.

Cadmium, silver, and thallium were not detected, or were below the analyte's minimum detection limit (MDL), for stormwater samples. The MDL for cadmium and silver exceeded the hardness-dependent criteria for some samples. The MDL for cadmium is 0.3 µg/L; the hardness-dependent screening levels ranged from 0.14 µg/L to 1.32 µg/L. The MDL for silver is also 0.3 µg/L, and the hardness-dependent screening levels for silver ranged from 0.08 µg/L to 1.8 µg/L. The thallium MDL of 0.6 µg/L is 1.3 times the human health screening level of 0.47 µg/L. More sensitive analytical methods are not available for these compounds.

A summary of 2022 analytical data is shown in Figure 4.1-1. Analytical data for parameters with exceedances of water-quality criteria are presented in Figure 4.1-2 as exceedance ratios. This ratio is defined as the analytical result divided by the applicable water-quality standard. Thus, results exceeding the standard will be greater than an exceedance ratio of 1.0.

In summary, exceedances in stormwater are associated with pollutant loadings emanating from Los Alamos County and are mainly associated with the developed urban landscape and day-to-day activities associated with vehicle traffic, and with the weathering of roads, parking lots, and structures that are in various stages of decay. The chemical signature of stormwater runoff is representative of many urban landscapes on a national scale.

4.2 Relationships between Discharge and SSC

Discharge was calculated from stage using a rating curve, which is the relationship between discharge in ft^3 per second and height of the water in feet, developed for each individual gaging station. Stage was measured at 5-min intervals and logged continuously during each sampled storm event. SSC and particle size were measured during each storm in conjunction with inorganic and organic chemicals and radionuclides.

SSC and instantaneous discharge estimates were calculated for each sample using a linear relationship between the two corresponding analytically determined SSCs, or the two corresponding physically measured discharges, as follows:

$$y = mx + b$$ **Equation 3**

where y = the calculated SSC or discharge at the time of sample collection,

m = the slope of the line,

x = the time differential in minutes between SSC sample collections or discharge measurements, and

b = the concentration of analytically determined SSC before sample analyses or corresponding physically determined discharge.

The slope is determined by dividing the difference in SSC or discharge by the difference in time (in minutes) between SSC sample collection or discharge measurements before and after analytical sample collection. This equation was used to calculate SSC and instantaneous discharge for samples collected and interpolate the gaps between known data. Where analytical results are not bounded by sediment results, the concentration of the nearest sediment result is used as an estimate of the sediment concentration at the time the sample was collected. If SSC was not measured during a storm, an estimate was not produced. The calculated SSCs and instantaneous discharges are presented in Table 4.2-1.

4.3 Relationship between SSC and Concentrations of Constituents

The projected total metals values for each sample with measured SSC analyses were planned to be calculated using equations presented in the "2015 Monitoring Report for Los Alamos/Pueblo Watershed" (LANL 2016, 601433). SSC-estimated concentrations for each metal and isotopic uranium are presented in Table 4.3-1.

4.4 Stormwater Sampling below SWMU 01-001(f)

One stormwater sample was collected at the inlet to the upper detention basin below SWMU 01-001 in 2022. Only gross alpha was measured, and the result was a non-detect. The results from 2010 through 2019 indicate that the hillslope continues to be a source of PCBs, even after sediment and rock were removed during corrective action at SWMU 01-001(f) in 2010. No samples were collected in 2020 or 2021.

5.0 CHANGES FROM THE 2021 REPORT

This report has been updated from the 2021 report based on changes that occurred in 2022. The changes are summarized as follows:

- Data for gaging station Lower Los Alamos Canyon at Rio Grande (E110.7), as well as data for existing gaging station Guaje Canyon at SR 4 (E099), were not included in the 2021 report but are included in the 2022 report.
- Appendix E, Requalification of 2012 and 2015 Polychlorinated Biphenyl Congener Data, was included in the 2021 report, but is not part of the 2022 report.

6.0 2023 MONITORING PLAN

This monitoring plan has been developed to satisfy the requirements of the NMED- approved “Interim Measure Work Plan to Mitigate Contaminated Sediment Transport in Los Alamos and Pueblo Canyons” (LANL 2008, 101714) and NMED’s “Approval with Modification, Interim Measure Work Plan to Mitigate Contaminated Sediment Transport in Los Alamos and Pueblo Canyons” (NMED 2008, 103007) and in response to NMED’s comments on previous monitoring plans (NMED 2010, 108444; NMED 2011, 203705; NMED 2013, 521854; NMED 2013, 523106; NMED 2015, 600507; NMED 2016, 601563; NMED 2017, 602504; NMED 2018, 700007; NMED 2019, 700461; NMED 2020, 700928; NMED 2021, 701517; NMED 2022, 702096), as well as the 2016 Consent Order.

Monitoring proposed within this plan is designed to satisfy four purposes:

1. Monitoring is intended to evaluate the performance of the controls installed to mitigate sediment transport. Two types of monitoring that began in 2010 are designed to meet this objective:
    a. Monitoring geomorphic changes in the canyon bottom facilitates continued evaluation of sediment control mitigation measures.
    b. Collecting and analyzing stormwater runoff samples supports assessment of the performance of sediment control measures.
2. Monitoring is intended to support the analyses requested by NMED to assess attainment of designated uses. Monitoring concentrations of dissolved metals and total recoverable metals and other pollutants, as requested by NMED in its approval of the 2010 monitoring plan (NMED 2010, 108444) and as adjusted via the annual monitoring plans, supports the determination of whether surface waters of the state are attaining designated uses.
3. Monitoring of contaminants in affected environmental media at DOE sites is required under DOE Order 458.1 Administrative Change 4, “Radiation Protection of the Public and the Environment,” and reporting is required under DOE Order 231.1B, “Environment, Safety, and Health Reporting.”
4. Monitoring is intended to satisfy requirements of the memorandum of understanding (MOU) between the DOE and the BDDB regarding water-quality monitoring (hereafter, the DOE-BDDB MOU) (DOE and BDD Board 2017, 602995). Analysis of gross beta, isotopic uranium, radium-226, and radium-228 at gaging stations E050.1 and E060.1 is being performed to support the DOE-BDDB MOU.

Stormwater and geomorphic monitoring conducted under this 2023 monitoring plan will evaluate the potential impacts of any changes that occur in the watershed and the efficacy of the mitigations over time. Figures 1.1-2 and 2.2-1 show stormwater monitoring locations and sediment control features. Before 2021, the annual monitoring plans were submitted separately from the annual report (LANL 2009, 107457; LANL 2011, 201578; LANL 2012, 222833; LANL 2013, 243432; LANL 2014, 256575; LANL 2016, 601434; LANL 2017, 602342; LANL 2018, 603015; N3B 2019, 700418; N3B 2020, 700841; N3B 2021, 701361; N3B 2022, 701997).

6.1 Monitoring Geomorphic Changes

As of 2018, LiDAR surveys for monitoring geomorphic change will be performed triennially to maintain a baseline and also after large disturbance events. Previously, ground-based bank, thalweg, and transect surveys were performed annually along with a field visit with NMED at the end of the monitoring year. The field visits were conducted to observe whether geomorphic changes occurred and what level of monitoring needed to be conducted in order to quantify the change, potentially including a new LiDAR survey. LiDAR surveys began in 2014 and repeat surveys were performed in 2015 and 2016.

A new baseline was performed in 2018, a survey was conducted in 2021, and the next LiDAR survey is planned for 2025, unless a large disturbance event occurs, in which case visual or Global Positioning System– (GPS-) based ground surveys will be performed to determine if significant geomorphic change has occurred and a LiDAR survey will potentially be performed. A field visit will be scheduled in conjunction with NMED at the end of the monitoring year to observe whether geomorphic changes have occurred and what level of monitoring needs to be conducted in order to quantify the change. If stormwater peak discharge at any gaging station in the LA/P watershed is greater than 50 ft^3 per second (cfs), the upgradient reach will be visually inspected at the end of the monsoonal period to document qualitative geomorphic changes. Biannual and greater-than-50 cfs inspections of the GCSs and detention basins will continue to be performed.

A large disturbance event has been defined for each canyon based on historical knowledge. Storm events where significant erosion or channel alterations occurred were examined, along with the associated peak discharge at the nearest gaging stations (Table 6.1-1). Based on this analysis, the discharge magnitude that has the potential to cause significant erosion was determined to be 300 cfs in Los Alamos Canyon, 250 cfs in Pueblo Canyon, and 350 cfs in DP Canyon. To simplify monitoring, a discharge of 200 cfs is used for all canyons. If discharge at one or more gaging station reaches this discharge value, it will be considered a large disturbance event that might warrant an aerial-based geomorphic and/or vegetation survey before the routine triennial survey. After a field visit is performed, if significant erosion or vegetation disturbance is observed, aerial surveys will be performed.

If events warrant, the plan for monitoring quantitative geomorphic changes via LiDAR survey is as follows. A baseline LiDAR aerial survey was performed in 2018 during which points were measured at a density at least equivalent to the 2016 LiDAR data set. The LiDAR surveys will provide a DEM of the entire active channel within each monitoring area so a comparison with the previous survey's DEM can show areas of geomorphic change. In addition, triangulated irregular networks will be developed and compared to identify areas of significant geomorphic change. If noteworthy features are identified in the LiDAR comparison, the features will be visually field-verified and additional ground-based survey methods may be implemented.

6.2 Monitoring Vegetation Changes

As of 2019, triennial airborne hyperspectral and LiDAR sensors will be performed to classify vegetation species and determine vegetation density, stand height, and spatial extent. In addition, the normalized-difference vegetation index, which is an indicator of photosynthetic activity using the red and near-infrared bands, will be computed as a measure of the health of the Pueblo Canyon wetlands, including the historical upper and lower willow-planting areas. A baseline vegetation survey was performed in 2019; the first triennial vegetation survey was conducted in 2022, and the next vegetation survey is planned for 2025.

6.3 Monitoring Stormwater Runoff

In 2023, stormwater monitoring will be conducted at 13 gaging stations (Figure 1.1-2) and 2 ungaged stations (denoted as sampling locations in Figure 2.2-1) within the LA/P watershed. No changes to monitoring locations are planned from 2022 to 2023. Gaging stations are located where they will monitor sediment transport and performance of mitigations effectively throughout each watershed. Each gaging station automatically collects stormwater runoff using ISCO samplers. Stormwater analytical suites for each gaging station are listed in Table 2.4-2.

The goal of the sampling is to collect data that

- represent spatial and temporal variations in potential contaminant concentrations and SSC in stormwater;
- allow evaluation of short- and long-term trends in contaminant concentrations, SSC, and suspended sediment yield;
- provide data to support the determination of whether surface waters of the state are attaining designated uses; and
- meet requirements of the DOE-BDDB MOU.

The monitoring strategy described below was developed to achieve these goals.

6.3.1 2023 Stormwater Monitoring Locations Inspection, Maintenance, and Sample Retrieval Plan

Stormwater monitoring at all locations proposed for 2023 will use ISCO-type automated pump samplers. Table 6.3-1 presents sampling locations and trip-level information. Two sampling locations, CO111041 and CO101038 in Figure 2.2-1, are not gaged and are located at the detention basins below SWMU 01-001(f). The sampling sequences for these locations are listed in Table 6.3-2. These sampling locations will allow evaluation of how the sediment detention basins and associated vegetative buffer below the basins are performing. These monitoring locations will be inspected following a rain event exceeding 0.25 in. in a 30-min period as recorded at the rain gage at RG055.5.

All other stormwater monitoring will occur at gaging stations. Samplers at gaging stations E050.1 and E060.1 will be activated by May 1, and samplers at all other gaging stations will be activated by June 1. Battery voltage, stage, and sensor function at each gaging station will be remotely monitored daily. Flow-measurement devices and telemetry at gaging stations E050.1 and E060.1 will be inspected at least weekly and after each flow event throughout the year. Automated samplers, flow-measurement devices, and telemetry at other gaging stations will be inspected following a discharge event with peak discharge greater than the trip level and on a rolling 30-day schedule from June 1 to October 31. The rolling 30-day schedule will ensure that gaging stations are inspected at least monthly and after sampler-trip discharge storm events. Gaging station inspections will occur monthly from November 1 to May 31. Equipment found to be damaged or malfunctioning will be repaired within 5 business days after the problem is identified. If the time to repair monitoring equipment at E050.1 and E060.1 is expected to exceed 48 hr, DOE will notify BDDB per the DOE-BDDB MOU.

Automated samplers at gaging stations will be deployed and operational on or before June 1. All sample retrievals will be attempted within 1 business day after collection. Table 2.3-5 presents the sample collection and sample retrieval working-day interval for 2023. However, sample retrieval within one business day of collection is not always feasible, such as with a sitewide storm event. If this is the case, sample retrieval will be performed using the following three-tiered priority order:

1. BDDB-related gaging stations E050.1 and E060.1;
2. Gaging stations bounding watershed mitigations at E038, E039.1, E042.1, E059.5, E059.8; and
3. Other gaging stations at E026, E030, E040, E055, E055.5, E056, CO101038, and CO111041.

Figure 6.3-1 illustrates this three-tiered approach to sample retrieval. Deviations from the planned inspection, maintenance, and sample collection objectives will be described in the 2023 Monitoring Report for Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project.

6.3.2 Stormwater Sampling and Analysis Plan

Evaluation of the performance of sediment controls will be supported by repeat analyses of SSC through each sampled storm at gaging stations above and below each watershed mitigation. Stormwater runoff sampling at E050.1, E060.1, CO101038, and CO111041 will be triggered by any detected streamflow. Because of ongoing drought conditions, trip levels for the remaining gaging stations will be set to a low value at the beginning of the season and raised after one sample has been collected (Table 6.3-1).

Four stormwater samples are planned at each of the following gaging stations: E026, E050.1, E059.5, E059.8, and E060.1. Two stormwater samples are planned at each of the following gaging stations: E030, E038, E039.1, E040, E042.1, E055, E055.5, and E056. The LA/P watershed system has been shown to be stable over the past 10 yr unless there is a large disturbance event, in which case the number of samples to be collected will be reconsidered. Stormwater runoff sampling for chemical and radiochemical analyses at all gaging stations will be triggered 10 min after the maximum discharge exceeding the sample-triggering discharge. Sampling at the detention basins below SWMU 01-001(f) will be triggered when liquid-level actuators detect water above each sampler’s intake. The chemical and radiochemical analyses will be bounded by analysis of SSC to calculate an estimate of the sediment content of each chemical and radiochemical analysis.

Analytical requirements for stormwater samples collected to satisfy the four monitoring purposes are presented in Tables 6.3-2 through 6.3-7. Samples at gaging stations will be collected using automated stormwater samplers that contain a carousel of twenty-four 1-L bottles and/or twelve 1-L bottles. Sample-collection inlets will be placed a minimum of 0.33 ft above the bottom of natural stream channels and at 0.17 ft above the bottom of supercritical flumes. The sampling approach summarized above is intended to allow characterization of suspended sediment flux and contaminant concentrations from each portion of the hydrograph consisting of

1. rapidly rising limb,
2. short-duration peak,
3. rapidly receding limb following the peak, and
4. longer-duration recessional limb following the peak.

To characterize water quality entering and leaving the sediment detention basins and adjoining vegetative buffer below the SWMU 01-001(f) drainage, automated pump samplers will collect stormwater from one location immediately upstream of sediment basin 1 and one location at the terminus of the vegetative buffer up to four times annually when stormwater discharge is occurring (Figure 2.2-1).

Analytical suites vary according to monitoring groups and are based on key indicator contaminants, NMED requests, and the DOE-BDDB MOU for portions of each watershed. Gross beta, isotopic uranium, and radium 226/radium-228 are supplemental BDDB monitoring. Dissolved organic carbon, alkalinity, and pH are investigative monitoring. All other parameters are requirements of the Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project. Table 2.4-2 shows the analytical suite for each location. The results of SSC analyses will be used to calculate the total mass/activity transported during stormwater runoff events at the gaging stations. Particle-size analyses conducted in conjunction with selected SSC analyses will support characterization of organic chemicals and radionuclides.

The list of analytical suites for each monitoring group is prioritized to guide what analyses will be conducted if the water volume collected from a storm event is not sufficient for all the planned suites (Table 2.4-1). The analytical method, expected MDL, and minimal detectable activity (MDA) (for radionuclides) are presented in Table 2.4-2. The sampling sequence for CO101038 and CO111041 is presented in Table 6.3-2. The sampling sequence for E026, E030, E055, E055.5, and E056 is presented in Table 6.3-3. Table 6.3-4 presents the sampling sequence at E038, E039.1, and E040. Table 6.3-5 presents the sampling sequence at E042.1. Table 6.3-6 presents the sampling sequence at E059.5 and E059.8. Table 6.3-7 presents the sampling sequence at E050.1 and E060.1. Additional samples beyond the required samples may potentially be submitted for chemical and radiochemical analyses at gaging stations E038, E059.5, E059.8, and E042.1 if samples are collected during an event at their paired downstream gaging stations (E039.1, E059.8, E060.1, and E050.1, respectively).

Total suspended sediment transport during a storm event is determined by sampling discharge periodically for SSC analysis throughout the hydrograph. Samples for SSC measurements will be collected at 2-min intervals for the first 30 min, then at 20-min intervals for the following 160 min if runoff is available. Repeat SSC measurements will be taken above and below the DP Canyon GCS at E038 and E039.1, above and below the Los Alamos Canyon low-head weir at E042.1 and E050.1, and above and below the Pueblo Canyon drop structure and GCS at E059.5, E059.8, and E060.1 to better characterize the performance of the structures. At these stations, a second sampler is dedicated to collecting stormwater for SSC analyses with the objective of representing most or all of the duration of runoff. Collecting SSC samples at 2-min intervals during the first 30 min allows characterization of the rapidly changing early part of the hydrograph.

6.3.3 Stage and Discharge Monitoring

Stormwater runoff (in the form of stage and discharge) at each of the gaging stations listed in Table 2.4-2 and gaging station E099 will be monitored continuously throughout the year. Stage will be monitored at gaging station E110.7 throughout the year. Rating curves are used to convert stage to discharge. Rating curves for the gaging stations are updated following channel-forming flood events.

6.3.4 Inspections of Erosion and Sediment Control Structures

Erosion and sediment control structures and monitoring stations will be inspected after storm events exceeding 50 cfs or other channel-forming flood events. Repairs will be made as necessary to ensure such structures and other stormwater mitigation features continue to function as intended.

6.3.5 Sediment Sampling and Analysis Plan

Sediment sampling is conducted annually within the LA/P watershed as part of monitoring conducted for the Annual Site Environmental Report (ASER). The results of the sediment sampling conducted in 2023 will be presented in the 2023 Monitoring Report and 2024 Monitoring Plan for Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project and the 2023 ASER.

6.4 Response to NMED Comments

The Permittees, in consultation with NMED, provided responses to NMEDs comments on the 2022 Monitoring Plan.

6.5 2023 Monitoring Plan Changes

There are no changes in monitoring from 2022 to 2023.

6.6 Reporting

Monitoring conducted as part of this 2023 monitoring plan to determine whether waters of the state are attaining designated uses and to fulfill monitoring requirements in DOE Order 450.1A (superseded by 436.1) will be reported in the 2023 Monitoring Report and 2024 Monitoring Plan for Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project. Monitoring conducted as part of this 2023 monitoring plan solely to fulfill requirements of the DOE-BDDB MOU will be made available publically in Intellus New Mexico, available at http://www.intellusnm.com/. All analytical data, stream discharge measurements, and DEM measurements collected as a result of this plan will be provided in the 2023 Monitoring Report and 2024 Monitoring Plan for Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project.

7.0 CONCLUSIONS

Attenuation of flow and associated sediment transport are primary goals of the sediment transport mitigation activities. Decreasing flow velocity allows increased infiltration, thus reducing peak discharge, reducing the distance the flood bore, sediment, and associated contaminants entrained in the stormwater travel downstream. In DP Canyon, the GCS and associated floodplains between gaging stations E038 and E039.1 facilitated a significant reduction in the suspended sediment being transported downstream. In Pueblo Canyon, the wetland, drop structure, and GCS between gaging stations E059.5 and E059.8 facilitated such a reduction in peak discharge that stormwater runoff at E059.8 and E060.1 was not large enough to sample. In Los Alamos Canyon, reductions in peak discharge, runoff volume, and sediment yield transmission downstream between E042.1 and E050.1 were attributed to the low-head weir and associated sediment detention basins between the two gaging stations. Monitoring data in the LA/P watershed indicate that, in general, the mitigations are performing as designed.

In 2018, triennial aerial-based LiDAR surveys replaced biennial aerial-based LiDAR surveys plus annual ground-based GPS surveys for monitoring of geomorphic change. In 2018 and 2021, LiDAR was flown over the LA/P watershed and the land surface data from the two surveys were compared to identify geomorphic change. The overall low magnitude of geomorphic change detected between the 2018 and 2021 LiDAR surveys provides evidence that the Los Alamos and Pueblo Canyon watershed is stable and that the sediment transport mitigations are functioning as designed.

In 2019, triennial aerial-based hyperspectral surveys replaced ground-based surveys for monitoring vegetation change. Hyperspectral surveys were performed over the Pueblo wetland in 2019 and 2022, and the imagery from the two surveys were compared to identify vegetation change. Notable species composition change was detected within the wetland, with decreases in canary reed grass and willow populations and increases in a newly-observed overstory species. The 2020–2021 drought and grazing of feral cattle are believed to be the primary drivers of these changes. Additional evaluations of vegetation health and height revealed minimal change, and the absence of any significant geomorphological change suggests that the wetland remains in a stable condition.

Continued monitoring in 2023 is expected to confirm that the sediment transport mitigations in the LA/P watershed are performing as designed.

8.0 REFERENCES AND MAP DATA SOURCES

8.1 References

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NMED (New Mexico Environment Department), June 18, 2016. "[Approval for the] 2016 Monitoring Plan for Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project, Los Alamos National Laboratory," New Mexico Environment Department letter to D. Rhodes (DOE-EM-LA) and J. McCann (LANL) from J.E. Kieling (NMED-HWB), Santa Fe, New Mexico. (NMED 2016, 601563)

NMED (New Mexico Environment Department), July 11, 2017. "Approval with Modifications, 2017 Monitoring Plan for Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project," New Mexico Environment Department letter to D. Hintze (DOE-NA-LA) and B. Robinson (LANL) from J.E. Kieling (NMED-HWB), Santa Fe, New Mexico. (NMED 2017, 602504)

NMED (New Mexico Environment Department), June 4, 2018. "Approval, 2018 Monitoring Plan for Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project," New Mexico Environment Department letter to D. Hintze (DOE-EM-LA) and J. Legare (N3B) from J.E. Kieling (NMED-HWB), Santa Fe, New Mexico. (NMED 2018, 700007)

NMED (New Mexico Environment Department), June 4, 2019. "Approval, 2019 Monitoring Plan for Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project," New Mexico Environment Department letter to D. Hintze (EM-LA) from J.E. Kieling (NMED-HWB), Santa Fe, New Mexico. (NMED 2019, 700461)

NMED (New Mexico Environment Department), June 2, 2020. "Approval, Monitoring Plan for Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project," New Mexico Environment Department letter to A. Duran (EM-LA) from K. Pierard (NMED-HWB), Santa Fe, New Mexico. (NMED 2020, 700928)

NMED (New Mexico Environment Department), July 8, 2021. "Approval with Comments, 2021 Monitoring Plan and 2020 Monitoring Report for Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project," New Mexico Environment Department letter to A. Duran (EM-LA) from R. Maestas (NMED-HWB), Santa Fe, New Mexico. (NMED 2021, 701517)

NMED (New Mexico Environment Department), June 1, 2022. "Approval, 2022 Monitoring Plan and 2021 Monitoring Report for Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project," New Mexico Environment Department letter to A. Duran (EM-LA) from R. Maestas (NMED-HWB), Santa Fe, New Mexico. (NMED 2022, 702096)

Onodera, S., J. Wakui, H. Morishita, and E. Matsumoto, July 1993. "Seasonal Variation of Sediment Yield on a Gentle Slope in Semi-Arid Region, Tanzania," in *Sediment Problems: Strategies for Monitoring, Prediction and Control*, Proceedings of the Yokohama Symposium, July 1993, International Association of Hydrological Sciences publication no. 217, pp. 29–37. (Onodera et al. 1993, 111759)

TCD Environmental (TCD Environmental, LLC), November 2004. "Copper Sources in Urban Runoff and Shoreline Activities, Information Update." (TCD Environmental 2004, 602305)

Tsihrintzis, V.A., and R. Hamid, 1997. "Modeling and Management of Urban Stormwater Runoff Quality: A Review," *Water Resources Management,* Vol. 11, pp. 137-164. (Tsihrintzis and Hamid 1997, 602314)

8.2 Map Data Sources

GageStation; Los Alamos National Laboratory, ER-ES, As published, project folder 15-0013; \\slip\gis\GIS\Projects\15-Projects\15-0013\zip\2015_E059.8_GageStation.shp; 2015

Facility location; Los Alamos National Laboratory, ER-ES, As published, project folder 15-0013; \\slip\gis\GIS\Projects\15-Projects\15-0013\project_data.gdb;merge_sandia_features_AGAIN;2015

Erosion control structure; Los Alamos National Laboratory, ER-ES, As published, project folder 15-0013; \\slip\gis\GIS\Projects\15-Projects\15-0013\project_data.gdb;merge_sandia_features_AGAIN;2015

Sediment control structure; Los Alamos National Laboratory, ER-ES, As published, project folder 15-0013; \\slip\gis\GIS\Projects\15-Projects\15-0013\project_data.gdb;merge_sandia_features_AGAIN;2015

Willow planting area; Los Alamos National Laboratory, ER-ES, As published, project folder 14-0015; \\slip\gis\GIS\Projects\14-Projects\14-0015\shp\as_built_willow_banks.shp; 2015

Structures; County of Los Alamos, Information Services; as published 29 October 2007.

Drainage; County of Los Alamos, Information Services; as published 16 May 2006.

Los Alamos County Boundary; Los Alamos National Laboratory, ENV Environmental Remediation and Surveillance Program; Unknown publication date.

Road Centerlines for the County of Los Alamos; County of Los Alamos, Information Services; as published 04 March 2009.

Watersheds; Los Alamos National Laboratory, ENV Environmental Remediation and Surveillance Program; EP2006-0942; 1:2,500 Scale Data; 27 October 2006.

Contour, 4-ft interval; Los Alamos National Laboratory, ER-ES, As published, project folder 15-0013;\\slip\gis\Data\HYP\LiDAR\2014\Bare_Earth\BareEarth_DEM_Mosaic.gdb; 2015

Technical Area Boundaries; Los Alamos National Laboratory, Site Planning & Project Initiation Group, Infrastructure Planning Office; September 2007; as published 13 August 2010.

Sediment Geomorphology; Los Alamos National Laboratory, ENV Environmental Remediation and Surveillance Program, ER2002-0589; 1:1,200 Scale Data; 01 January 2002.

Monitoring area; Los Alamos National Laboratory, ER-ES, As published, project folder 15-0013; \\slip\gis\GIS\Projects\15-Projects\15-0013\zip\ZoomAreas.shp; 2015

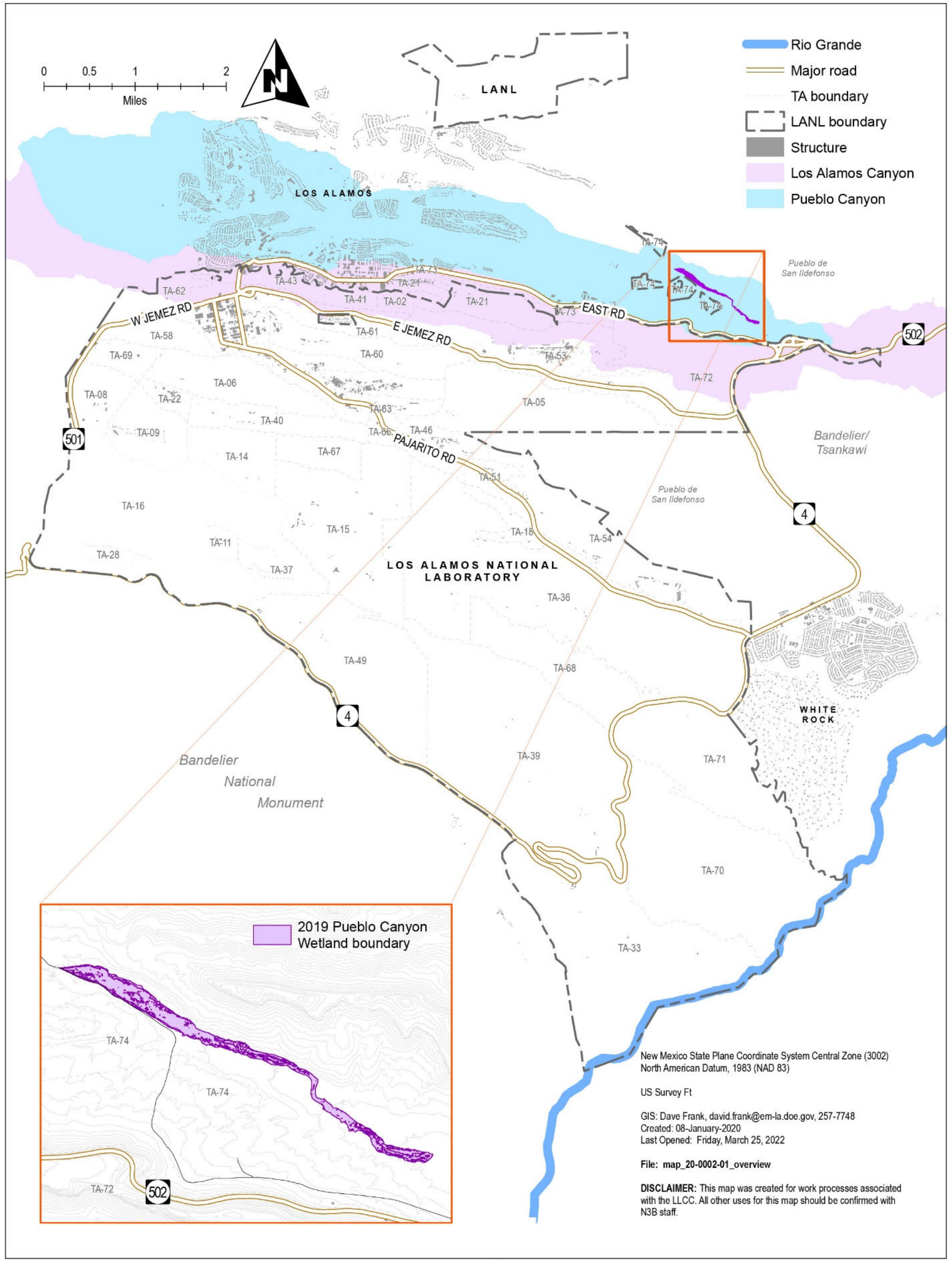


Figure 1.1-1 Los Alamos/Pueblo Canyon watershed and Pueblo Canyon wetland location in relation to Los Alamos National Laboratory property

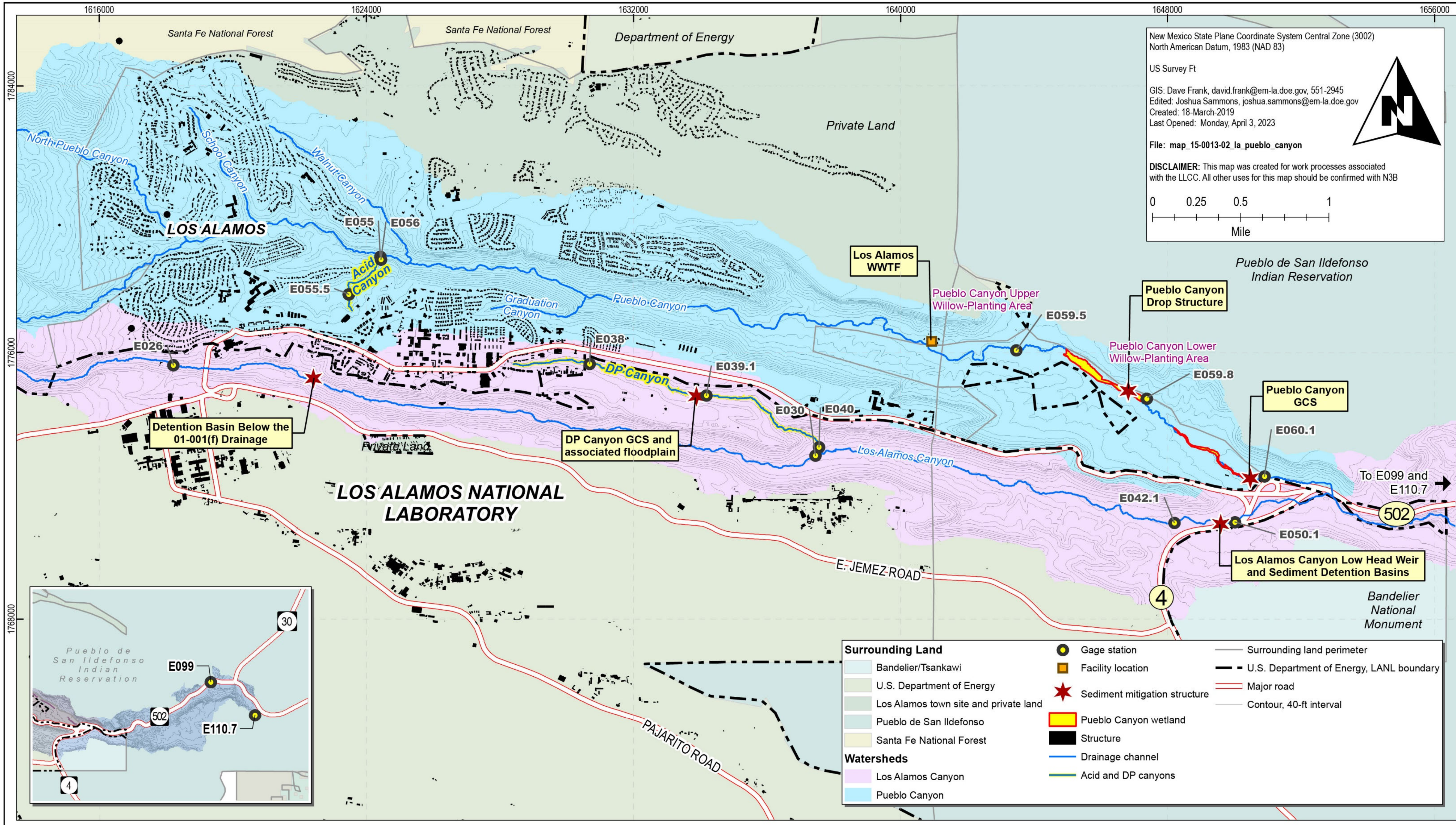
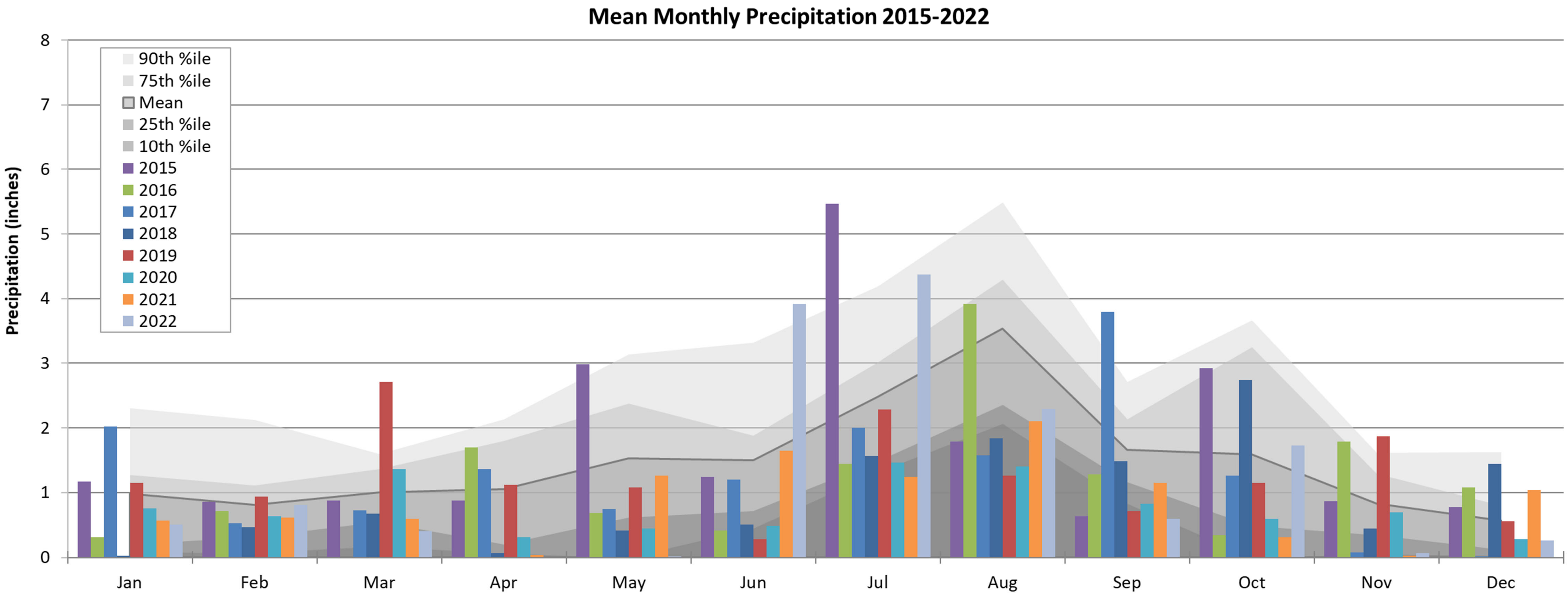
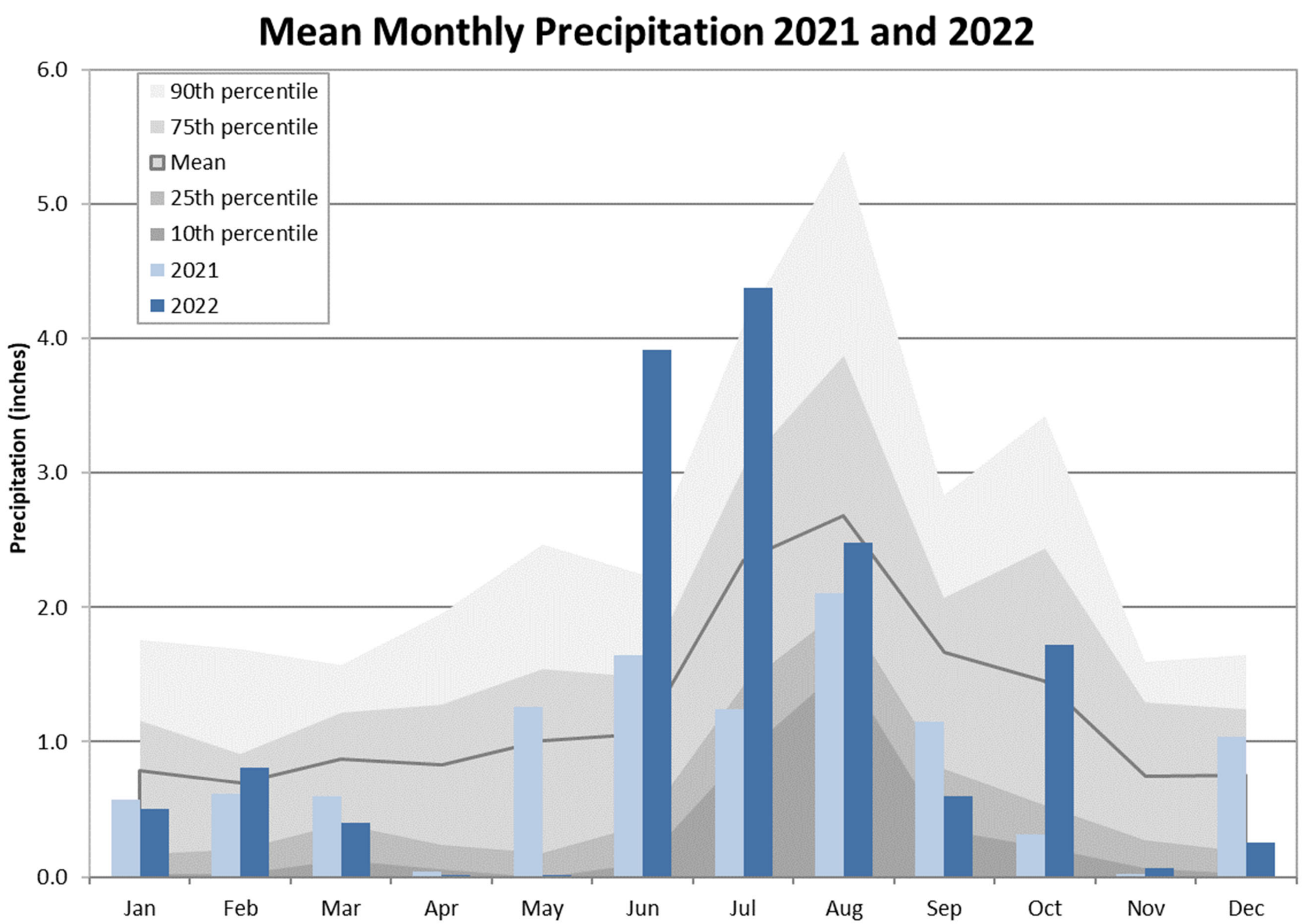


Figure 1.1-2 Los Alamos/Pueblo Canyon watershed showing monitoring locations and sediment transport mitigation sites



Note: Mean and percentiles are based on data from 1992 to 2022.

Figure 2.1-1 Total precipitation for each month between 2015 and 2022 based on meteorological tower data averaged across the Laboratory



Note: Mean and percentiles are based on data from 1992 to 2022.

Figure 2.1-2 Total precipitation for each month in 2021 and 2022 based on meteorological tower data averaged across the Laboratory

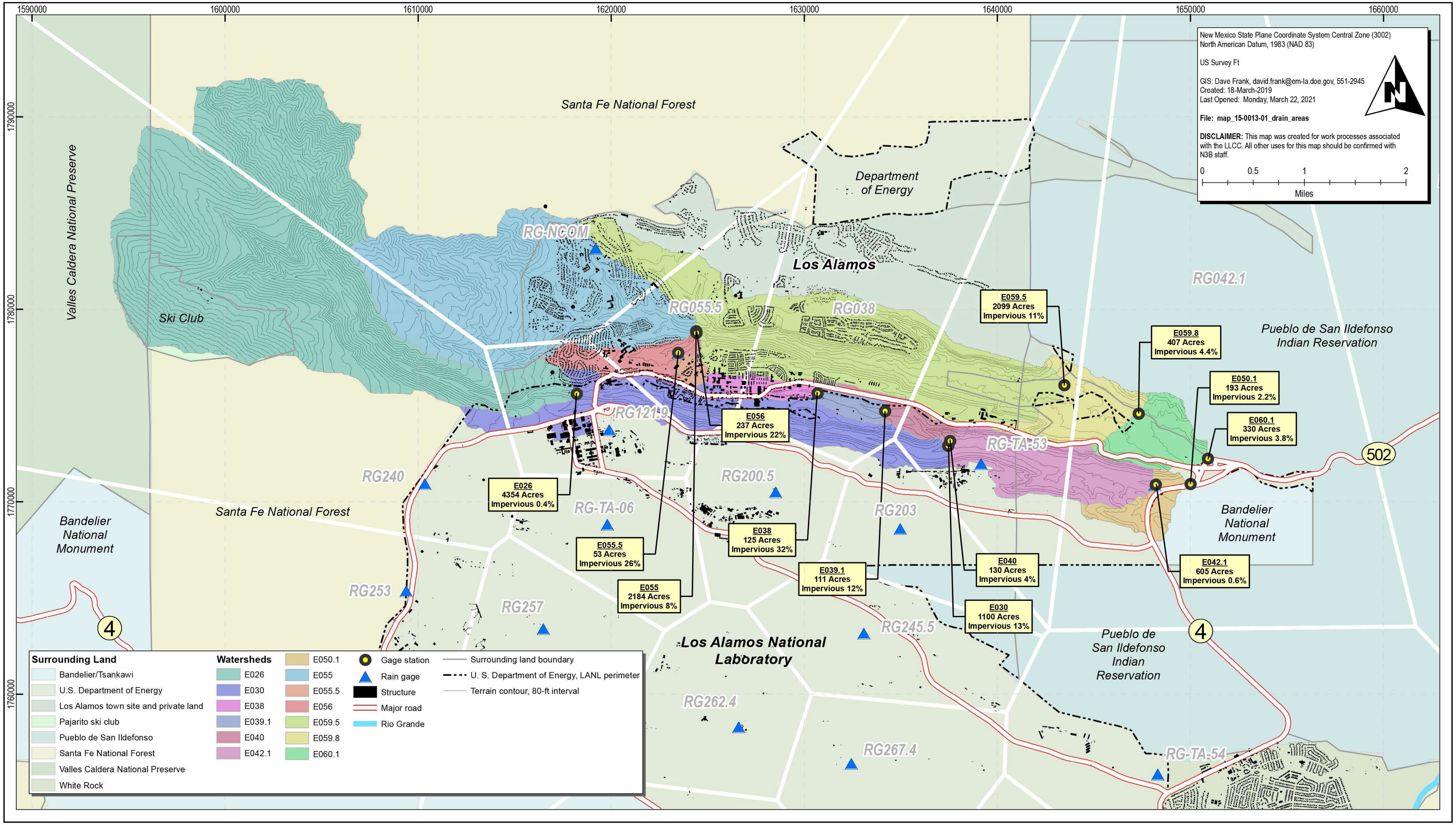


Figure 2.1-3 Los Alamos/Pueblo watershed showing drainage areas for each stream gaging station and associated rain gages and Thiessen polygons

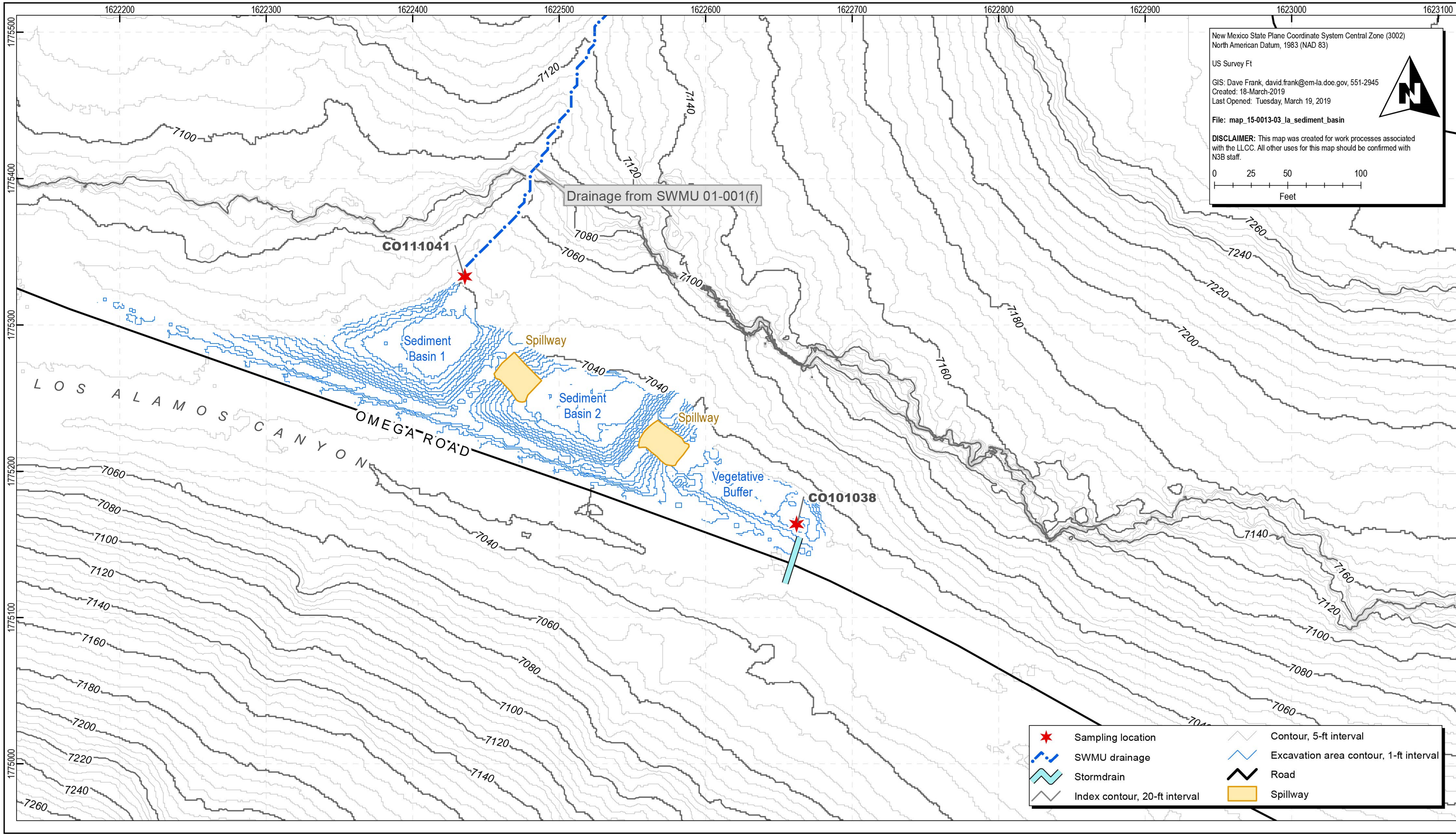
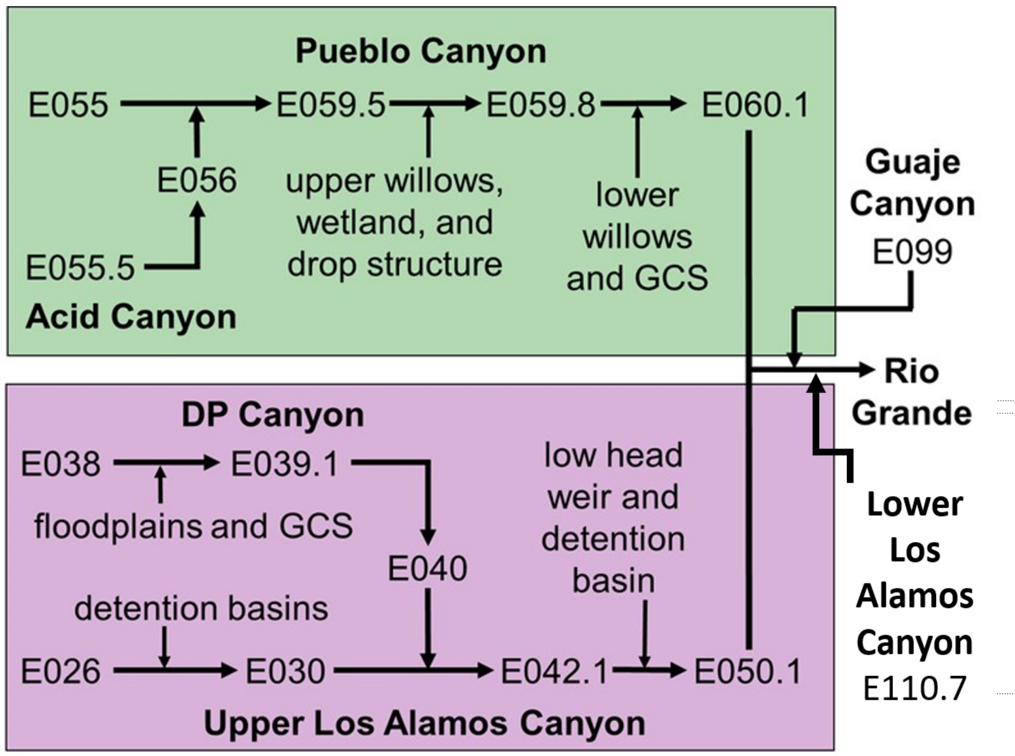


Figure 2.2-1 Upper Los Alamos Canyon sediment detention basins and sampling locations below the SWMU 01-001(f) drainage



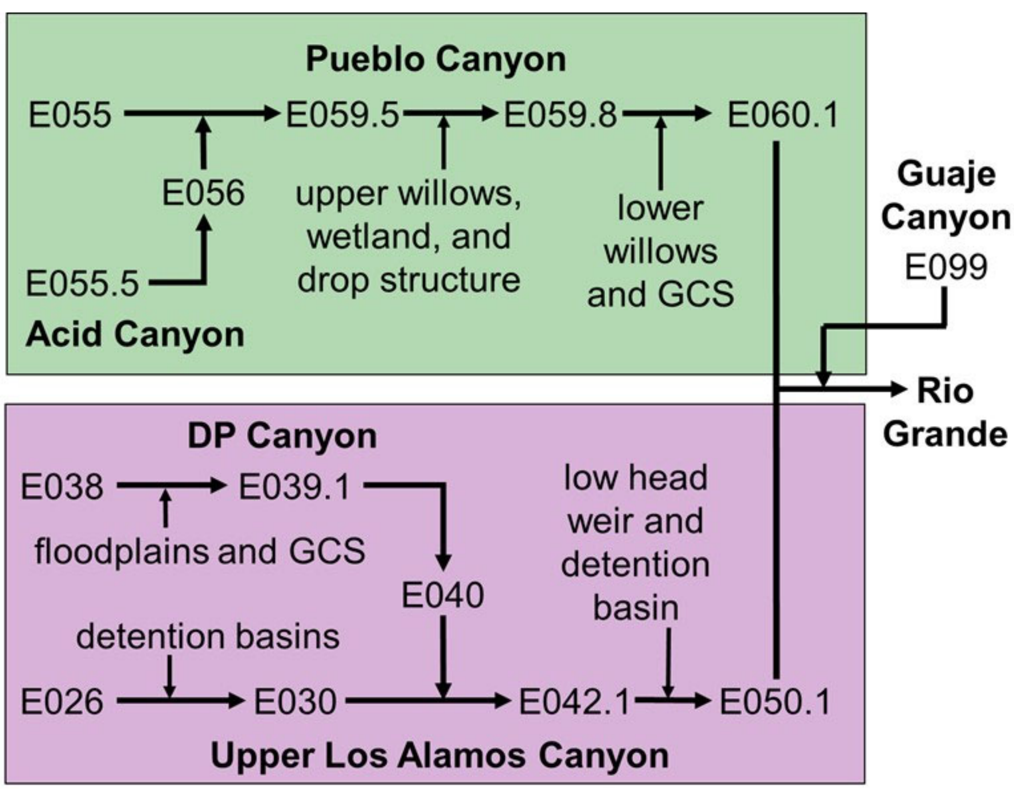
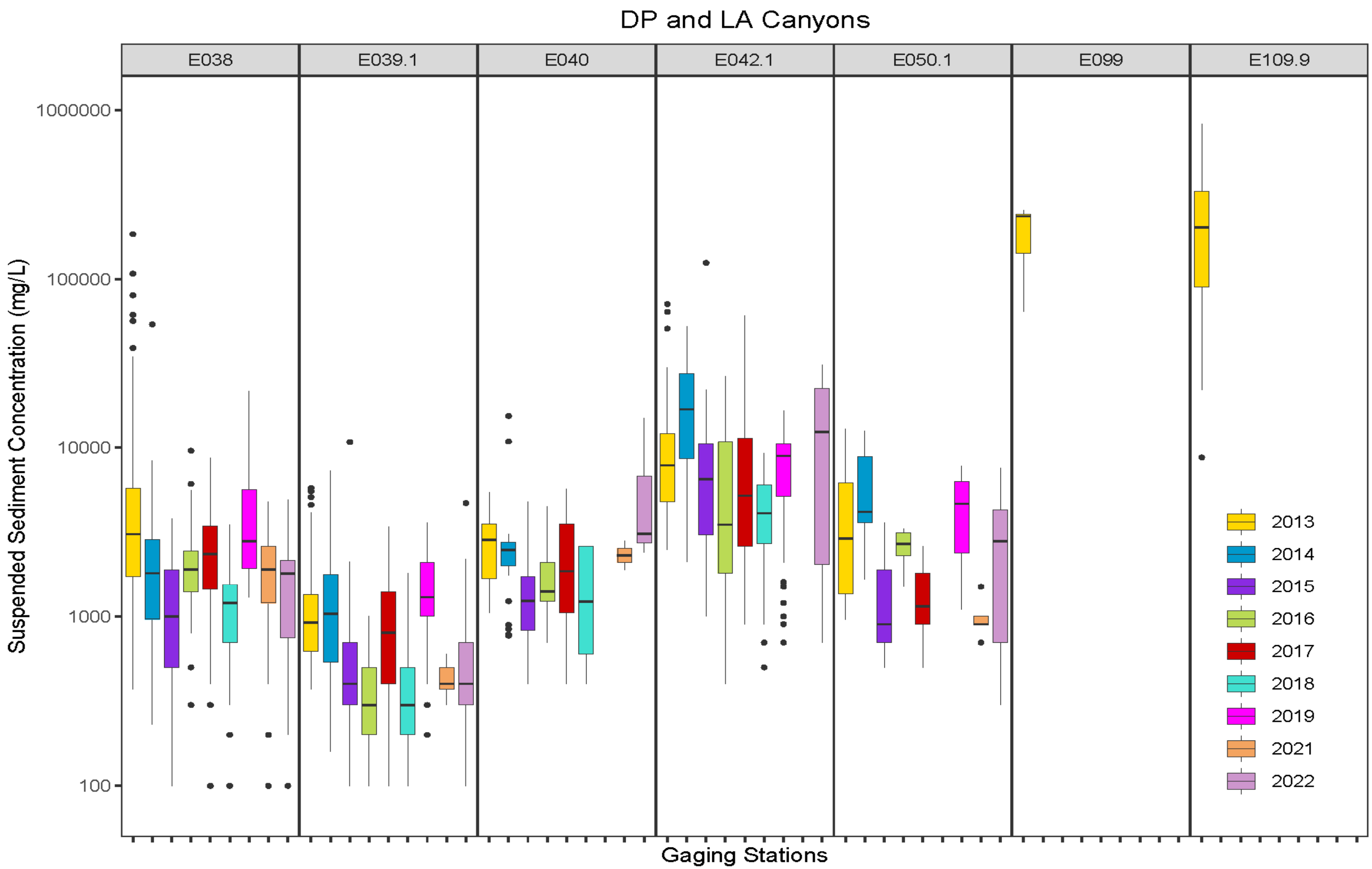
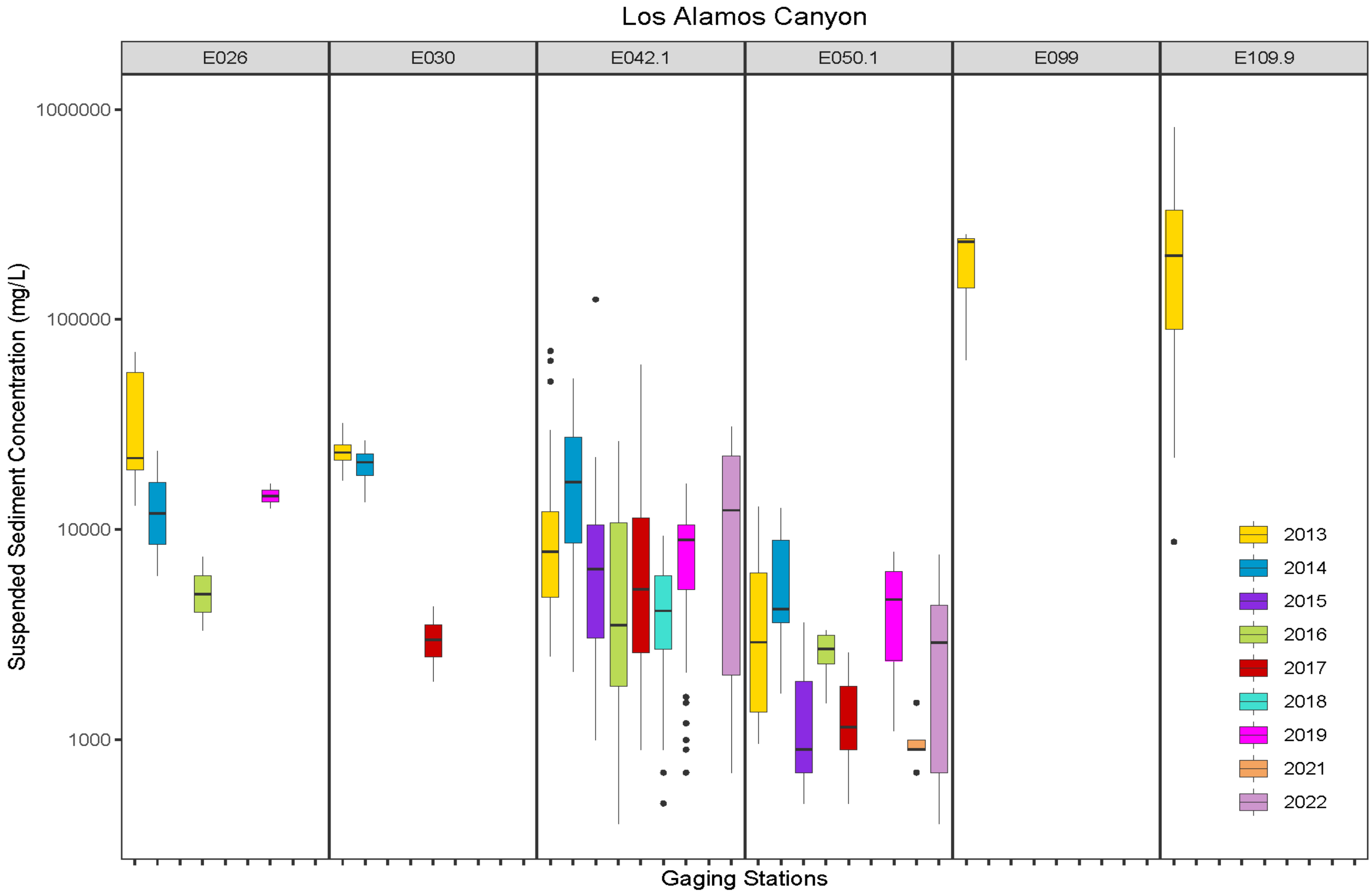


Figure 3.2-1 Flow diagram of gaging stations and sediment transport mitigation sites in the Los Alamos/Pueblo watershed



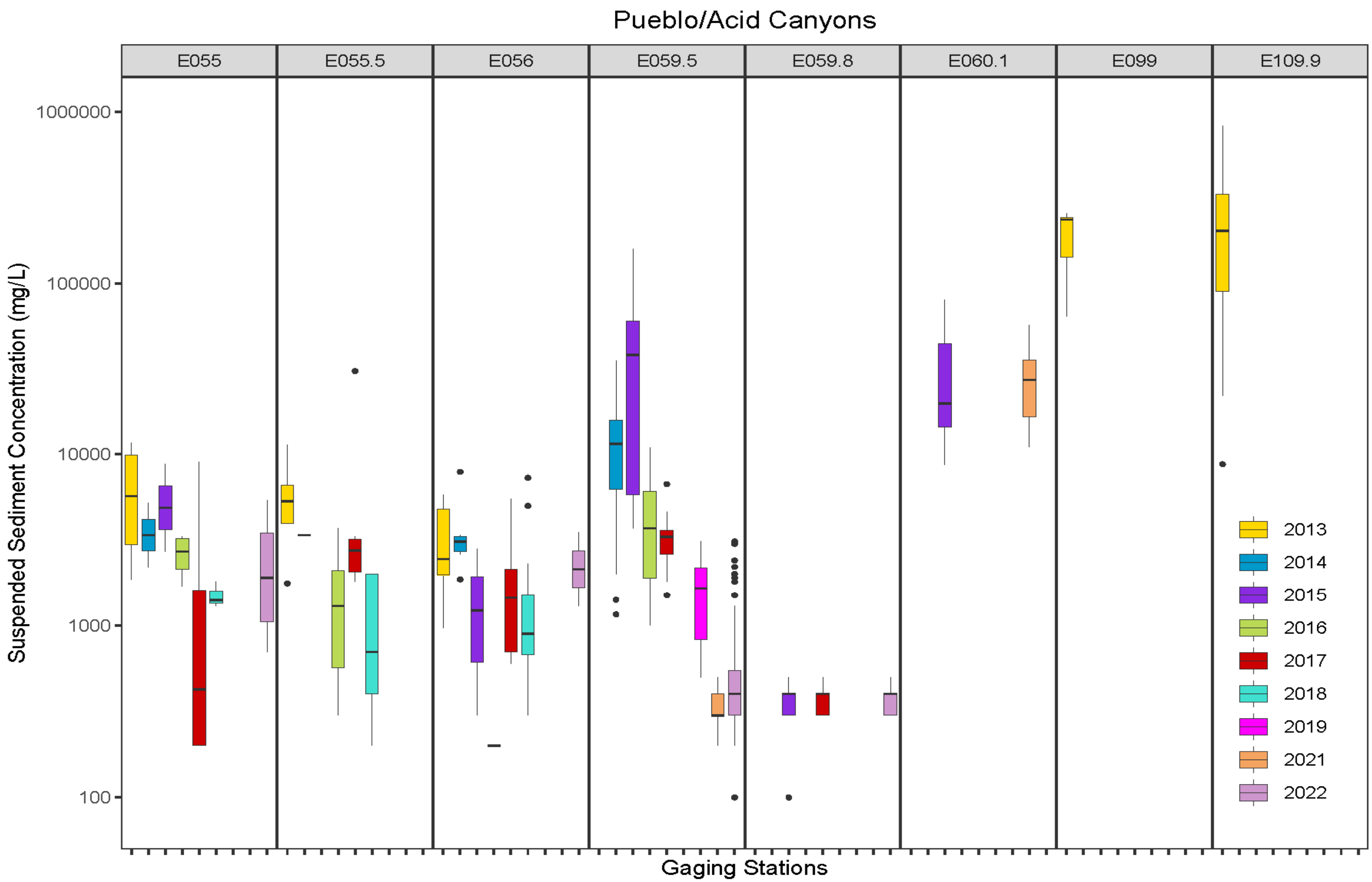
Note: Black dots represent outliers.

Figure 3.2-2 Box-and-whisker plots of SSC for all gaging stations in the Los Alamos/Pueblo watershed over the 10 yr of monitoring from 2013 to 2022 (excluding 2020 when no samples were collected)



Note: Black dots represent outliers.

Figure 3.2-2 (continued) **Box-and-whisker plots of SSC for all gaging stations in the Los Alamos/Pueblo watershed over the 10 yr of monitoring from 2013 to 2022 (excluding 2020 when no samples were collected)**



Note: Black dots represent outliers.

Figure 3.2-2 (continued) **Box-and-whisker plots of SSC for all gaging stations in the Los Alamos/Pueblo watershed over the 10 yr of monitoring from 2013 to 2022 (excluding 2020 when no samples were collected)**

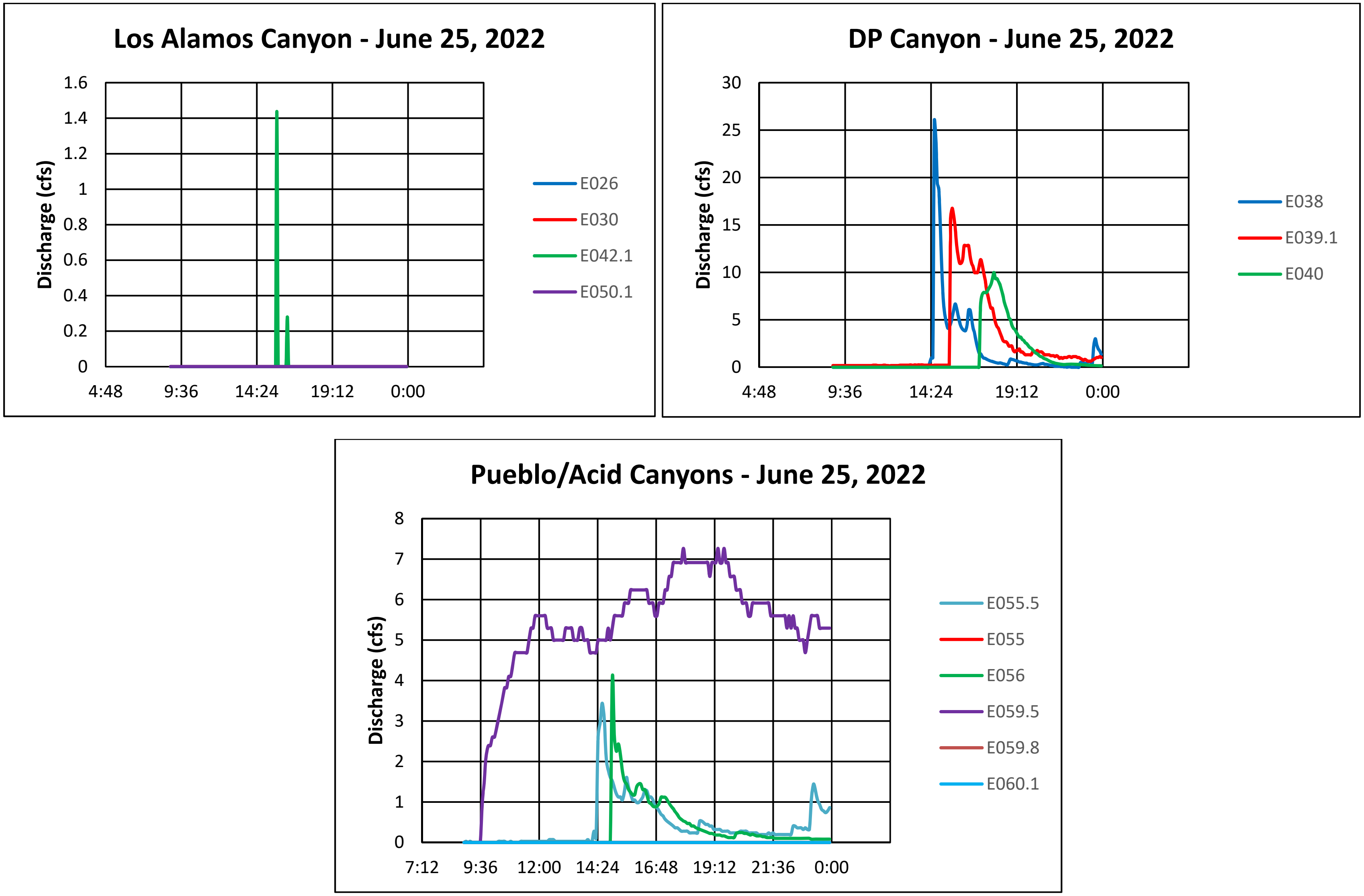
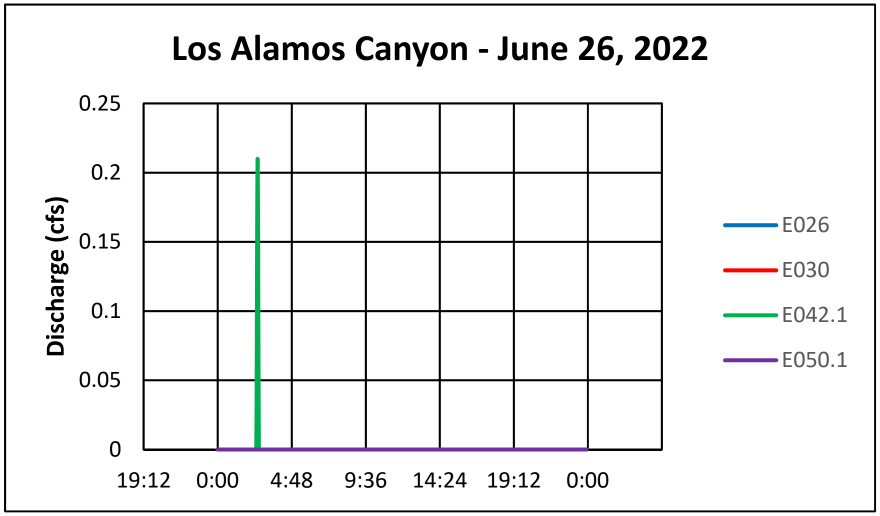
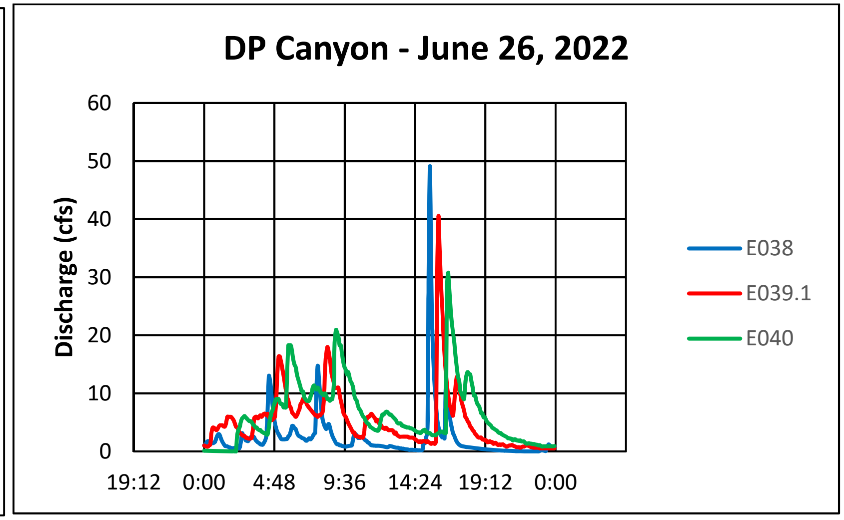


Figure 3.2-3 Hydrographs during each sample-triggering runoff event for each canyon from upstream to downstream reaches





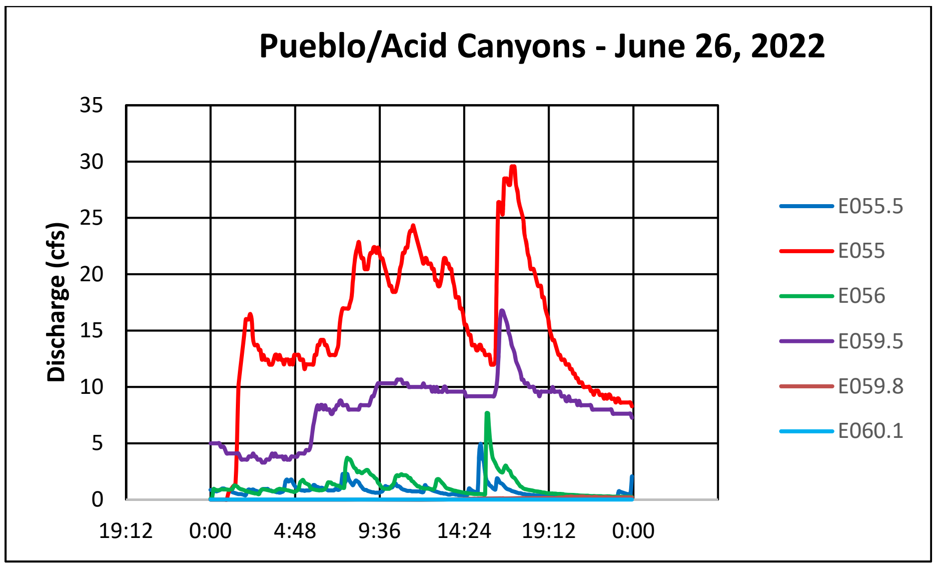


Figure 3.2-3 (continued) **Hydrographs during each sample-triggering runoff event for each canyon from upstream to downstream reaches**

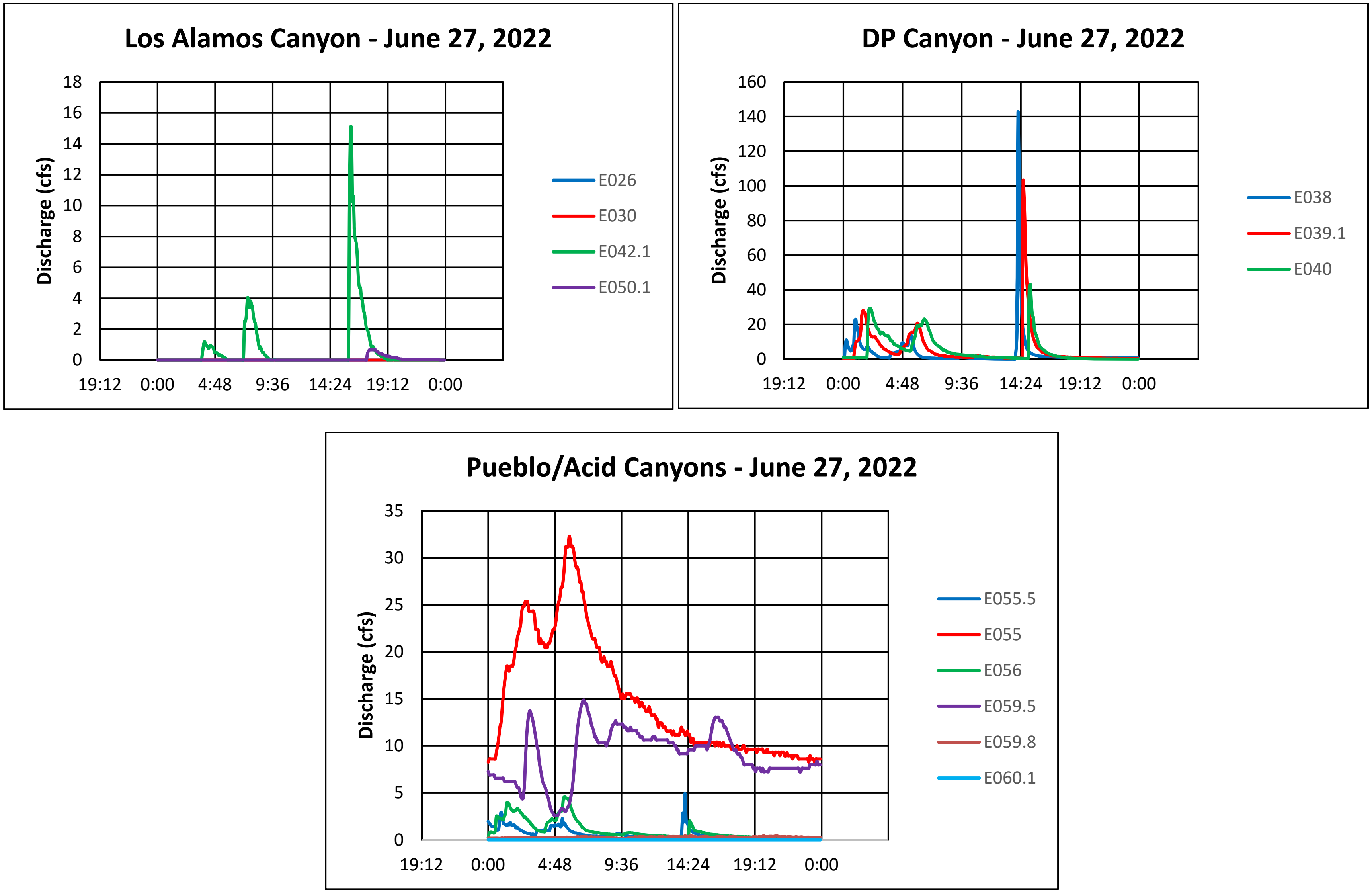


Figure 3.2-3 (continued) **Hydrographs during each sample-triggering runoff event for each canyon from upstream to downstream reaches**

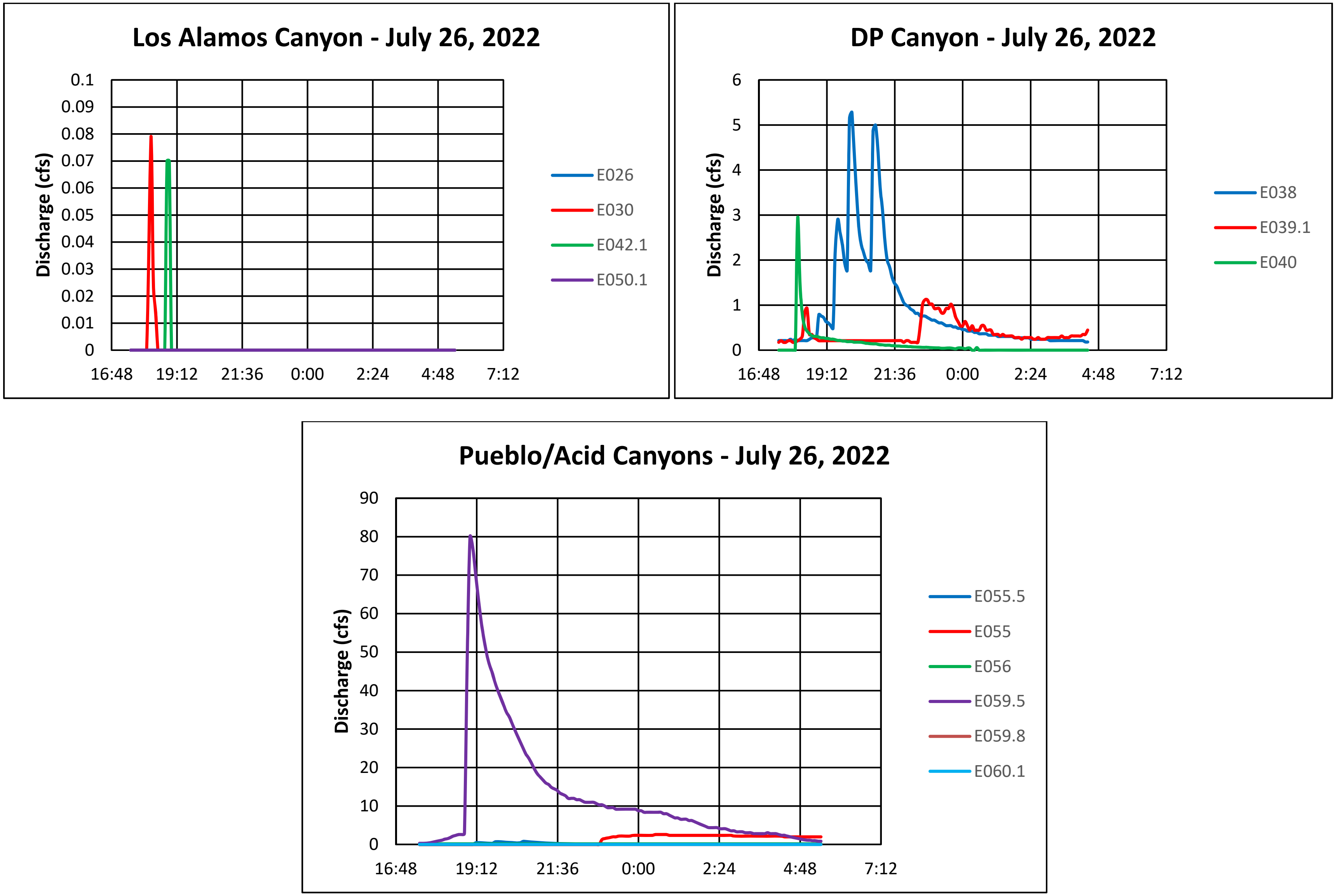


Figure 3.2-3 (continued) **Hydrographs during each sample-triggering runoff event for each canyon from upstream to downstream reaches**

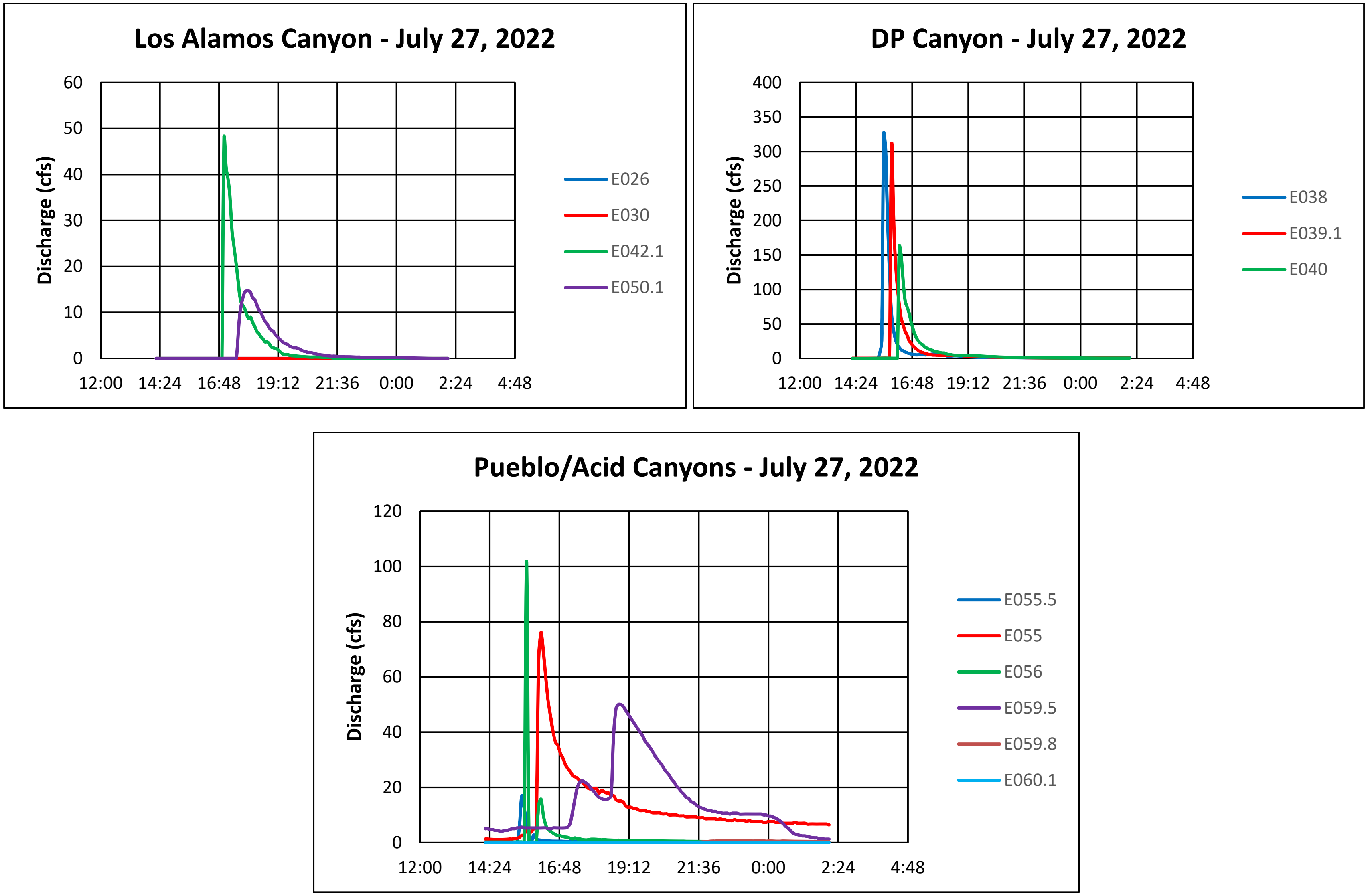


Figure 3.2-3 (continued) **Hydrographs during each sample-triggering runoff event for each canyon from upstream to downstream reaches**

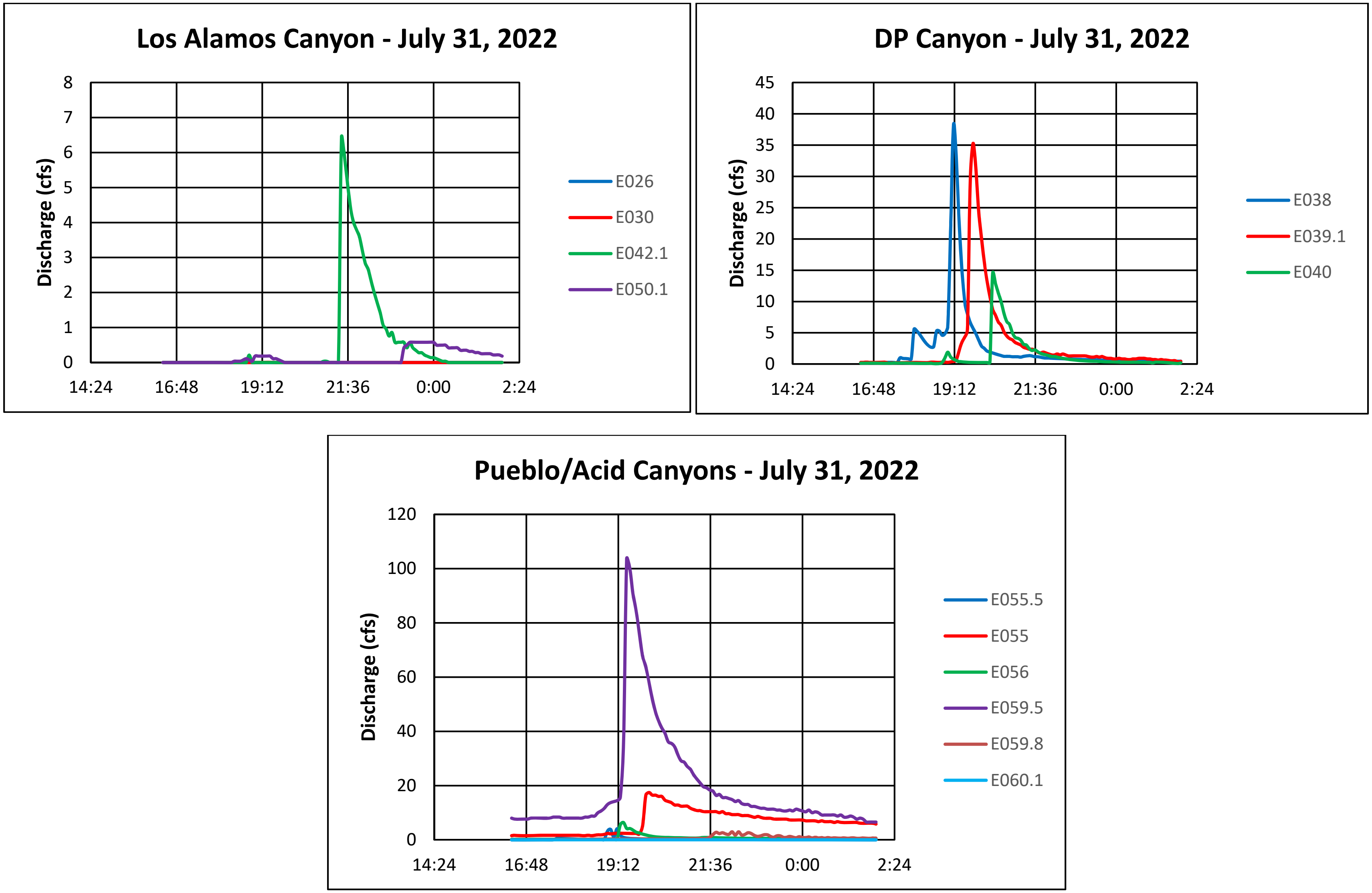


Figure 3.2-3 (continued) **Hydrographs during each sample-triggering runoff event for each canyon from upstream to downstream reaches**

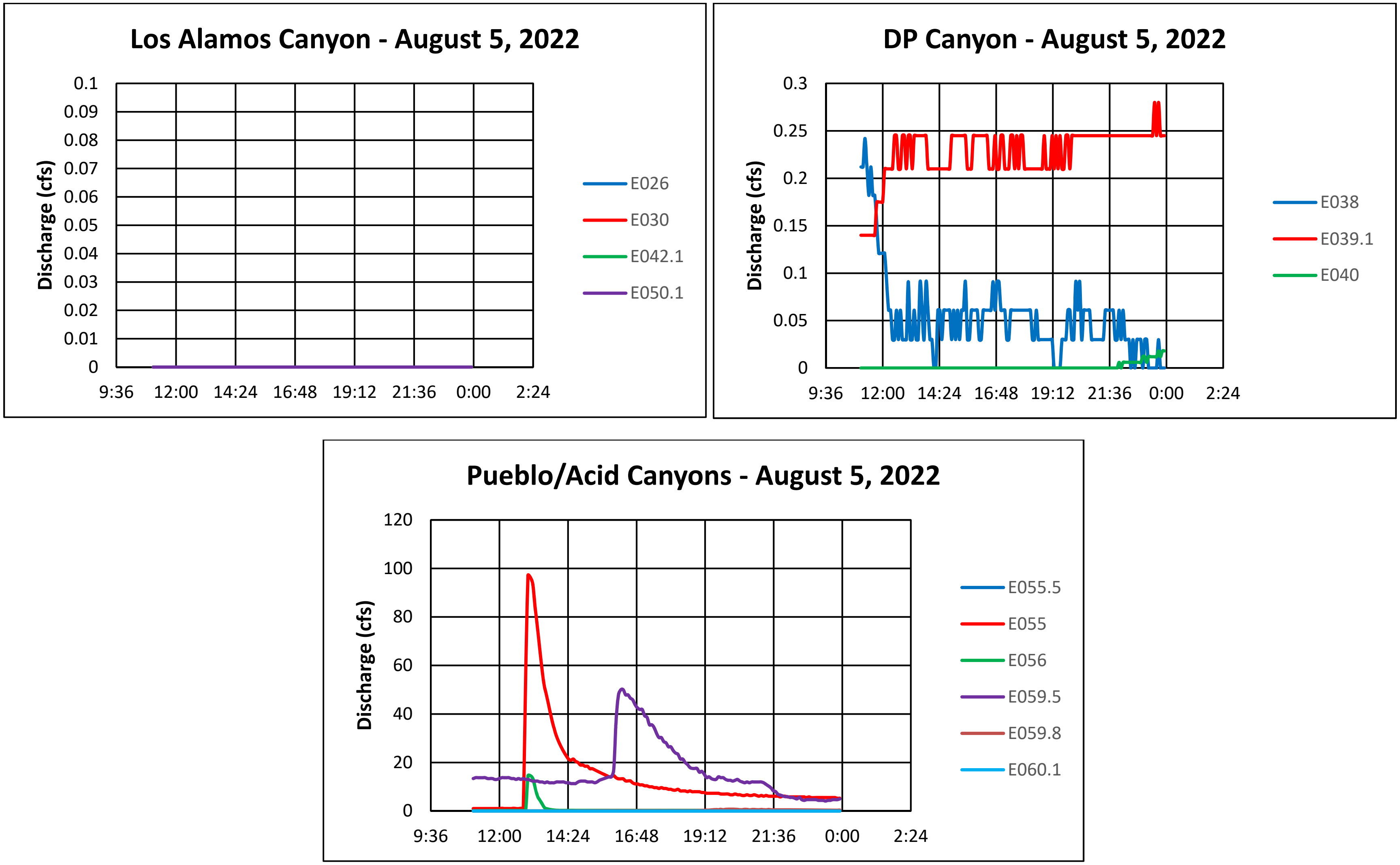


Figure 3.2-3 (continued) **Hydrographs during each sample-triggering runoff event for each canyon from upstream to downstream reaches**

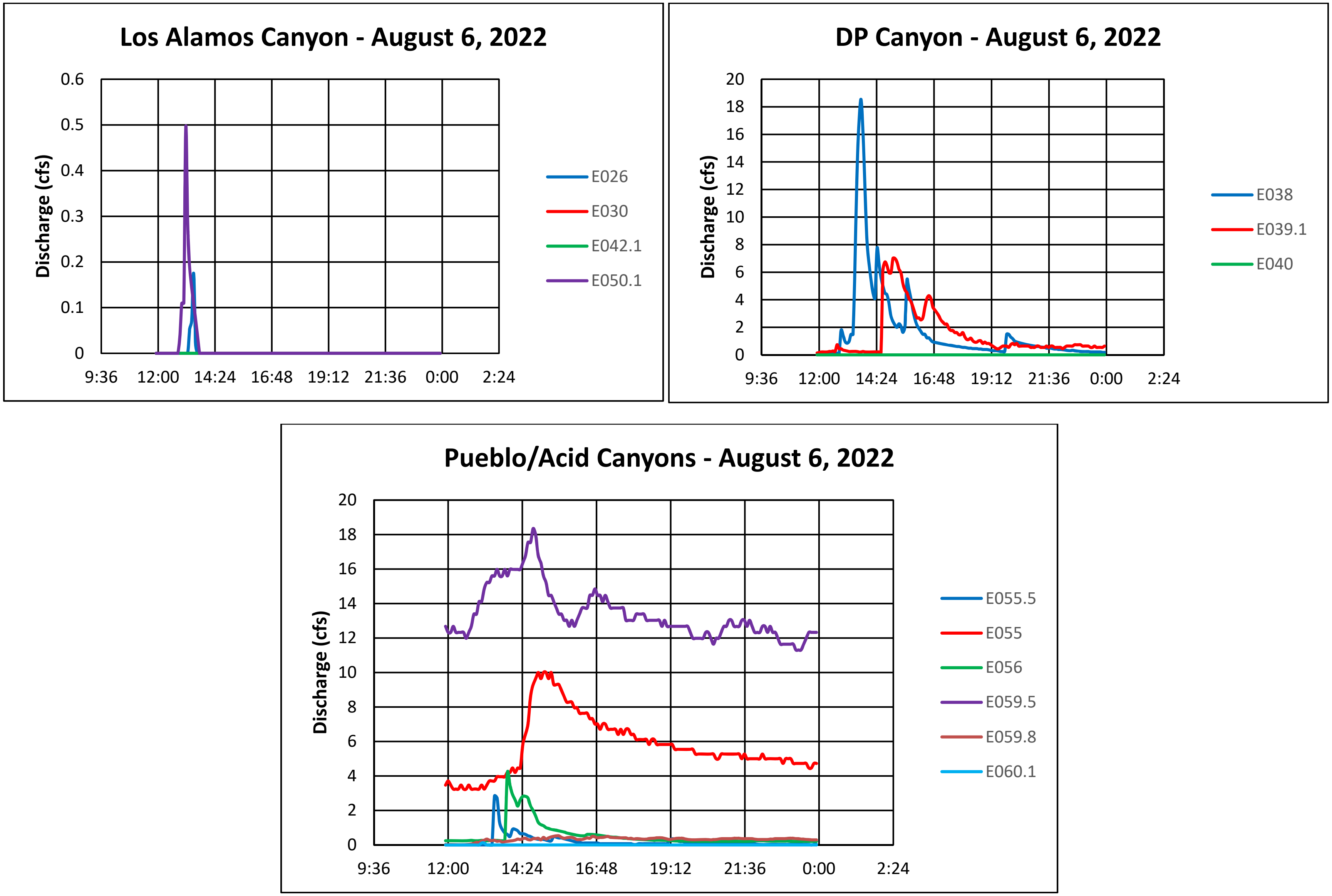


Figure 3.2-3 (continued) **Hydrographs during each sample-triggering runoff event for each canyon from upstream to downstream reaches**

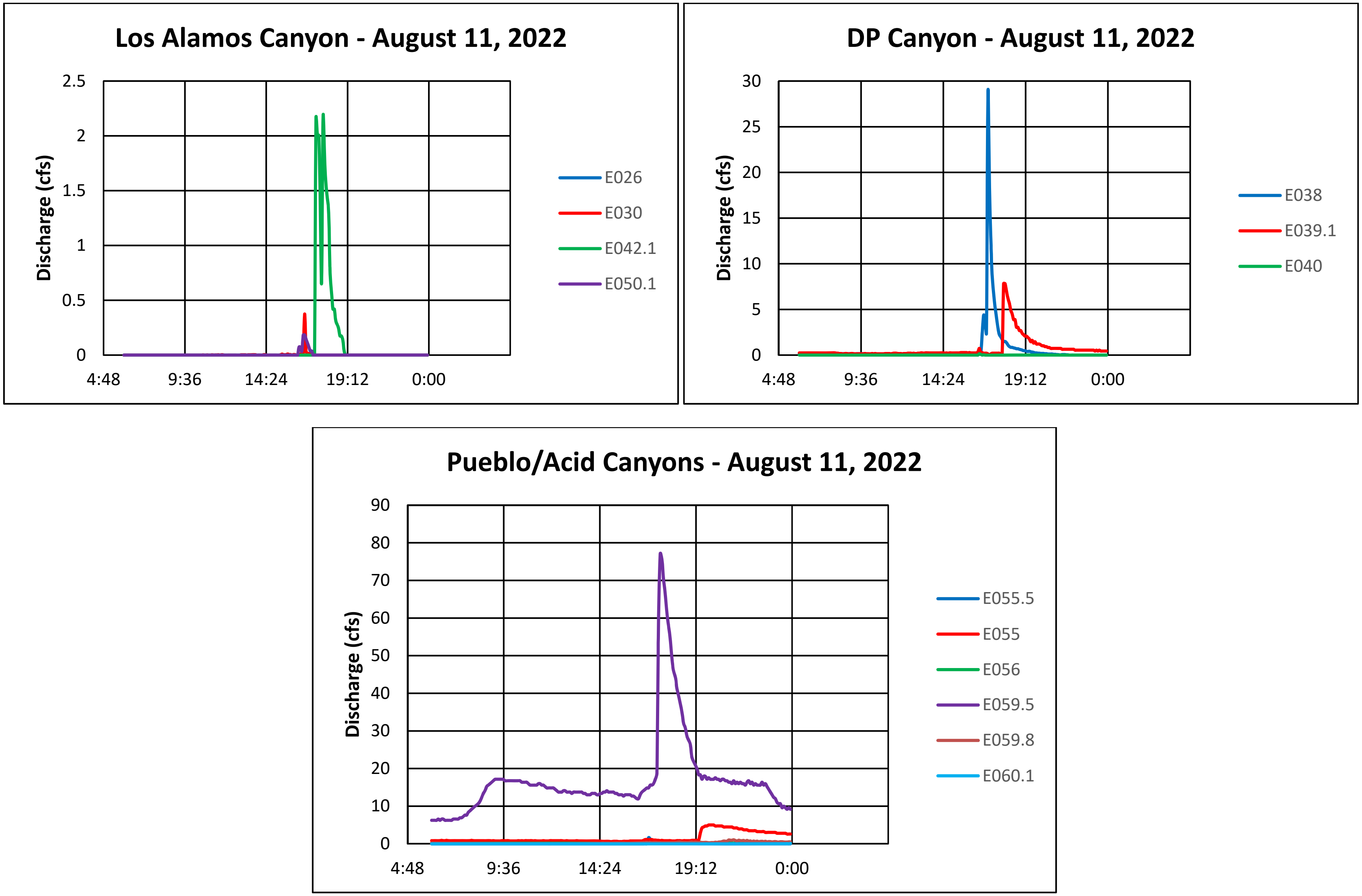


Figure 3.2-3 (continued) **Hydrographs during each sample-triggering runoff event for each canyon from upstream to downstream reaches**

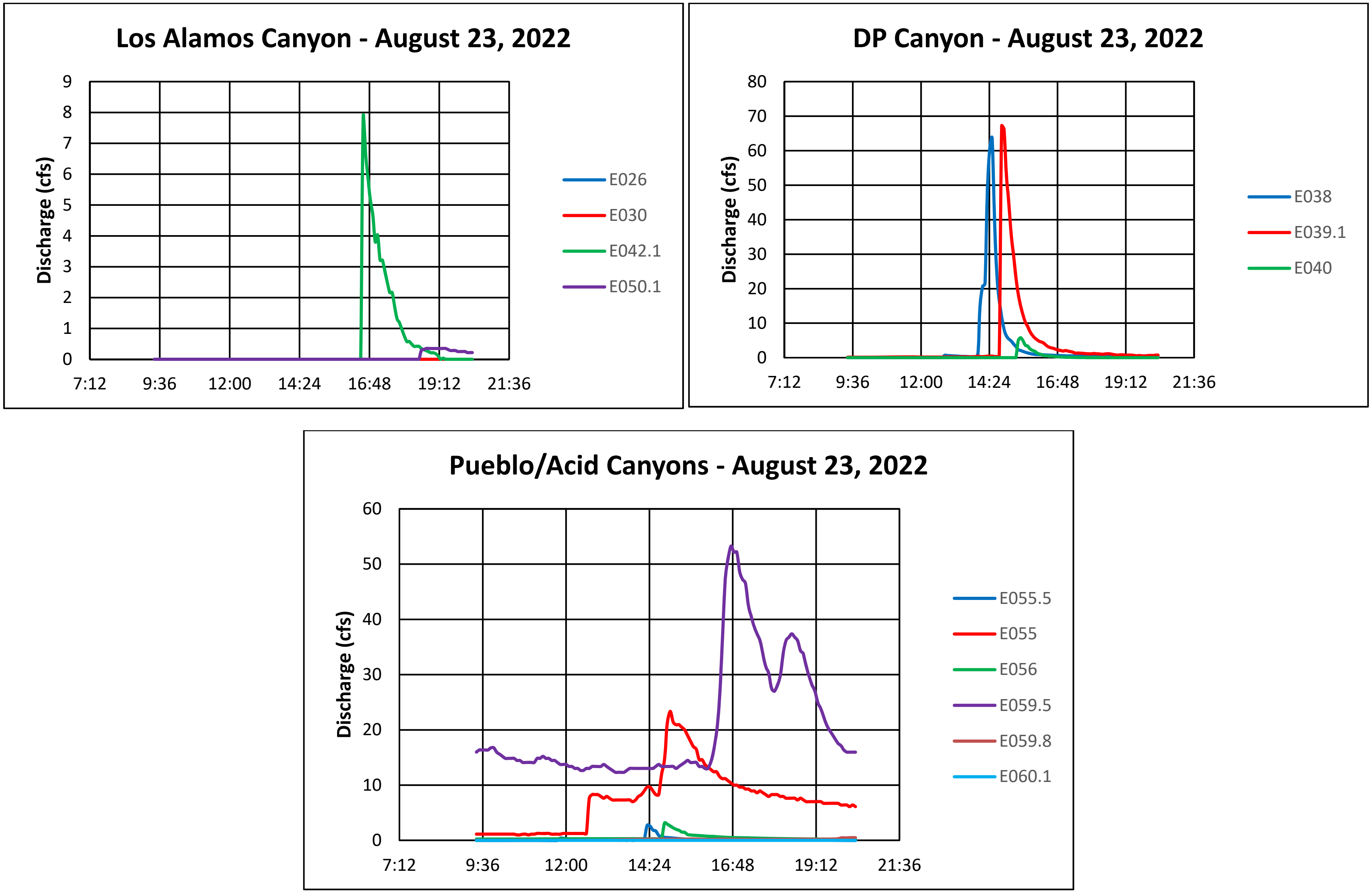


Figure 3.2-3 (continued) **Hydrographs during each sample-triggering runoff event for each canyon from upstream to downstream reaches**

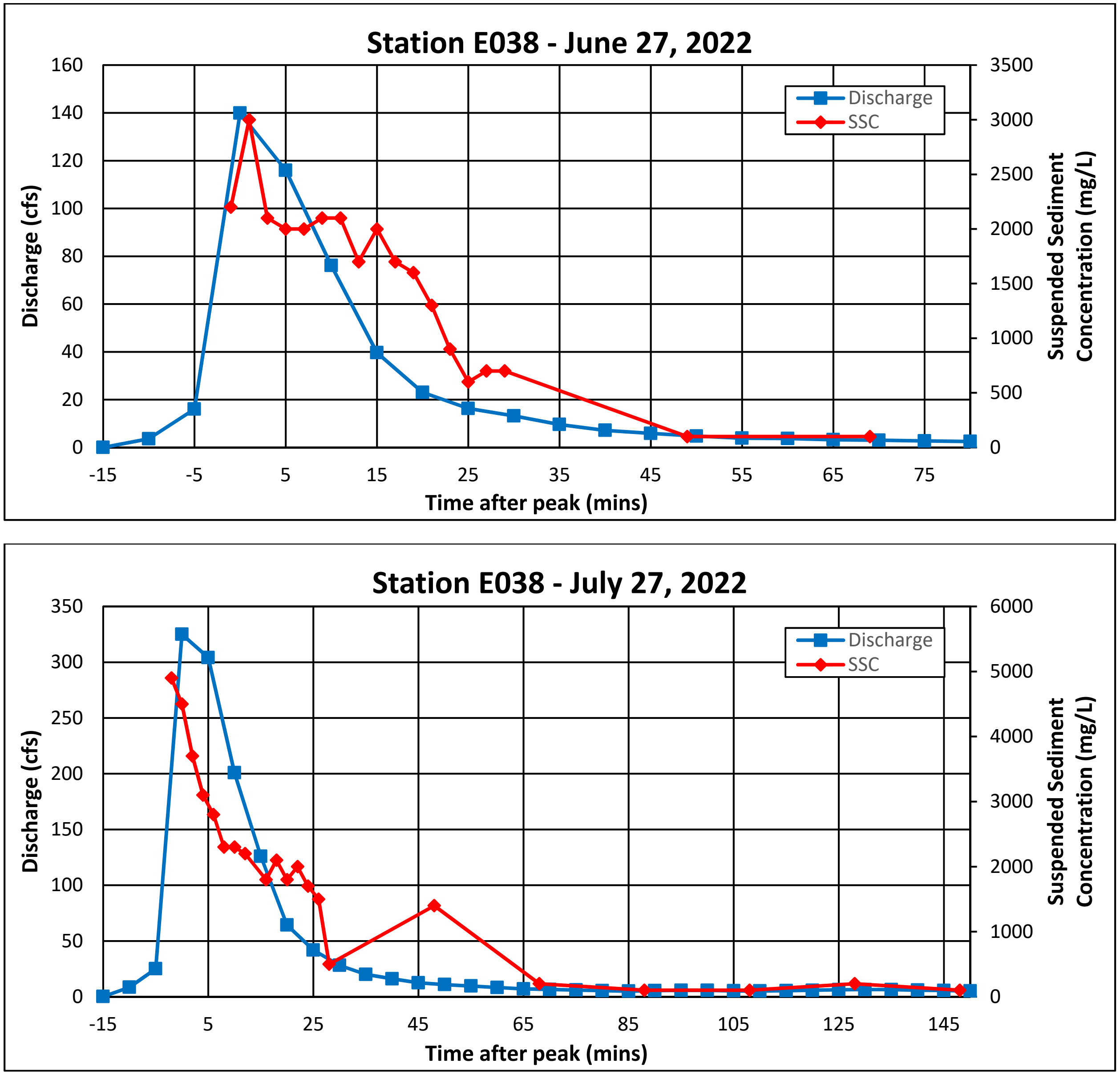
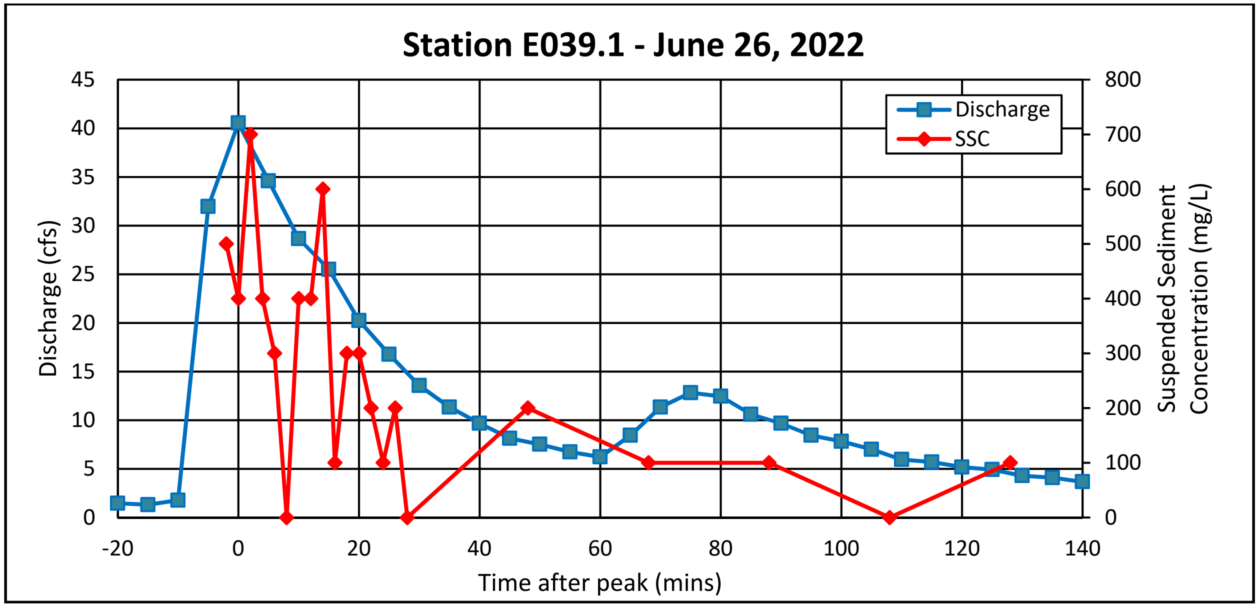


Figure 3.2-4 **Measured discharge and measured SSC for events sampled at E038, E039.1, E042.1, E050.1, E059.5, and E059.8**



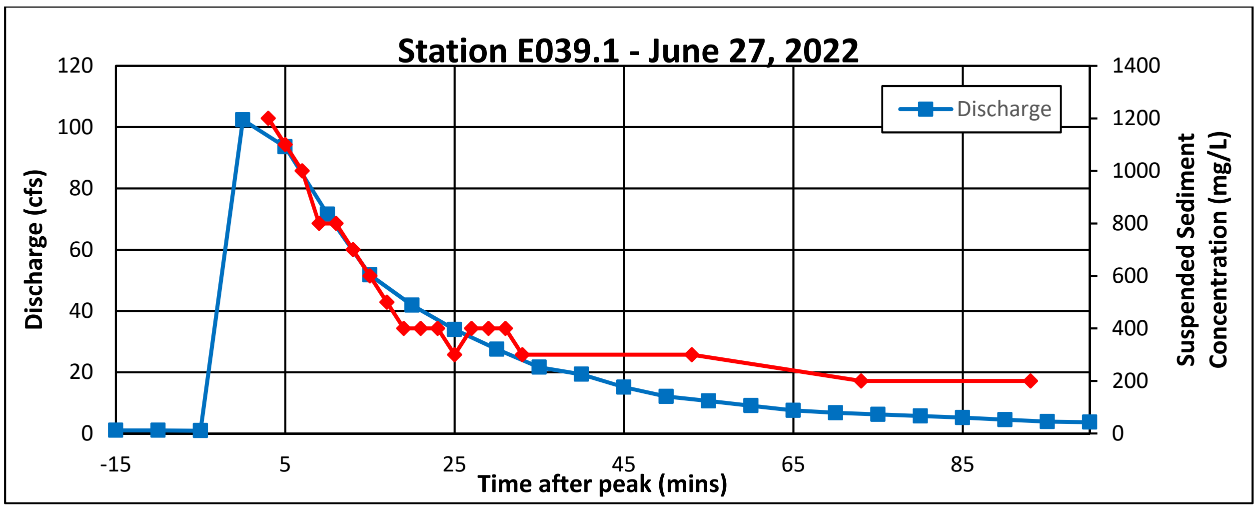
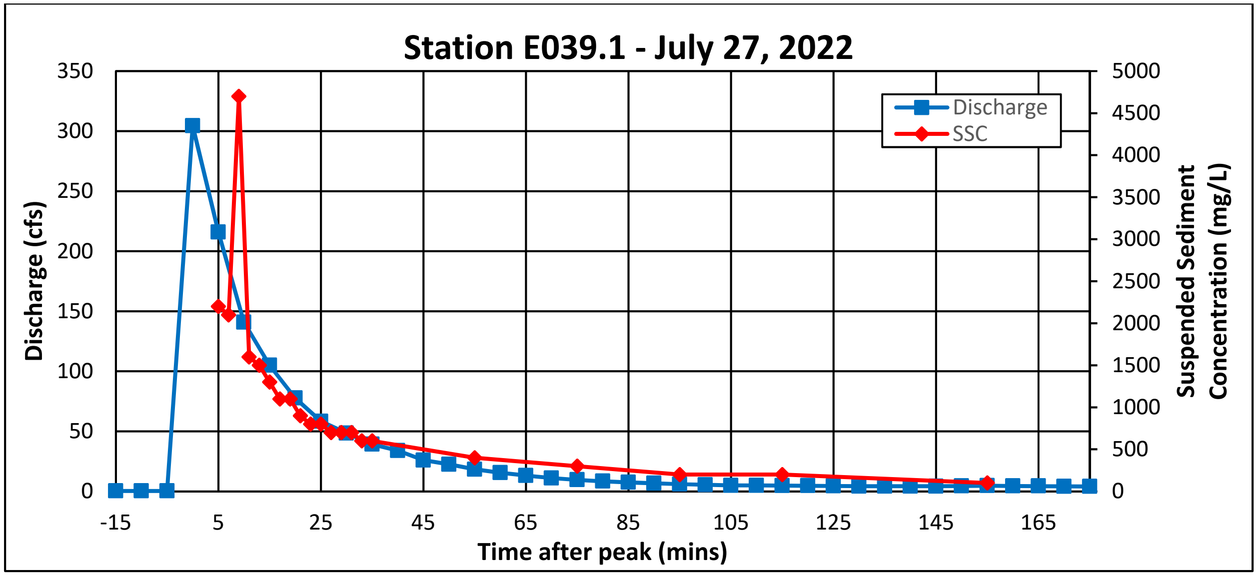


Figure 3.2-4 (continued) **Measured discharge and measured SSC for events sampled at E038, E039.1, E042.1, E050.1, E059.5, and E059.8**



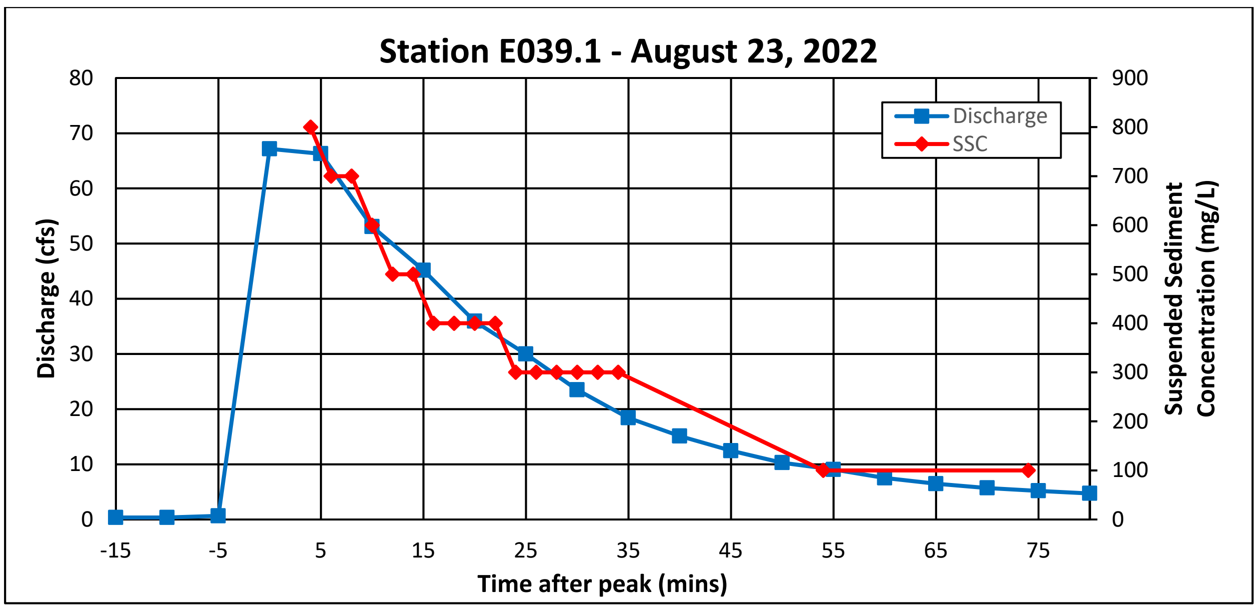
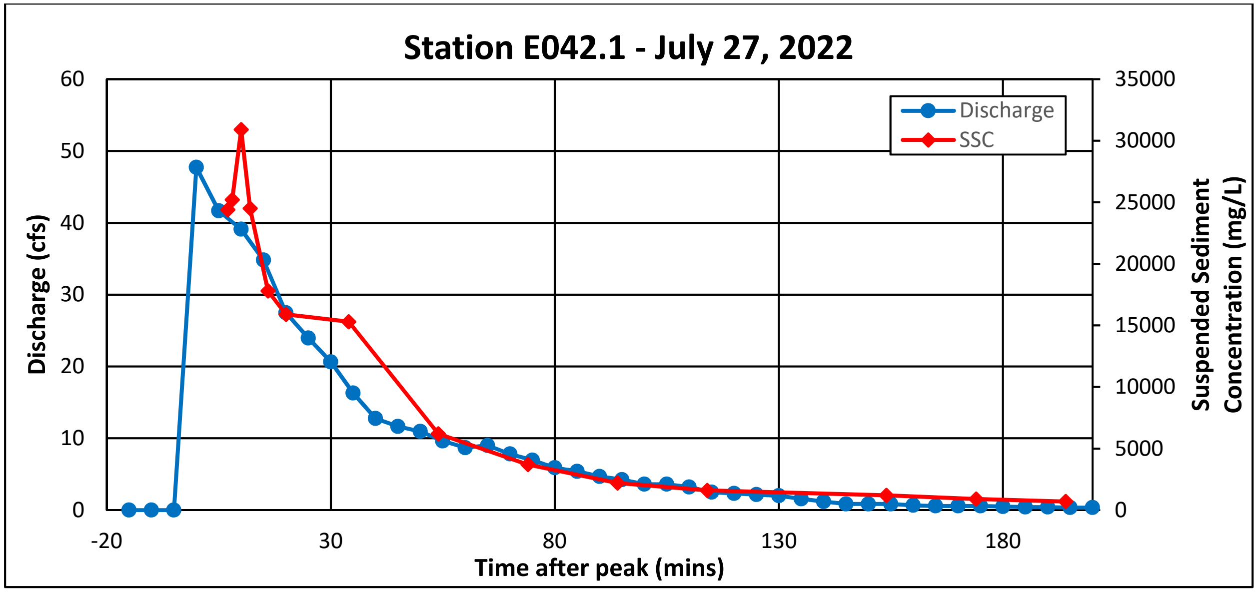


Figure 3.2-4 (continued) **Measured discharge and measured SSC for events sampled at E038, E039.1, E042.1, E050.1, E059.5, and E059.8**



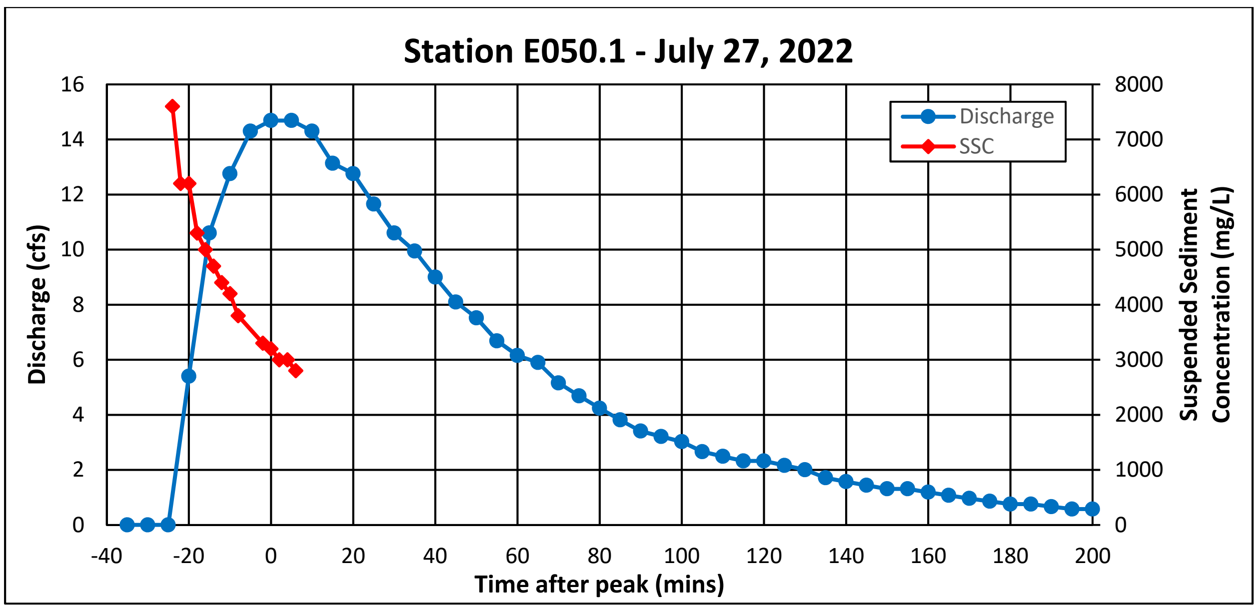
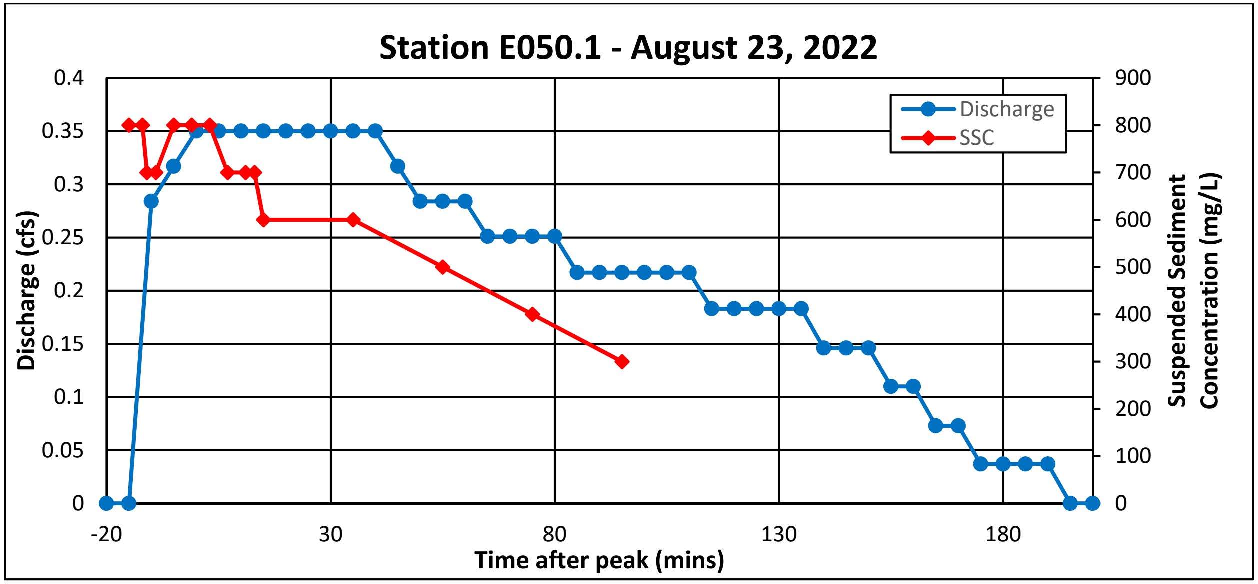


Figure 3.2-4 (continued) **Measured discharge and measured SSC for events sampled at E038, E039.1, E042.1, E050.1, E059.5, and E059.8**



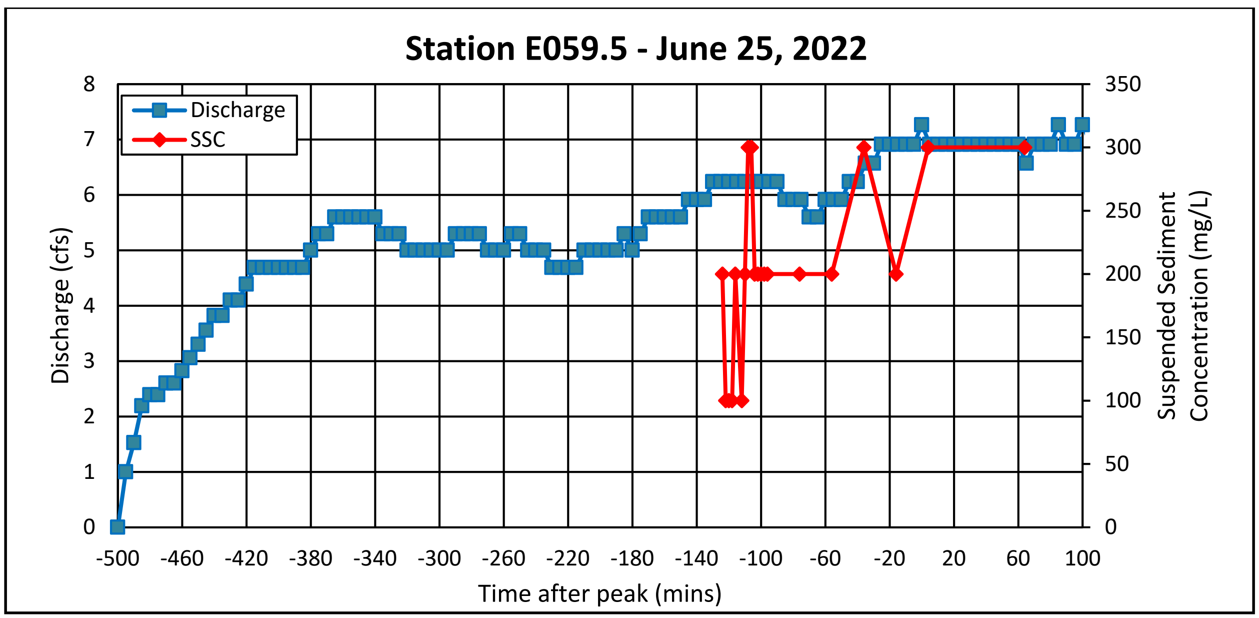
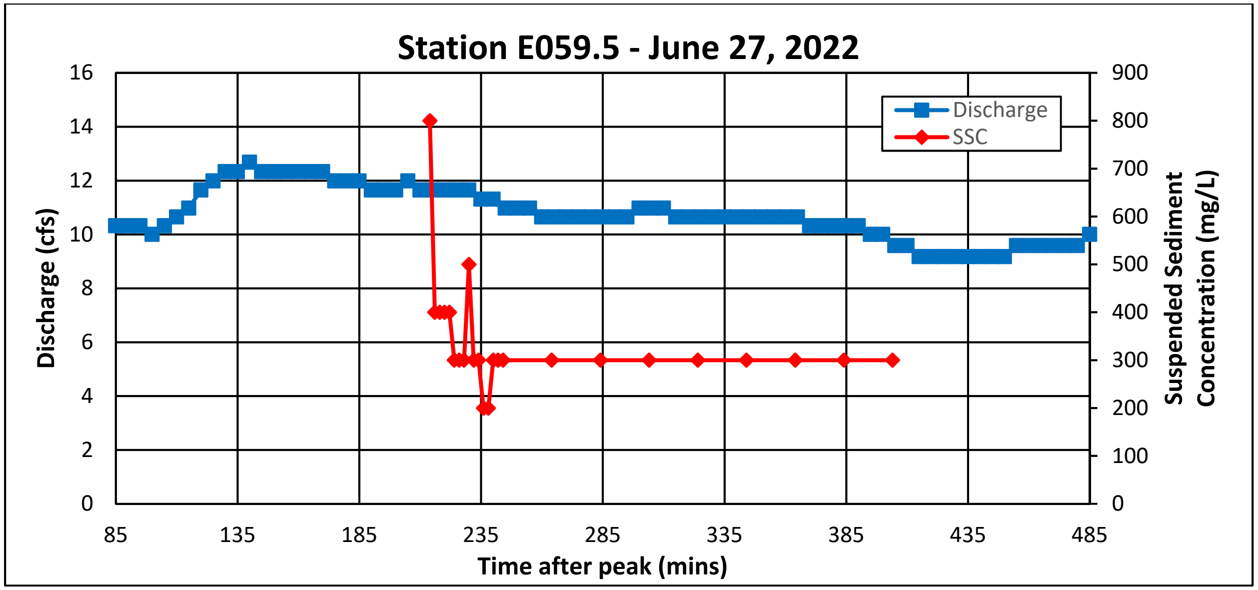


Figure 3.2-4 (continued) **Measured discharge and measured SSC for events sampled at E038, E039.1, E042.1, E050.1, E059.5, and E059.8**



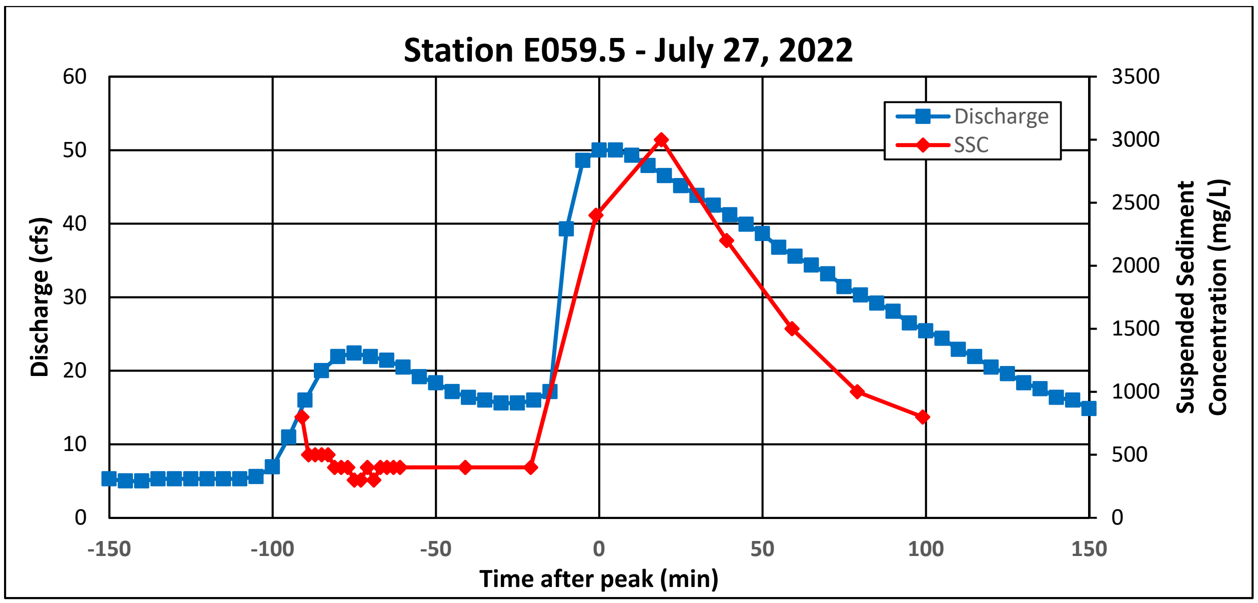
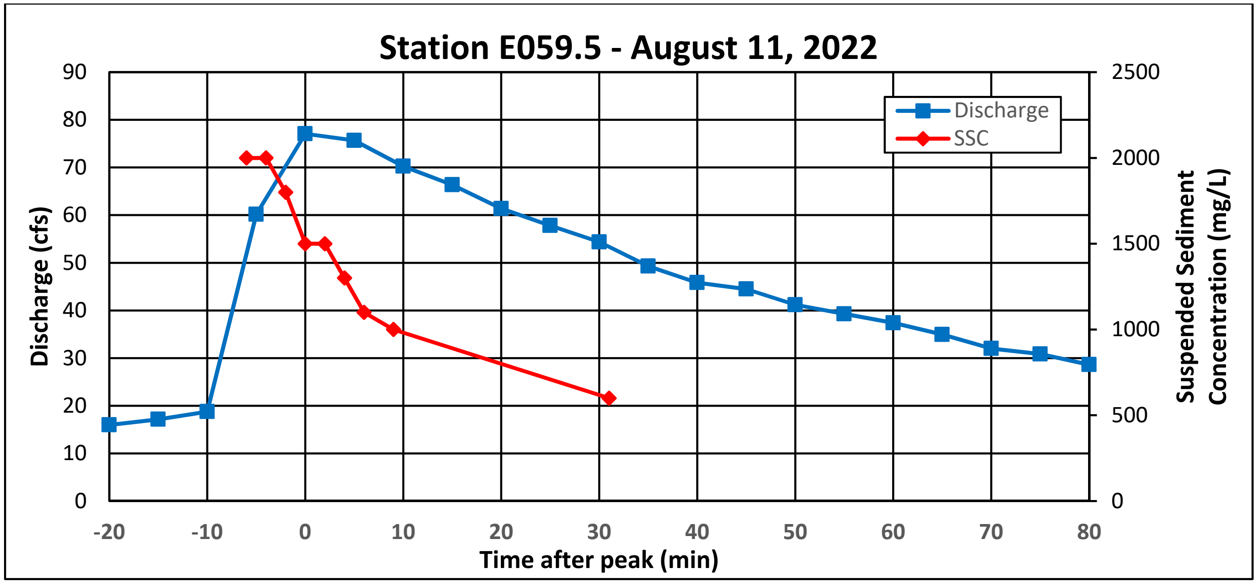


Figure 3.2-4 (continued) **Measured discharge and measured SSC for events sampled at E038, E039.1, E042.1, E050.1, E059.5, and E059.8**



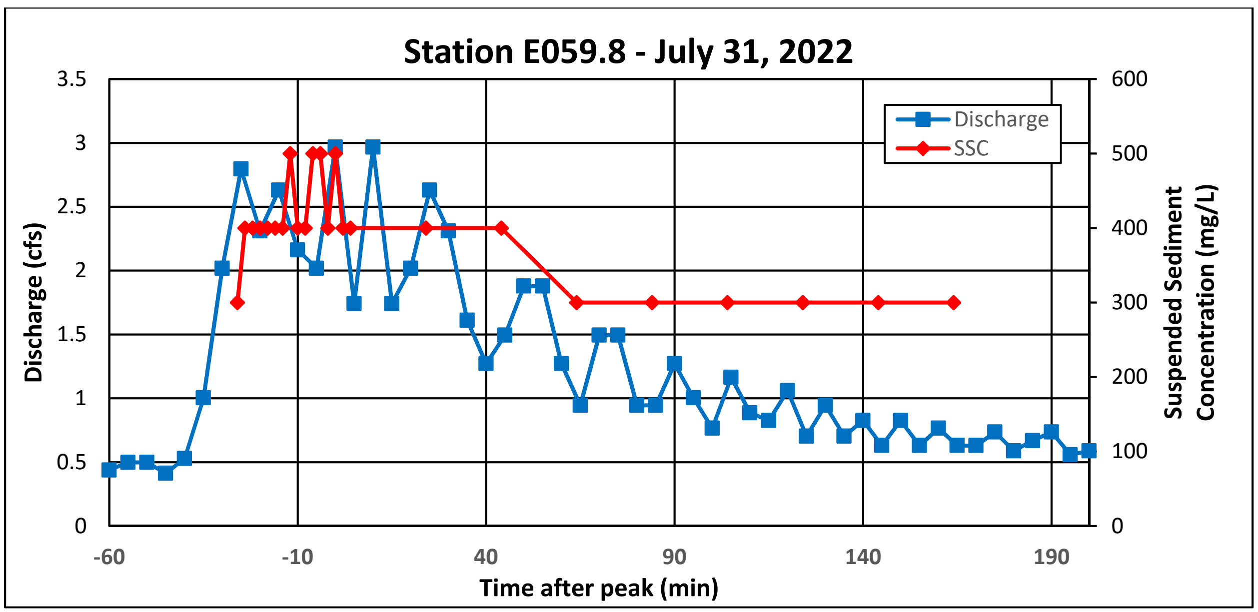
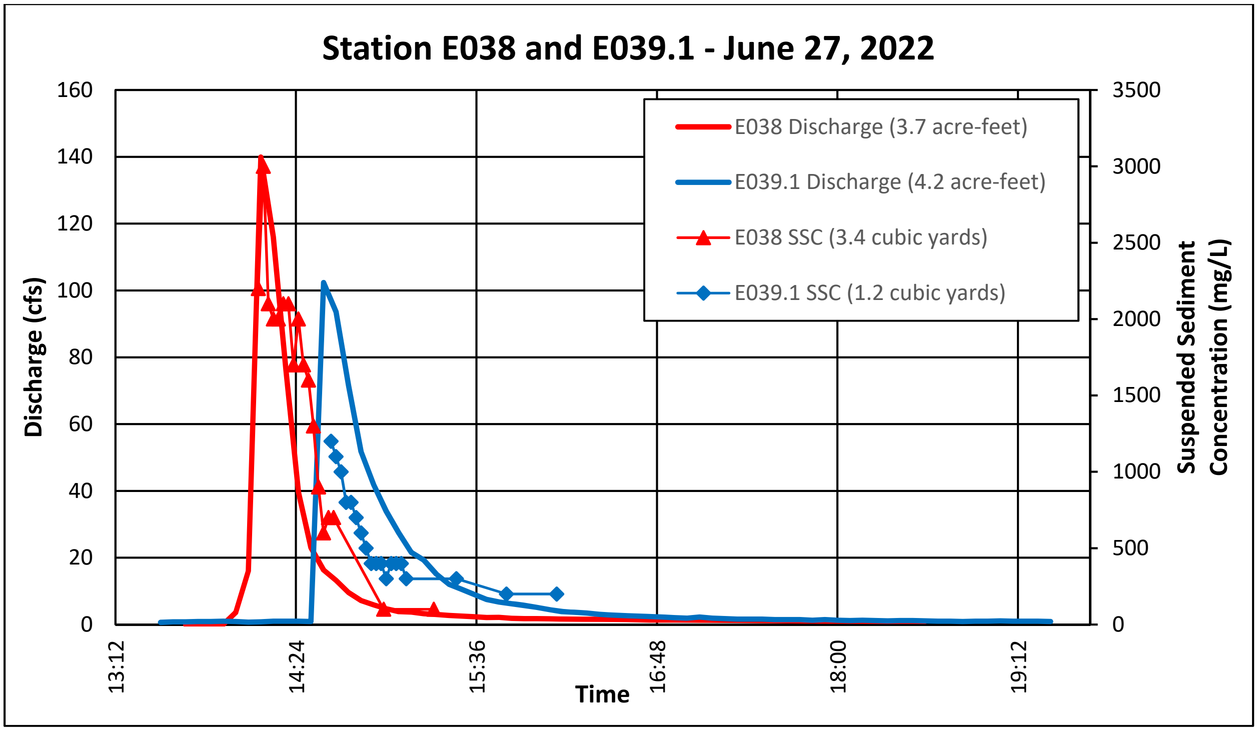


Figure 3.2-4 (continued) **Measured discharge and measured SSC for events sampled at E038, E039.1, E042.1, E050.1, E059.5, and E059.8**



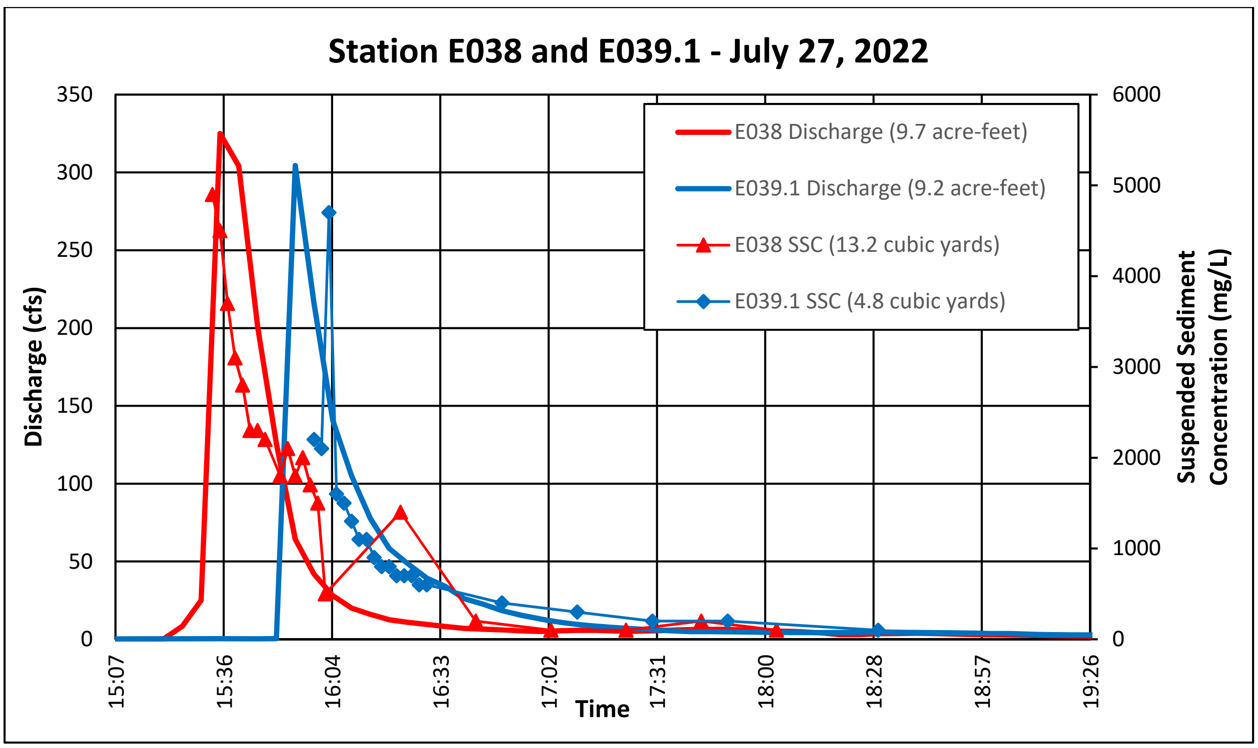


Figure 3.2-5 **Discharge and SSC at E038 and E039.1 in DP Canyon and at E042.1 and E050.1 in LA Canyon on days when sampling of the same runoff event occurred**

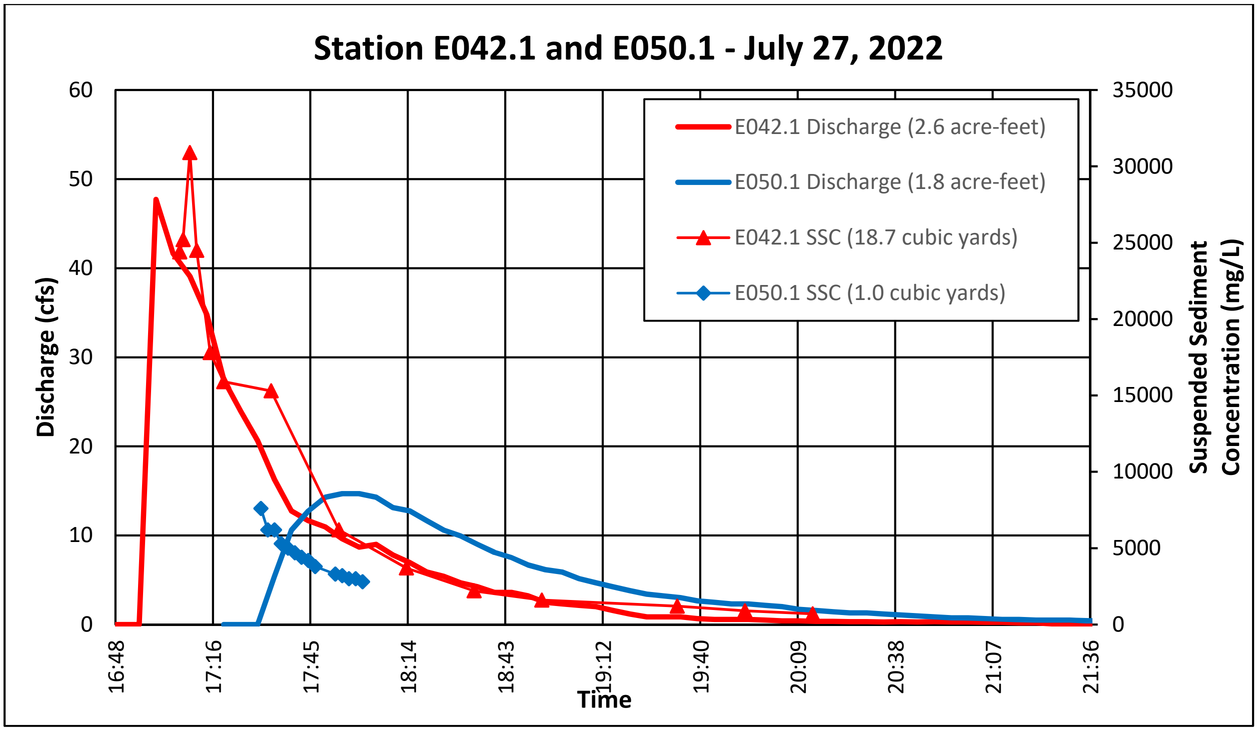


Figure 3.2-5 (continued) **Discharge and SSC at E038 and E039.1 in DP Canyon and at E042.1 and E050.1 in LA Canyon on days when sampling of the same runoff event occurred**

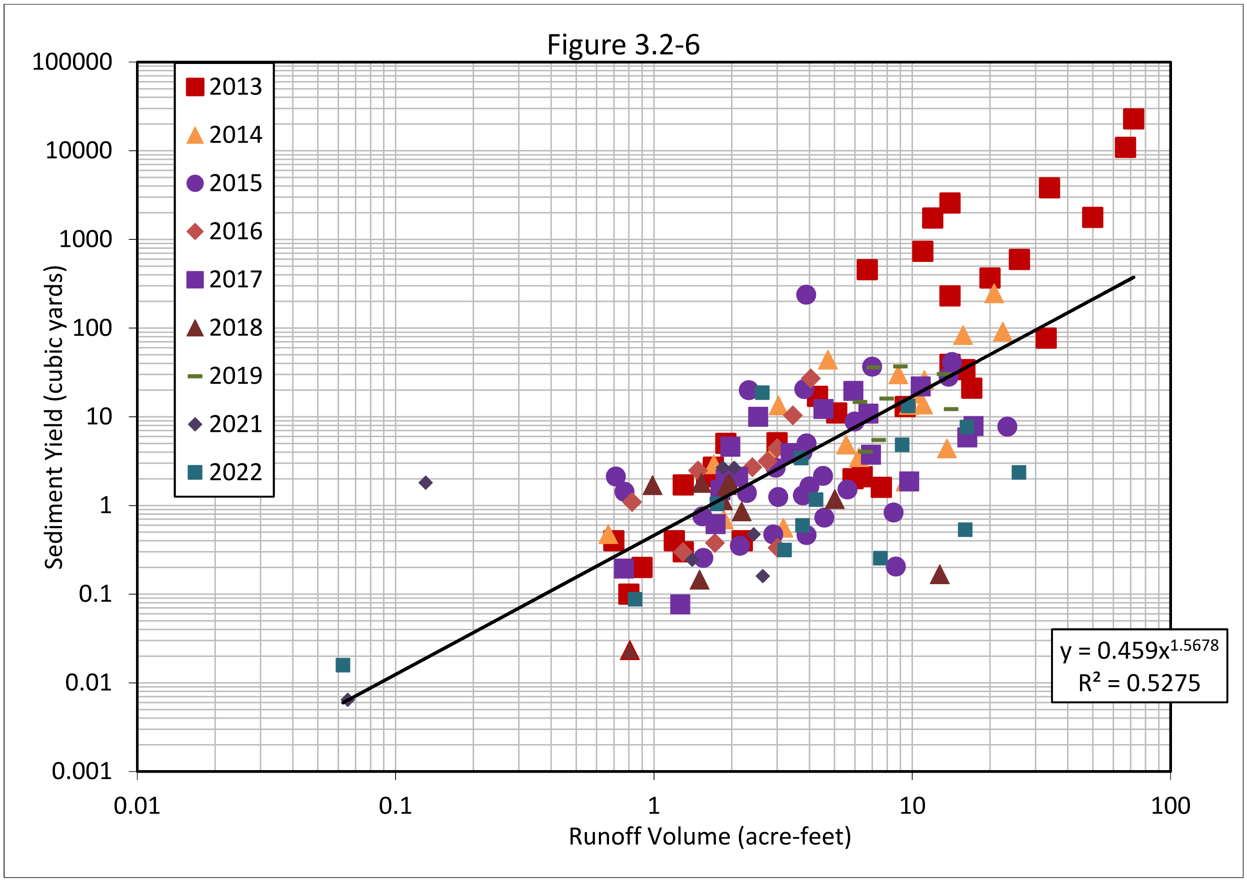


Figure 3.2-6 Relationship between SSC-based sediment yield and runoff volume over the 10 yr of monitoring from 2013 to 2022 (excluding 2020 when no samples were collected)

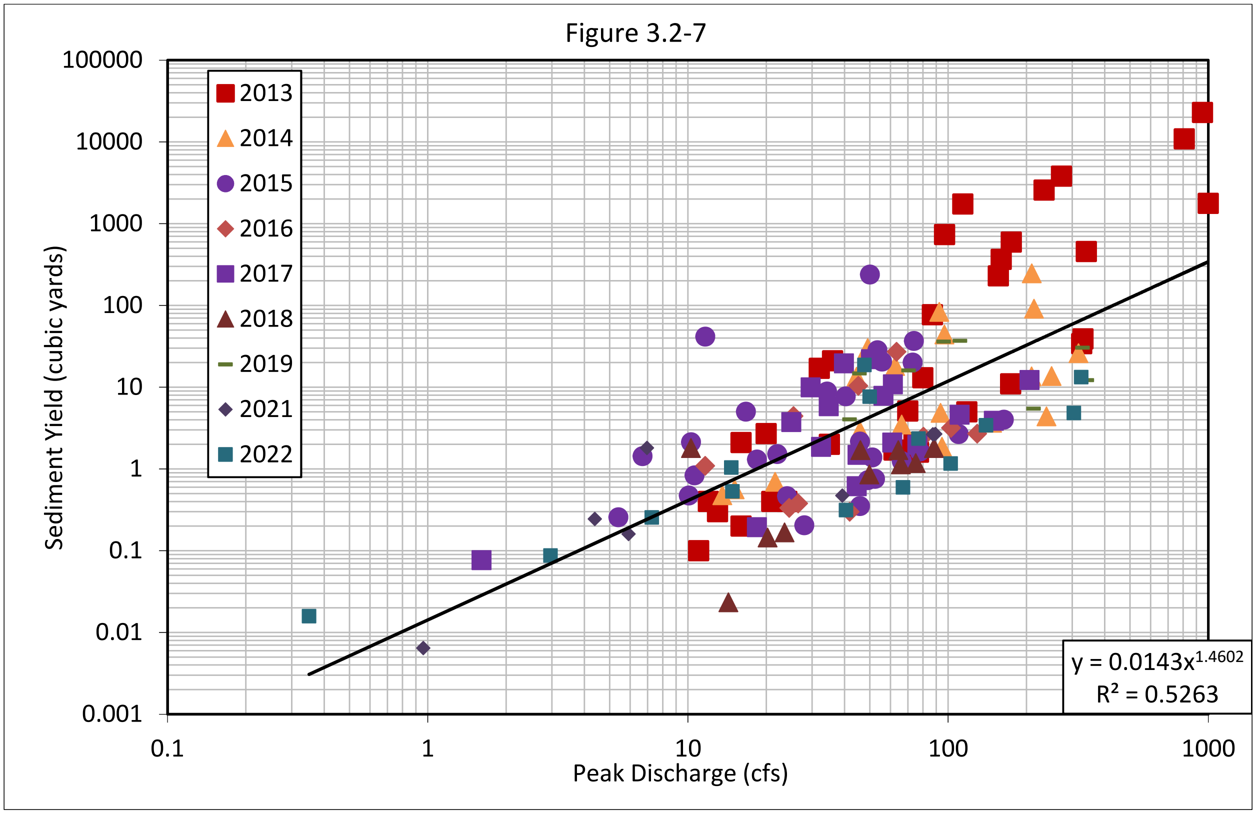
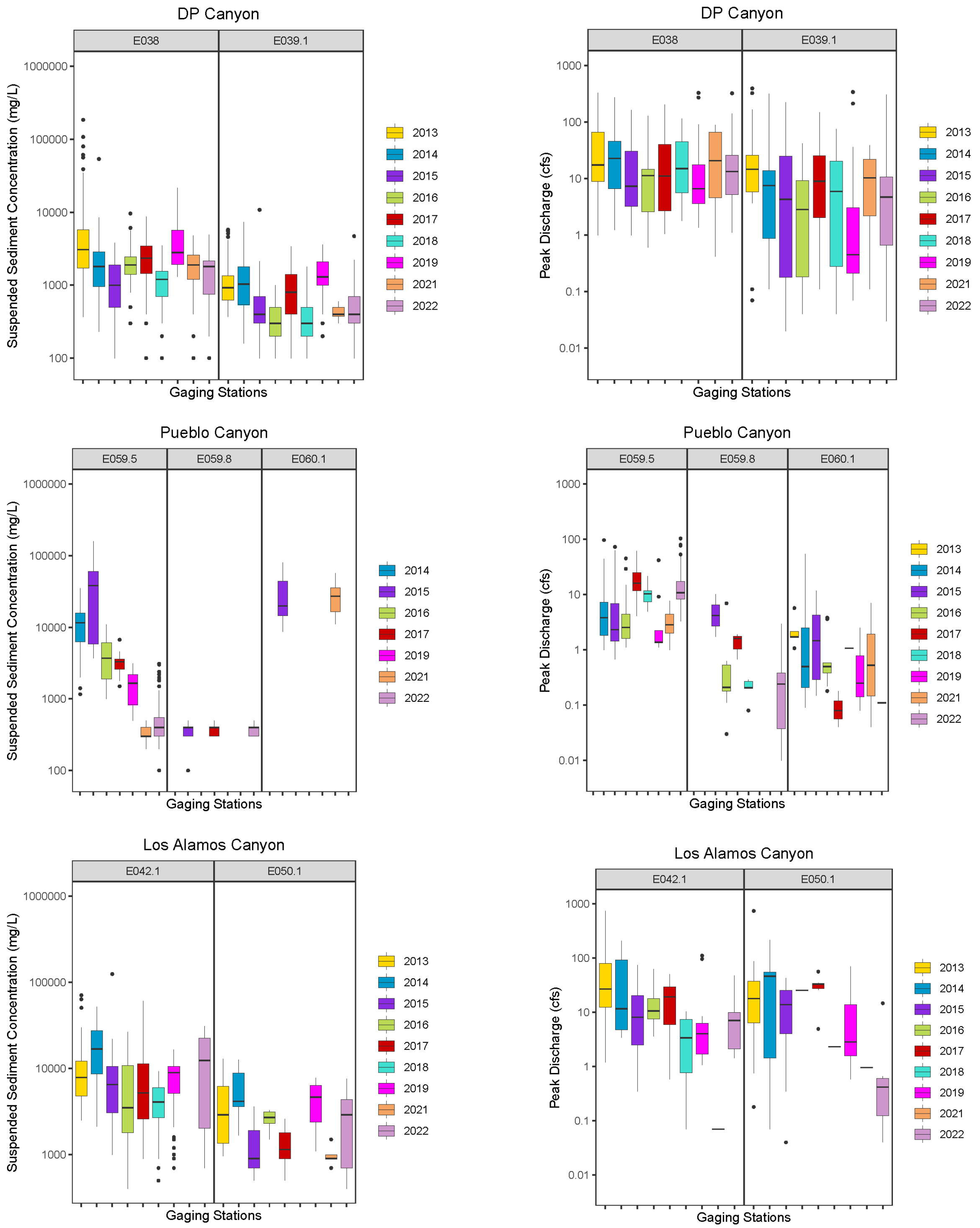


Figure 3.2-7 **Linear relationship between SSC-based sediment yield and peak discharge over the 10 yr of monitoring from 2013 to 2022 (excluding 2020 when no samples were collected)**



Note: Black dots represent outliers.

Figure 3.4-1 Box-and-whisker plots of SSC (left) and peak discharge (right) upstream and downstream of the watershed mitigations in DP (top), Pueblo (middle), and Los Alamos (bottom) Canyons over the 10 yr of monitoring from 2013 to 2022 (excluding 2020 when no samples were collected)

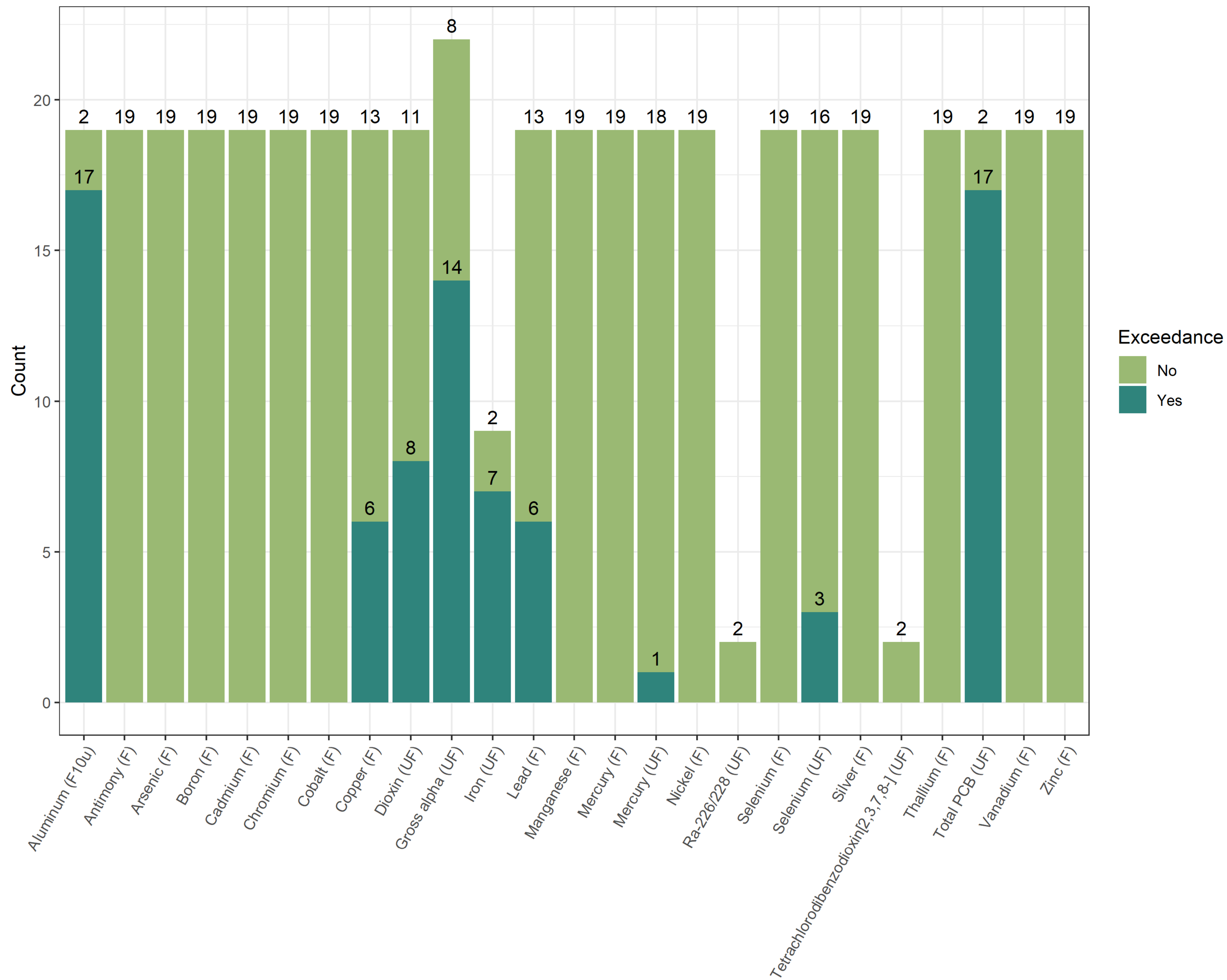
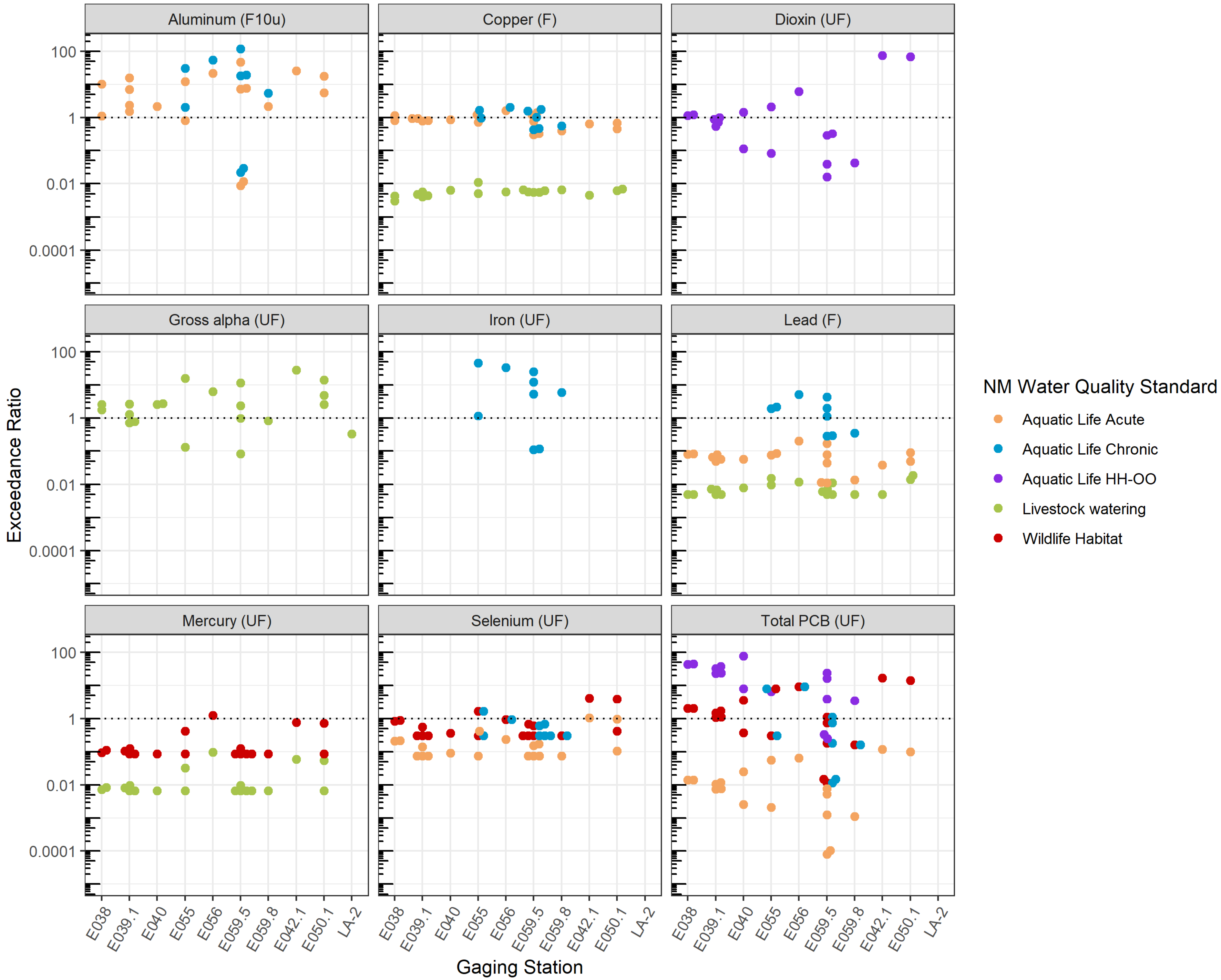


Figure 4.1-1 2022 Los Alamos/Pueblo stormwater analytical result summary



Notes: a = Dioxin result for E059.5 is 0 (nondetection) and cannot be displayed on log-scale.
b = Gross alpha result for the second sample at E059.5 is negative (nondetection) and cannot be displayed on log-scale.

Figure 4.1-2 2022 Los Alamos/Pueblo stormwater analytical result exceedance ratios

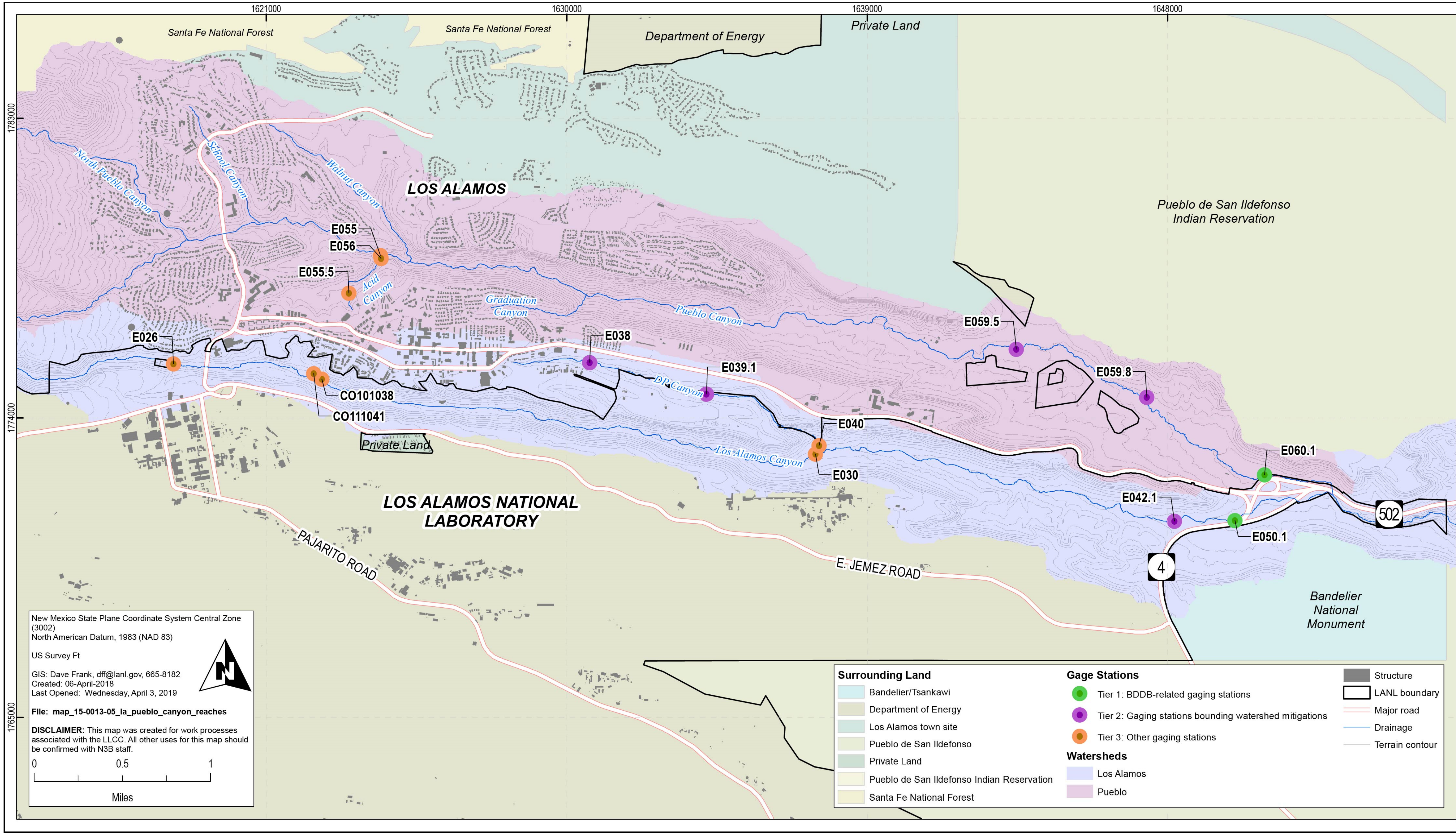


Figure 6.3-1 Three-tiered approach to sample retrieval when 1 business day collection is not feasible

Table 2.1-1
Equipment Configuration at Los Alamos/Pueblo Gaging Stations

Gaging Station	Stage Measurement Sensor	Communication Method with Data Logger	Sampler Trip Level (Discharge) (ft^3/s)	Dates Sampler Trip Level Active
E026	Radar sensor	Radio telemetry	2	Monitoring season
E030	Radar sensor	Radio telemetry	25	Monitoring season
E038	Radar sensor	Radio telemetry	50	Activation to 6/28/2022
E038	Radar sensor	Radio telemetry	100	6/28/2022 to the end of the monitoring season
E039.1	Radar sensor	Radio telemetry	25	Activation to 6/27/2022
E039.1	Radar sensor	Radio telemetry	50	6/27/2022 to the end of the monitoring season
E040	Radar sensor	Radio telemetry	25	Activation to 6/27/2022
E040	Radar sensor	Radio telemetry	50	6/27/2022 to the end of the monitoring season
E042.1	Radar sensor	Radio telemetry	25	Activation to 7/28/2022
E042.1	Radar sensor	Radio telemetry	50	7/28/2022 to the end of the monitoring season
E050.1	Encoder, bubble sensor, radar sensor	Radio telemetry	Liquid level actuator	Monitoring season
E055	Radar sensor	Radio telemetry	25	Activation to 6/27/2022
E055	Radar sensor	Radio telemetry	50	6/27/2022 to the end of the monitoring season
E055.5	Radar sensor	Radio telemetry	25	Monitoring season
E056	Radar sensor	Radio telemetry	25	Activation to 7/28/2022
E056	Radar sensor	Radio telemetry	50	7/28/2022 to the end of the monitoring season
E059.5	Bubble sensor	Radio telemetry	2 ft^3/s above base flow	Activation to 6/13/2022
E059.5	Bubble sensor	Radio telemetry	5 above base flow	6/13/2022 to the end of the monitoring season
E059.8	Radar sensor	Radio telemetry	2 ft^3/s above base flow	Monitoring season
E060.1	Encoder, bubble sensor, radar sensor	Radio telemetry	Liquid level actuator	Monitoring season

Table 2.3-1
Maximum Daily Discharge and Precipitation Totals for the Largest Storm Events in the Los Alamos/Pueblo Watershed during 2022

Date	Los Alamos/Pueblo															
	DP Canyon				Los Alamos Canyon					Acid Canyon			Pueblo Canyon			
	RG038	E038	E039.1	E040	RG042.1	E026	E030	E042.1	E050.1	RG055.5	E055.5	E056	E055	E059.5	E059.8	E060.1
6/25/2022	1.42	26 BT[a]	17 BT	10 BT	1.54	0	0	1.4 BT	0	1.42	3.4 BT	4.1 BT	0	7.3 S	0	0
6/26/2022	1.48	49 BT	41 S[b]	31 SBP[c]	1.03	0	0	0.21 BT	0	1.78	5.0 BT	7.7 BT	30 SBP	17 NS	0.27 BT	0
6/27/2022	0.46	140 S	102 S	43 SBP	0.17	0	0	15 BT	0.66 NS[d]	0.30	5.0 BT	4.6 BT	32 NS	15 S	0.44 BT	0
7/26/2022	0.39	5.3 BT	1.1 BT	2.9 BT	0.69	0	0.08 BT	0.07 BT	0	0.32	0.82 BT	0.16 BT	2.4 BT	80 S	0.03 BT	0
7/27/2022	1.16	325 S	304 S	162 NS	0.15	0	0	48 S	15 S	1.10	17 BT	102 S	76 NS	50 S	0.74 BT	0
7/31/2022	0.40	38 BT	35 BT	15 BT	0.27	0	0.01 BT	6.4 BT	0.58 BT	0.38	4.1 BT	6.4 BT	17 BT	104 NS	3.0 S	0
8/5/2022	0	0.24 BT	0.28 BT	1.3 BT	0	0	0	0	0	0.01	0	15 BT	97 SBP	50 NS	0.77 BT	0
8/6/2022	0.32	19 BT	7.0 BT	0.05 BT	0.48	0.18 BT	0	0	0.50 S	0.53	2.8 BT	4.2 BT	10 BT	18 BT	0.53 BT	0.11 BT
8/11/2022	0.38	29 BT	7.8 BT	0.14 BT	0	0	0.38 BT	2.2 BT	0.18 BT	0.32	1.6 BT	0.18 BT	5.0 BT	77 S	1.1 BT	0.11 BT
8/23/2022	0.68	64 BT	67 S	5.8 BT	0.38	0	0.	7.8 BT	0.35 S	0.45	2.7 BT	3.1 BT	23 BT	53 BT	0.77 BT	0

Note: Units are inches for precipitation gages RG038, RG042.1 and RG055.5, Units are cubic feet per second for Maximum Daily Discharge. Green shading denotes sample collected. Blue shading denotes streamflow below sampler trip level. Yellow shading indicates samples missed.

[a] BT = Below gaging station triggering threshold; no sample collected.

[b] S = Sample was collected.

[c] SBP = Sample collected at lower Peak flow than daily Peak flow. (Sample peak flow = 21ft^3/s at E040, 24 ft^3/s at E055.)

[d] NS = Flow was above tip level but no sample was collected.

Table 2.3-2
Sampling Operational Issues during the 2022 Monitoring Year

Gaging Station	Date	Peak Discharge (ft^3/s)	Reason	Comment
E040	7/27/2022	162	Equipment malfunction	Sampler intake tubes clogged with sediment during sample attempt. No sample collected. Sediment was cleared and intake tubing was replaced.
E050.1	6/27/2022	0.66	Equipment malfunction	The liquid level actuator was dislodged by the flow of water and the sensor was not in contact with the water to trigger the sampler. The sensor was repositioned.
E055	6/27/2022	32	Previous sample	Samples from the 6/26 storm event were retrieved on 6/27 after the 6/27 storm event. No sample was collected from the 6/27 storm event.
	7/27/2022	76	Equipment malfunction	Sampler did not trigger for unknown reason. The sampler successfully collected a sample on the next triggering storm event.
E059.5	6/26/2022	17	Previous sample	Samples from the 6/25 storm event were retrieved on 6/27 after the 6/26 storm event. No sample was collected from the 6/26 storm event.
	7/31/2022	104	Equipment malfunction	Sampler intake tubes clogged with sediment during sample attempt. No sample collected. Sediment was cleared and intake tubing was replaced.
	8/5/2022	50	Equipment malfunction	Sampler attempted to sample but the tubing was dislodged by storm flow and debris. No sample was collected. Debris was cleared and intake tubing was replaced.

Table 2.3-3
Sample-Triggering Events and Percentage of Samples Collected during the 2022 Monitoring Year

Gaging Station	Trip Level (ft^3/s)	Date Range in 2022	Number of Storm Events Which Exceeded Trip Level	% Sampled Storms	Total Number of Samples
E026	2	5/2–10/26	0	n/a*	0
E030	25	4/26–10/26	0	n/a	0
E038	50	5/4–6/28	1	100	1
	100	6/28–10/27	1	100	1
E039.1	25	5/4–6/27	2	100	2
	50	6/27–10/26	2	100	2
E040	25	4/26–6/27	2	100	2
	50	6/27–10/26	1	0	0
E042.1	25	5/3–7/28	1	100	1
	50	7/28–10/26	0	n/a	0
E050.1	0.5	4/19–10/25	4	75	3
E055	25	5/5–6/27	2	50	1
	50	6/27–10/27	2	50	1
E055.5	25	5/5–10/27	0	n/a	0
E056	25	5/5–7/28	1	100	1
	50	7/28–10/27	0	n/a	0
E059.5	3.3	5/18–6/13	0	n/a	0
	6.2	6/13–6/28	3	67	2
	13.7	6/28–8/1	3	67	2
	20	8/1–8/12	2	50	1
	123	8/12–10/26	0	0	0
E059.8	2	5/18–10/26	1	100	1
E060.1	0.5	4/19–10/25	0	n/a	0

*n/a= Not applicable.

Table 2.3-4
Gaging Station Operational Issues during the 2022 Monitoring Year

Gaging Station	Issue Description	Issue Date	Repair Date	Working Days from Issue to Repair	Potential Missed Discharge above Trigger	Peak Discharge (ft^3/s)
E040	Silting	6/28/2022	7/6/2022	4	0	1.1
E040	Silting	8/11/2022	8/23/2022	8	0	5.8
E040	Silting	8/23/2022	9/13/2022	13	0	0.03
E056	Equipment malfunction. Dead battery.	10/16/2022	10/18/2022	2	0	ND*

*ND = No discharge data recorded.

Table 2.3-5
Sample Collection and Sample Retrieval Working-Day Interval

Location Alias	Date Sample Collected	Date Sample Retrieved	Working Days between Collection and Retrieval	Comment
E038	6/27/2022	6/28/2022	1	Sample was retrieved the day after the storm event.
	7/27/2022	7/28/2022	1	Sample was retrieved the day after the storm event.
E039.1	6/26/2022	6/27/2022	1	Sample was retrieved the day after the storm event.
	6/27/2022	6/28/2022	1	Sample was retrieved the day after the storm event.
	7/27/2022	7/28/2022	1	Sample was retrieved the day after the storm event.
	8/23/2022	8/24/2022	1	Sample was retrieved the day after the storm event.
E040	6/26/2022	6/27/2022	1	Sample was retrieved the day after the storm event.
	6/27/2022	6/28/2022	1	Sample was retrieved the day after the storm event.
E042.1	7/27/2022	7/28/2022	1	Sample was retrieved the day after the storm event.
E050.1	7/27/2022	7/28/2022	1	Sample was retrieved the day after the storm event.
E055	6/26/2022	6/27/2022	1	Sample was retrieved the day after the storm event.
	8/5/2022	8/8/2022	1	Sample was collected on Friday and retrieved on Monday.
E056	7/27/2022	7/28/2022	1	Sample was retrieved the day after the storm event.
E059.5	6/25/2022	6/27/2022	1	Sample was collected Saturday and retrieved on Monday.
	6/27/2022	6/28/2022	1	Sample was collected on Saturday and was retrieved on Monday.
	7/26/2022	7/27/2022	1	Sample was retrieved the day after the storm event.
	7/27/2022	7/28/2022	1	Sample was retrieved the day after the storm event.
	8/11/2022	8/12/2022	1	Sample was retrieved the day after the storm event.
E059.8	7/31/2022	8/1/2022	1	Sample was retrieved the day after the storm event.

Table 2.4-1
Analytical Suite Prioritization for each Gaging Station

Gaging Station	Priority	Analytical Suite	Glass Bottle	Polyethylene Bottle	Minimum Volume Required (L)
DP Canyon Gaging Stations					
E038, E039.1, E040	1	PCBs	Yes	No	1
	2	Gamma spectroscopy[a] and gross alpha	Yes	Yes	1
	3	Isotopic radionuclides	Yes	Yes	1
	4	Strontium-90	No	Yes	1
	5	TAL metals[b]	Yes	Yes	0.25
	6	BLM suite[c]	Yes	No	1
	7	Particle size and SSC[d]	Yes	Yes	1
Upper Los Alamos Canyon Gaging Stations					
E026, E030	1	PCBs	Yes	No	1
	2	Gamma spectroscopy and gross alpha	Yes	Yes	1
	3	Isotopic radionuclides	Yes	Yes	1
	4	Strontium-90	No	Yes	1
	5	Dioxins and furans	Yes	No	1
	6	TAL metals	Yes	Yes	0.25
	7	BLM suite	Yes	No	1
	8	Particle size and SSC	Yes	Yes	1
Upper Pueblo Canyon and Acid Canyon Gaging Stations					
E055, E055.5, E056	1	PCBs	Yes	No	1
	2	Gamma spectroscopy and gross alpha	Yes	Yes	1
	3	Isotopic radionuclides	Yes	Yes	1
	4	TAL metals	Yes	Yes	0.25
	5	BLM suite	Yes	No	1
	6	Particle size and SSC	Yes	Yes	1
Lower Los Alamos Canyon Gaging Stations					
E042.1	1	PCBs	Yes	No	1
	2	Gamma spectroscopy and gross alpha	Yes	Yes	1
	3	Isotopic radionuclides	Yes	Yes	1
	4	Strontium-90	Yes	Yes	1
	5	Dioxins/furans	Yes	No	1
	6	TAL metals	Yes	Yes	0.25
	7	BLM suite	Yes	No	1
	8	Particle size and SSC	Yes	Yes	1

Table 2.4-1 (continued)

Gaging Station	Priority	Analytical Suite	Glass Bottle	Polyethylene Bottle	Minimum Volume Required (L)
Lower Los Alamos Canyon Gaging Stations (cont.)					
E050.1	1	PCBs	Yes	No	1
	2	Gamma spectroscopy and gross alpha	Yes	Yes	1
	3	Isotopic radionuclides	Yes	Yes	1
	4	Dioxins/furans	Yes	No	1
	5	Strontium-90	Yes	Yes	1
	6	TAL metals	Yes	Yes	0.25
	7	BLM suite	Yes	No	1
	8	Gross beta	Yes	Yes	0.25
	9	Radium-226/radium-228	Yes	Yes	1
	10	Particle size and SSC	Yes	Yes	1
Lower Pueblo Canyon Gaging Stations					
E059.5, E059.8	1	PCBs	Yes	No	1
	2	Gamma spectroscopy and gross alpha	Yes	Yes	1
	3	Isotopic radionuclides	Yes	Yes	1
	4	Strontium-90	Yes	Yes	1
	5	TAL metals	Yes	Yes	0.25
	6	BLM suite	Yes	No	1
	7	Particle size and SSC	Yes	Yes	1
E060.1	1	PCBs	Yes	No	1
	2	Gamma spectroscopy and gross alpha	Yes	Yes	1
	3	Isotopic radionuclides	Yes	Yes	1
	4	Dioxins/furans	Yes	No	1
	5	Strontium-90	Yes	Yes	1
	6	TAL metals	Yes	Yes	0.25
	7	BLM suite	Yes	No	1
	8	Gross beta	Yes	Yes	0.25
	9	Radium-226/radium-228	Yes	Yes	1
	10	Particle size and SSC	Yes	Yes	1

Table 2.4-1 (continued)

Gaging Station	Priority	Analytical Suite	Glass Bottle	Polyethylene Bottle	Minimum Volume Required (L)
Detention Basin and Vegetative Buffer below the SWMU 01-001(f) Drainage					
CO111041, CO101038	1	PCBs	Yes	No	1
	2	TAL metals	Yes	Yes	0.25
	3	BLM suite	Yes	No	1
	4	Gross alpha	Yes	Yes	1
	5	Particle size and SSC	Yes	Yes	1

[a] Gamma spectroscopy = Ac-228, Be-7, Bi-212, Bi-214, Cs-134, Cs-137, Co-60, gross gamma, I-131, Pb-212, Pb-214, K-40, Pa-234, Na-22, Tl-208, and Th-234.

[b] Target analyte list (TAL) metals = Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Hg, K, Mg, Mn, Na, Ni, Pb, Sb, Se, Tl, V, and Zn; hardness is calculated from Ca and Mg, components of the TAL list.

[c] BLM suite = Biotic ligand model suite: alkalinity, dissolved organic carbon, and pH.

[d] SSC = Suspended sediment concentration.

Table 2.4-2
Analytical Requirements for Stormwater Samples

Analytical Suite	Method	Contract-Required Reporting Limit	Detection Limit in Stormwater[a]	Upper Los Alamos Canyon (E026, E030)	Upper Pueblo Canyon and Acid Canyon (E055, E056, E055.5)	DP Canyon (E038, E039.1, E040)	Lower Los Alamos Canyon (E042.1, E050.1)	Lower Pueblo Canyon (E059.5, E059.8, E060.1)	Supplemental BDDB Monitoring (E050.1, E060.1)	Detention Basins below the SWMU 01-001(f) Drainage
PCBs	EPA:1668A	n/a[b]	25 pg/L	X[c]	X	X	X	X	—[d]	X
Isotopic plutonium	HASL-300	0.075 pCi/L	0.5 pCi/L	X	X	X	X	X	—	—
Gamma spectroscopy[e]	EPA:900.0 EPA:901.1	8 pCi/L (Cs-137)	10 pCi/L (Cs-137)	X	X	X	X	X	—	—
Isotopic uranium	HASL-300	0.1 pCi/L	0.5 pCi/L	—	—	—	—	—	X	—
Americium-241	HASL-300	0.075 pCi/L	0.5 pCi/L	—	X	—	X	X	—	—
Strontium-90	EPA:905.0	0.5 pCi/L	0.5 pCi/L	X	—	X	X	X	—	—
TAL metals[f] + boron + uranium (total and dissolved)	EPA:200.7/200.8/245.2 SM:A2340B	Variable	Variable	X	X	X	X	X	—	X
Total recoverable aluminum	EPA:200.8	100 µg/L	20 µg/L	X	X	X	X	X	—	X
Dioxins and furans	EPA:1613B	10–50 ng/L	50 pg/L	X	—	—	X	X[g]	—	—
Gross alpha	EPA:900	3 pCi/L	10 pCi/L	X	X	X	X	X	—	X
Gross beta	EPA:900	3 pCi/L	10 pCi/L	—	—	—	—	—	X	—
Radium-226/Radium-228	EPA:903.1/EPA:904	1 pCi/L	0.5/0.5 pCi/L	—	—	—	—	—	X	—
SSC	ASTM: D3977-97	3 mg/L	10 mg/L	X	X	X	X	X	—	X
Particle size[h]	ASTM:C1070	n/a	0.01%	X	X	X	X	X	—	X

Table 2.4-2 (continued)

Analytical Suite	Method	Contract-Required Reporting Limit	Detection Limit in Stormwater[a]	Upper Los Alamos Canyon (E026, E030)	Upper Pueblo Canyon and Acid Canyon (E055, E056, E055.5)	DP Canyon (E038, E039.1, E040)	Lower Los Alamos Canyon (E042.1, E050.1)	Lower Pueblo Canyon (E059.5, E059.8, E060.1)	Supplemental BDDB Monitoring (E050.1, E060.1)	Detention Basins below the SWMU 01-001(f) Drainage
Alkalinity[h]	EPA:310	n/a	n/a	X	X	X	X	X	—	X
pH[h]	EPA:150.1	n/a	n/a	X	X	X	X	X	—	X
Dissolved organic carbon[i]	EPA:415.1	n/a	0.5 mg/L	X	X	X	X	X	—	X

[a] Method detection limit or minimum detectable activity for radionuclides.

[b] n/a = Not applicable.

[c] X = Monitoring planned.

[d] — = Monitoring not planned.

[e] Gamma spectroscopy = Ac-228, Be-7, Bi-212, Bi-214, Cs-134, Cs-137, Co-60, gross gamma, I-131, Pb-212, Pb-214, K-40, Pa-234, Na-22, Tl-208, and Th-234.

[f] Target analyte list (TAL) metals are Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Hg, K, Mg, Mn, Na, Ni, Pb, Sb, Se, Tl, V, and Zn; hardness is calculated from CA and Mg, components of the TAL list.

[g] Dioxins and furans are measured at E060.1 only.

[h] These analytical suites are investigative monitoring.

Table 3.1-1
Drainage Area and Impervious Surface Percentage in the Los Alamos Canyon Watersheds

Canyon	Gaging Station	Drainage Area (acres)	Impervious Surface (%)
Acid	E055.5	53	26
Acid*	E056	237	22
Acid	Acid Canyon above E056	290	23
Pueblo	E055	2184	8.0
Pueblo	E059.5	2099	11
Pueblo	E059.8	407	4.4
Pueblo*	E060.1	330	3.8
Pueblo	Pueblo Canyon above E060.1	5310	9.5
DP	E038	125	32
DP*	E039.1	111	12
DP*	E040	130	4.0
DP	DP Canyon above E039.1	236	23
DP	DP Canyon above E040	366	16
LA	E026	4354	0.4
LA*	E030	1100	13
LA*	E042.1	605	0.6
LA*	E050.1	193	2.2
LA*	E109.9 (including Guaje Canyon)	27,000	1.2
LA	Los Alamos Canyon above E050.1	6250	2.7
LA	Los Alamos, Pueblo, and Guaje Canyons above E109.9	37,760	2.6
LA*	Los Alamos Canyon between E050.1, E060.1, and E109.9	5240	2.4
Guaje	E099	21,000	0.9

* Drainage areas marked by an asterisk do not extend to the head of the watershed above the gaging station; unmarked drainage areas extend from the gaging station to the head of the watershed.

Table 3.2-1
Travel Time of Flood Bore, Peak Discharge, Increase or Decrease in Peak Discharge, and Percent Change in Peak Discharge from Upstream to Downstream Gaging Stations for 2022 Runoff Events Exceeding Sampling Triggers across the Watershed Mitigations

Date	Travel Time from E038 to E039.1 (min)	Peak Discharge (ft^3/s)		+/−[a]	% RPD[b]	Travel Time from E042.1 to E050.1 (min)	Peak Discharge (ft^3/s)		+/−	% RPD
		E038	E039.1				E042.1	E050.1		
25-Jun	60	26	17	-	35	n/a[c]	1.4	0	-	100
26-Jun	35	49	41	-	18	n/a	0.21	0	-	100
27-Jun	25	140	102	-	27	90	15	0.66	-	96
26-Jul	155	5.3	1.1	-	79	n/a	0.07	0	-	100
27-Jul	20	325	304	-	6	55	48	15	-	69
31-Jul	35	38	35	-	7	115	6.4	0.58	-	91
5-Aug	375	0.24	0.28	+	14	n/a	0	0	n/a	n/a
6-Aug	80	19	7.0	-	62	n/a	0	0.5	+	100
11-Aug	55	29	7.8	-	73	—[d]	2.2	0.18	n/a	n/a
23-Aug	20	64	67	+	5	130	7.8	0.35	-	96
Min	20	0.24	0.28	n/a	5	55	0	0	n/a	69
Mean	86	69	58	n/a	33	98	12	2.7	n/a	94
Max	375	325	304	n/a	79	130	0.14	0.96	n/a	100

Date	Travel Time from E059.5 to E059.8 (min)	Peak Discharge (ft^3/s)		+/−[a]	% RPD[b]	Travel Time from E059.8 to E060.1 (min)	Peak Discharge (ft^3/s)		+/−	% RPD
		E059.5	E059.8				E059.8	E060.1		
25-Jun	—	7.3	0	-	100	n/a	0	0	n/a	n/a
26-Jun	230	17	0.27	-	98	n/a	0.27	0	-	100
27-Jun	440	15	0.44	-	97	n/a	0.44	0	-	100
26-Jul	10	80	0.03	-	100	n/a	0.03	0	-	100
27-Jul	230	50	0.74	-	99	n/a	0.74	0	-	100
31-Jul	165	104	3.0	-	97	n/a	3.0	0	-	100
5-Aug	235	50	0.77	-	99	n/a	0.77	0	-	100
6-Aug	45	18	0.53	-	97	—	0.53	0.11	n/a	n/a
11-Aug	220	77	1.1	-	99	190	1.06	0.11	-	90
23-Aug	285	53	0.77	-	99	n/a	0.77	0	-	100
Min	10	7.3	0	n/a	97	190	0	0	n/a	90
Mean	207	47	0.76	n/a	99	190	0.76	0.02	n/a	99
Max	440	104	3.0	n/a	100	190	3.0	0.11	n/a	100

[a] + = Increase; − = decrease

[b] % RPD = Relative percent difference in peak discharge.

[c] n/a = Result not applicable.

[d] — = Travel time events where peak discharge occurred at the lower station before the upper station due to localized rain events.

Table 3.2-2
SSC-Based Sediment Yield and Runoff Volume for Sampled 2013 to 2022 Runoff Events

Gaging Station	Date	Sediment Yield (tons)	Sediment Yield (yd^3)[a]	Runoff Volume (acre-ft)	Peak Discharge (ft^3/s)
2013 Runoff Events					
E038	6/14/2013	11	5.1	3.0	70
E038	6/30/2013	11	5.0	1.9	120
E038	7/12/2013	87	39	14	330
E038	7/28/2013	4.7	2.1	1.6	74
E038	8/5/2013	25	11	5.1	170
E038	8/9/2013	3.8	1.7	1.3	62
E039.1	6/14/2013	0.6	0.3	1.3	13
E039.1	6/30/2013	0.3	0.1	0.8	11
E039.1	7/12/2013	75	34	16	330
E039.1	7/28/2013	0.8	0.4	1.2	24
E039.1	8/4/2013	0.8	0.4	0.7	12
E039.1	8/9/2013	0.5	0.2	0.9	16
E039.1	9/10/2013	4.4	2.0	5.9	35
E039.1	9/12/2013	3.6	1.6	7.6	77
E039.1	11/5/2013	0.9	0.4	2.2	21
E042.1	7/12/2013	817	366	20	160
E042.1	8/5/2013	29	13	9.4	80
E042.1	9/10/2013	48	21	17	36
E050.1	7/12/2013	39	17	4.3	32
E050.1	8/5/2013	6.1	2.7	1.7	20
E050.1	9/10/2013	4.6	2.1	6.4	11
E050.1	9/12/2013	171	77	33	87
E099	7/12/2013	5748	2574	14	230
E099	8/5/2013	1015	455	6.7	340
E109.9	7/8/2013	3880	1737	12	110
E109.9	7/12/2013[b]	1326	594	26	180
E109.9	7/20/2013[b]	24,305	10,883	67	810
E109.9	7/25/2013	1639	734	11	100
E109.9	7/26/2013[b]	515	230	14	160
E109.9	8/3/2013	51,060	22,862	72	950
E109.9	8/5/2013[b]	3955	1771	50	1000
E109.9	8/9/2013	8524	3816	34	270

Table 3.2-2 (continued)

Gaging Station	Date	Sediment Yield (tons)	Sediment Yield (yd^3)[a]	Runoff Volume (acre-ft)	Peak Discharge (ft^3/s)
2014 Runoff Events					
E038	7/8/2014	6.5	2.9	1.7	46
E038	7/27/2014	7.9	3.5	2.9	148
E038	7/29/2014	11	4.8	5.5	94
E039.1	7/8/2014	1.1	0.5	0.7	14
E039.1	7/15/2014	1.3	0.6	3.2	15
E039.1	7/15/2014	58	26	11	317
E039.1	7/27/2014	1.6	0.7	1.9	22
E039.1	7/29/2014	7.8	3.5	6.2	66
E039.1	7/31/2014	31	14	11	250
E040	7/29/2014	4.2	1.9	9.4	95
E040	7/31/2014	9.8	4.4	14	239
E042.1	7/29/2014	186	83	16	92
E042.1	7/31/2014	551	247	21	210
E050.1	7/15/2014	67	30	8.8	49
E050.1	7/29/2014	41	18	11	63
E050.1	7/31/2014	204	91	22	214
E059.5	7/29/2014	30	13	3.0	44
E059.5	7/31/2014	98	44	4.7	97
2015 Runoff Events					
E038	6/26/2015	9.0	4.0	3.8	163
E038	7/20/2015	3.7	1.6	4.0	78
E038	7/31/2015	6.0	2.7	3.0	110
E038	8/08/2015	1.7	0.8	1.5	52
E039.1	5/21/2015	1.0	0.5	3.9	24
E039.1	6/26/2015[b]	2.8	1.3	3.0	66
E039.1	7/3/2015	3.1	1.4	2.3	51
E039.1	7/07/2015	4.8	2.2	4.5	46
E039.1	7/29/2015	1.6	0.7	4.6	49
E039.1	8/8/2015	0.8	0.4	2.1	46
E039.1	10/21/2015	0.5	0.2	8.6	28
E042.1	7/3/2015	4.7	2.1	0.7	10
E042.1	7/7/2015	63	28	14	53
E042.1	7/20/2015	46	21	3.8	56
E042.1	7/31/2015	82	37	7.0	74
E042.1	10/21/2015	11	5.0	3.9	17
E050.1	7/7/2015	17	7.8	23	40
E050.1	7/20/2015	20	8.9	6.0	34

Table 3.2-2 (continued)

Gaging Station	Date	Sediment Yield (tons)	Sediment Yield (yd^3)[a]	Runoff Volume (acre-ft)	Peak Discharge (ft^3/s)
2015 Runoff Events (cont.)					
E050.1	7/29/2015	3.4	1.5	5.6	22
E050.1	8/8/2015	1.9	0.8	8.5	11
E050.1	10/21/2015	2.9	1.3	3.8	18
E050.1	10/23/2015[b]	0.6	0.3	1.6	5.4
E059.5	7/3/2015	533	239	3.9	50
E059.5	7/31/2015	44.8	20	2.3	73
E059.8	10/21/2015	1.1	0.5	2.9	10
E060.1	7/2/2015[b]	93	42	14	12
E060.1	7/20/2015	3.2	1.4	0.8	6.7
2016 Runoff Events					
E038	8/19/2016	5.5	2.5	1.5	80
E038	8/24/2016	6.0	2.7	2.4	129
E038	8/27/2016	7.1	3.2	2.8	103
E039.1	8/3/2016	0.8	0.4	1.7	27
E039.1	9/6/2016	0.7	0.3	1.3	42
E039.1	11/5/2016	0.7	0.3	3.0	25
E042.1	8/27/2016	60	27	4.0	63
E042.1	11/6/2016	2.4	1.1	0.8	12
E050.1	8/27/2016	9.9	4.4	3.0	25
E059.5	8/27/2016	23	10	3.5	45
2017 Runoff Events					
E038	7/8/2017	9327	4.6	2.0	110
E038	7/26/2017	24,828	12.3	4.5	205
E038	7/29/2017	3016	1.5	1.8	45
E038	8/7/2017	4013	2.0	1.9	76
E039.1	7/8/2017	4273	2.1	2.1	60
E039.1	7/26/2017	7881	3.9	3.4	150
E039.1	7/29/2017	1247	0.6	1.7	45
E039.1	8/7/2017	394	0.2	0.8	18
E042.1	7/26/2017	20,223	10.0	2.5	30
E042.1	9/27/2017	7583	3.7	6.9	25
E042.1	9/29/2017	44,574	22.0	10.8	51
E042.1	10/4/2017	39,745	19.6	5.9	40
E050.1	9/27/2017	3781	1.9	9.7	32
E050.1	9/29/2017	15,899	7.8	17.3	56
E050.1	10/4/2017	11,842	5.8	16.3	35
E059.5	9/29/2017	22,036	10.9	6.8	61
E059.8	10/5/2017[b]	156	0.1	1.3	1.6

Table 3.2-2 (continued)

Gaging Station	Date	Sediment Yield (tons)	Sediment Yield (yd^3)[a]	Runoff Volume (acre-ft)	Peak Discharge (ft^3/s)
2018 Runoff Events					
E038	8/2/2018	2.5	1.1	1.8	66
E038	8/10/2018	4.0	1.8	2.0	88
E038	8/15/2018	3.8	1.7	1.9	64
E038	9/3/2018	3.8	1.7	1.0	46
E039.1	8/2/2018	0.4	0.2	13	24
E039.1	8/10/2018	1.9	0.9	2.2	50
E039.1	8/15/2018	0.3	0.1	1.5	20
E039.1	9/3/2018	0.1	0.0	0.8	14
E039.1	9/4/2018	2.6	1.2	5.0	75
E042.1	9/4/2018	4.0	1.8	1.5	10
2019 Runoff Events					
E038	8/7/2019	68.0	30.5	13.3	329[c]
E039.1	7/26/2019	12.2	5.5	7.4	213
E039.1	8/7/2019	27.2	12.2	14.2	342
E042.1	7/26/2019	80.7	36.1	7.1	96
E042.1	8/7/2019	82.5	36.9	9.0	111
E050.1	7/26/2019	32.9	14.7	6.3	46
E050.1	8/7/2019	35.8	16.0	8.0	71
E059.5	8/7/2019	9.0	4.0	6.6	42
2020 Runoff Events					
No samples were collected in 2020.					
2021 Runoff Events					
E038	6/27/2021	5.9	2.7	2.0	87.4
E038	7/31/2021	6.0	2.7	1.8	89.2
E039.1	7/31/2021	1.1	0.5	2.4	39.2
E050.1	8/26/2021[b]	0.0	0.0	0.1	1.0
E059.5	8/15/2021[b]	0.5	0.2	1.4	4.4
E059.5	8/28/2021[b]	0.4	0.2	2.5	5.9
E060.1	8/26/2021	4.0	1.8	0.1	7.0
2022 Runoff Events					
E038	6/27/2022	7.6	3.4	3.7	140
E038	7/27/2022	29.5	13.2	9.7	325[c]
E039.1	6/26/2022	0.7	0.31	3.2	40.5
E039.1	6/27/2022	2.6	1.2	4.3	102
E039.1	7/27/2022	10.8	4.8	9.2	304
E039.1	8/23/2022	1.3	0.59	3.8	67.2
E042.1	7/27/2022	41.7	18.7	2.6	47.7
E050.1	7/27/2022[b]	2.3	1.0	1.8	14.7

Table 3.2-2 (continued)

Gaging Station	Date	Sediment Yield (tons)	Sediment Yield (yd^3)[a]	Runoff Volume (acre-ft)	Peak Discharge (ft^3/s)
E050.1	8/23/2022[b]	0.04	0.02	0.06	0.35
E059.5	6/25/2022[b]	0.57	0.25	7.5	7.3
E059.5	6/27/2022[b]	1.2	0.53	16.1	14.9
E059.5	7/27/2022[b]	17.0	7.6	16.3	50
E059.5	8/11/2022[b]	5.2	2.4	25.9	77.1
E059.8	7/31/2022[b]	0.2	0.09	0.85	3

Note: Sediment yield and runoff volume were calculated only from sampled events with reliable hydrographs and sedigraphs; hence, the 09/12/2013 sampling at E026 and E109.9 was excluded.

[a] Volumetric sediment yield was computed using a soil bulk density of 2650 kg/m^3 and volume = mass/density.

[b] Samples were not collected throughout the entire hydrograph (see Figures 3.2-4 and 3.2-5 in the 2015, 2017, 2021, and 2022 LAP reports); hence, sediment yields may be underestimated.

[c] At E038 the peak stage during the 08/07/2019 and 7/27/2022 flow events exceeded the rating curve. The peak discharge value was calculated using a best-fit equation for the rating curve.

Table 4.1-1
Comparison of Detected Analytical Results from 2022 with NMED Water Quality Criteria

Gaging Station	Sample Date	Analyte	Field Prep Code	Result	MDL[c]/ MDA[d]	PQL[e]	Unit[f]	Hardness Used[g]	Exceedance Ratio[a,b]				
									LW	WH	AAL	CAL	HH-OO
E038	6/27/2022	Aluminum	F10μ[h]	221	19.3	50.0	μg/L	12.4	—[i]	—	1.13	—	—
E038	6/27/2022	Copper	F[j]	1.52	0.300	2.00	μg/L	12.4	<0.01	—	0.81	—	—
E038	6/27/2022	Dioxin[k]	UF	5.90 E-08	—	—	μg/L	—	—	—	—	—	1.16
E038	6/27/2022	Gross Alpha	UF	27.2	2.91	—	pCi/L	—	1.81	—	—	—	—
E038	6/27/2022	Mercury	UF	0.072	0.067	2.00	μg/L	—	<0.01	0.09	—	—	—
E038	6/27/2022	Selenium	UF	4.36	1.50	5.00	μg/L	—	—	0.87	0.22	—	—
E038	6/27/2022	Total PCB	UF	0.029	—	—	μg/L	—	—	2.04	0.01	—	44.5
E038	6/27/2022	Vanadium	F	1.09	1.00	5.00	μg/L	—	0.01	—	—	—	—
E038	7/27/2022	Aluminum	F10μ	1900	19.3	50.0	μg/L	12	—	—	10.1	—	—
E038	7/27/2022	Copper	F	2.13	0.300	2.00	μg/L	12	<0.01	—	1.17	—	—
E038	7/27/2022	Dioxin	UF	6.21 E-08	—	—	μg/L	—	—	—	—	—	1.22
E038	7/27/2022	Gross Alpha	UF	38.7	2.43	—	pCi/L	—	2.58	—	—	—	—
E038	7/27/2022	Manganese	F	3.31	2.00	10.0	μg/L	12	—	—	<0.01	—	—
E038	7/27/2022	Mercury	UF	0.085	0.0670	2.00	μg/L	—	<0.01	0.11	—	—	—
E038	7/27/2022	Selenium	UF	4.16	1.50	5.00	μg/L	—	—	0.83	0.21	—	—
E038	7/27/2022	Total PCB	UF	0.028	—	—	μg/L	—	—	2.01	0.01	—	44.1
E038	7/27/2022	Vanadium	F	2.19	1.00	5.00	μg/L	—	0.02	—	—	—	—
E038	7/27/2022	Zinc	F	7.24	3.30	20.0	μg/L	12	<0.01	—	0.31	—	<0.01
E039.1	6/26/2022	Aluminum	F10μ	812	19.3	50.0	μg/L	18.8	—	—	2.34	—	—
E039.1	6/26/2022	Copper	F	2.23	0.300	2.00	μg/L	18.8	<0.01	—	0.80	—	—
E039.1	6/26/2022	Dioxin	UF	2.77 E-08	—	—	μg/L	—	—	—	—	—	0.54
E039.1	6/26/2022	Gross Alpha	UF	11.7	2.25	—	pCi/L	—	0.78	—	—	—	—
E039.1	6/26/2022	Nickel	F	0.894	0.600	2.00	μg/L	18.8	—	—	<0.01	—	<0.01
E039.1	6/26/2022	Total PCB	UF	0.015	—	—	μg/L	—	—	1.10	<0.01	—	24.1

Table 4.1-1 (continued)

Gaging Station	Sample Date	Analyte	Field Prep Code	Result	MDL[c]/ MDA[d]	PQL[e]	Unit[f]	Hardness Used[g]	Exceedance Ratio[a,b]				
									LW	WH	AAL	CAL	HH-OO
E039.1	6/26/2022	Vanadium	F	2.23	1.00	5.00	µg/L	—	0.02	—	—	—	—
E039.1	6/27/2022	Aluminum	F10µ	445	19.3	50.0	µg/L	16.5	—	—	1.53	—	—
E039.1	6/27/2022	Copper	F	2.02	0.300	2.00	µg/L	16.5	<0.01	—	0.82	—	—
E039.1	6/27/2022	Dioxin	UF	5.11 E-08	—	—	µg/L	—	—	—	—	—	1.00
E039.1	6/27/2022	Gross Alpha	UF	10.8	2.84	—	pCi/L	—	0.72	—	__	—	—
E039.1	6/27/2022	Manganese	F	2.26	2.00	10.0	µg/L	16.5	—	—	<0.01	—	—
E039.1	6/27/2022	Mercury	UF	0.097	0.0670	0.200	µg/L	—	0.01	0.13	__	—	—
E039.1	6/27/2022	Nickel	F	0.646	0.600	2.00	µg/L	16.5	—	—	<0.01	—	<0.01
E039.1	6/27/2022	Total PCB	UF	0.024	—	—	µg/L	—	—	1.71	0.01	—	37.3
E039.1	6/27/2022	Vanadium	F	2.07	1.00	5.00	µg/L	—	0.02	—	—	—	—
E039.1	6/27/2022	Zinc	F	4.93	3.30	20.0	µg/L	16.5	<0.01	—	0.16	—	<0.01
E039.1	7/27/2022	Aluminum	F10µ	4600	19.3	50.0	µg/L	16.6	__	—	15.7	—	—
E039.1	7/27/2022	Copper	F	2.37	0.300	2.00	µg/L	16.6	<0.01	—	0.96	—	—
E039.1	7/27/2022	Dioxin	UF	4.55 E-08	—	—	µg/L	—	—	—	—	—	0.89
E039.1	7/27/2022	Gross Alpha	UF	40.5	1.42	—	pCi/L	—	2.70	—	—	—	—
E039.1	7/27/2022	Lead	F	0.691	0.500	2.00	µg/L	16.6	<0.01	—	0.08	—	—
E039.1	7/27/2022	Manganese	F	4.63	2.00	10.0	µg/L	16.6	—	—	<0.01	—	—
E039.1	7/27/2022	Mercury	UF	0.082	0.0670	2.00	µg/L	__	<0.01	0.11	__	—	—
E039.1	7/27/2022	Nickel	F	0.833	0.600	2.00	µg/L	16.6	—	—	<0.01	—	<0.01
E039.1	7/27/2022	Selenium	UF	2.76	1.50	5.00	µg/L	—	—	0.55	0.14	—	—
E039.1	7/27/2022	Total PCB	UF	0.021	—	—	µg/L	—	—	1.49	0.01	—	32.7
E039.1	7/27/2022	Vanadium	F	2.70	1.00	5.00	µg/L	—	0.03	—	—	—	—
E039.1	7/27/2022	Zinc	F	7.11	3.30	20.0	µg/L	16.6	<0.01	—	0.23	—	<0.01
E039.1	8/23/2022	Aluminum	F10µ	2690	19.3	50.0	µg/L	20.2	—	—	7.03	—	—
E039.1	8/23/2022	Copper	F	2.82	0.300	2.00	µg/L	20.2	<0.01	—	0.95	—	—
E039.1	8/23/2022	Dioxin	UF	3.68 E-08	—	—	µg/L	—	—	—	—	—	0.72

Table 4.1-1 (continued)

Gaging Station	Sample Date	Analyte	Field Prep Code	Result	MDL[c]/ MDA[d]	PQL[e]	Unit[f]	Hardness Used[g]	Exceedance Ratio[a,b]				
									LW	WH	AAL	CAL	HH-OO
E039.1	8/23/2022	Gross Alpha	UF	19.6	3.22	—	pCi/L	—	1.31	—	—	—	—
E039.1	8/23/2022	Lead	F	0.714	0.500	2.00	μg/L	20.2	<0.01	—	0.07	—	—
E039.1	8/23/2022	Manganese	F	4.53	2.00	10.0	μg/L	20.2	—	—	<0.01	—	—
E039.1	8/23/2022	Nickel	F	1.03	0.600	2.00	μg/L	20.2	—	—	<0.01	—	<0.01
E039.1	8/23/2022	Total PCB	UF	0.015	—	—	μg/L	—	—	1.06	<0.01	—	23.3
E039.1	8/23/2022	Vanadium	F	2.56	1.00	5.00	μg/L	—	0.03	—	—	—	—
E039.1	8/23/2022	Zinc	F	12.7	3.30	20.0	μg/L	20.2	<0.01	—	0.34	—	<0.1
E040	6/26/2022	Aluminum	F10μ	1130	19.3	50.0	μg/L	25.1	—	—	2.19	—	—
E040	6/26/2022	Boron	F	20.0	15.0	50.0	μg/L	—	<0.01	—	—	—	—
E040	6/26/2022	Copper	F	3.20	0.300	2.00	μg/L	25.1	<0.01	—	0.88	—	—
E040	6/26/2022	Dioxin	UF	5.77 E-09	—	—	μg/L	—	—	—	—	—	0.11
E040	6/26/2022	Gross Alpha	UF	39.2	2.89	—	μg/L	—	2.61	—	—	—	—
E040	6/26/2022	Lead	F	0.787	0.500	2.00	μg/L	25.1	<0.01	—	0.06	—	—
E040	6/26/2022	Manganese	F	5.02	2.00	10.0	μg/L	25.1	—	—	<0.01	—	—
E040	6/26/2022	Nickel	F	0.90	0.600	2.00	μg/L	25.1	—	—	<0.01	—	<0.01
E040	6/26/2022	Selenium	UF	1.81	1.50	5.00	μg/L	—	—	0.36	0.09	—	—
E040	6/26/2022	Total PCB	UF	0.005	—	—	μg/L	—	—	0.37	<0.01	—	8.06
E040	6/26/2022	Vanadium	F	2.27	1.00	5.00	μg/L	—	0.02	—	—	—	—
E040	6/26/2022	Zinc	F	4.80	3.30	20.0	μg/L	25.1	<0.01	—	0.11	—	<0.01
E040	6/27/2022	Dioxin	UF	7.45 E-08	—	—	μg/L	—	—	—	—	—	1.46
E040	6/27/2022	Gross Alpha	UF	41	2.94	—	μg/L	—	2.73	—	—	—	—
E040	6/27/2022	Total PCB	UF	0.050	—	—	μg/L	—	—	3.55	0.02	—	77.7
E042.1	7/27/2022	Aluminum	F10μ	12400	19.3	50.0	μg/L	23.7	—	—	26.0	—	—
E042.1	7/27/2022	Boron	F	19	15.0	50.0	μg/L	—	<0.01	—	—	—	—
E042.1	7/27/2022	Copper	F	2.28	0.300	2.00	μg/L	23.7	<0.01	—	0.66	—	—
E042.1	7/27/2022	Dioxin	UF	1.26 E-05	—	—	μg/L	—	—	—	—	—	247

Table 4.1-1 (continued)

Gaging Station	Sample Date	Analyte	Field Prep Code	Result	MDL[c]/ MDA[d]	PQL[e]	Unit[f]	Hardness Used[g]	Exceedance Ratio[a,b]				
									LW	WH	AAL	CAL	HH-OO
E042.1	7/27/2022	Gross Alpha	UF	426	30.3	—	pCi/L	—	28.4	—	—	—	—
E042.1	7/27/2022	Manganese	F	11.1	2.00	10.0	µg/L	23.7	—	—	<0.01	—	—
E042.1	7/27/2022	Mercury	UF	0.59	0.0676	2.00	µg/L	—	0.06	0.76	—	—	—
E042.1	7/27/2022	Nickel	F	0.76	0.600	2.00	µg/L	23.7	—	—	<0.01	—	<0.01
E042.1	7/27/2022	Selenium	UF	20.8	1.50	5.00	µg/L	—	—	4.2	1.04	—	—
E042.1	7/27/2022	Total PCB	UF	0.234	—	—	µg/L	—	—	16.7	0.12	—	366
E042.1	7/27/2022	Vanadium	F	2.25	1.00	5.00	µg/L	—	0.02	—	—	—	—
E042.1	7/27/2022	Zinc	F	9.33	3.30	20.0	µg/L	23.7	<0.01	—	0.22	—	<0.01
E050.1	7/27/2022	Aluminum	F10µ	14800	19.3	50.0	µg/L	35.8	__	—	17.7	—	—
E050.1	7/27/2022	Boron	F	25.1	15.0	50.0	µg/L	—	<0.01	—	—	—	—
E050.1	7/22/2022	Copper	F	3.49	0.300	2.00	µg/L	35.8	<0.01	—	0.68	—	—
E050.1	7/27/2022	Dioxin	UF	1.26 E-05	—	—	µg/L	—	__	—	—	—	246
E050.1	7/27/2022	Gross Alpha	UF	214	8.1	—	pCi/L	—	14.3	—	—	—	—
E050.1	7/27/2022	Lead	F	1.87	0.500	2.00	µg/L	35.8	0.02	—	0.09	—	—
E050.1	7/27/2022	Manganese	F	13.1	2.00	10.0	µg/L	35.8	—	—	<0.01	—	—
E050.1	7/27/2022	Mercury	UF	0.548	0.067	0.200	µg/L	—	0.05	0.71	—	—	—
E050.1	7/27/2022	Nickel	F	1.51	0.600	2.00	µg/L	35.8	—	—	<0.01	—	<0.01
E050.1	7/27/2022	Radium-226 and Radium-228	UF	6.55	—	—	pCi/L	—	0.22	—	—	—	—
E050.1	7/27/2022	Selenium	UF	19.4	1.50	5.00	µg/L	—	—	3.88	0.97	—	—
E050.1	7/27/2022	Total PCB	UF	0.198	—	—	µg/L	—	—	14.1	0.10	—	309
E050.1	7/27/2022	Vanadium	F	3.92	1.00	5.00	µg/L	—	0.04	—	—	—	—
E050.1	7/27/2022	Zinc	F	14.2	3.30	20.0	µg/L	35.8	<0.01	—	0.23	—	<0.01
E050.1	8/6/2022	Gross Alpha	UF	39.3	4.25	—	pCi/L	—	2.62	—	__	—	—
E050.1	8/23/2022	Aluminum	F10µ	6910	19.3	50.0	µg/L	47.5	—	—	5.60	—	—
E050.1	8/23/2022	Boron	F	22.2	15.0	50.0	µg/L	—	<0.01	—	__	—	—

Table 4.1-1 (continued)

Gaging Station	Sample Date	Analyte	Field Prep Code	Result	MDL[c]/ MDA[d]	PQL[e]	Unit[f]	Hardness Used[g]	Exceedance Ratio[a,b]				
									LW	WH	AAL	CAL	HH-OO
E050.1	8/23/2022	Copper	F	3.07	0.300	2.00	µg/L	47.5	<0.01	—	0.46	—	—
E050.1	8/23/2022	Gross Alpha	UF	73.7	5.05	—	pCi/L	—	4.91	—	—	—	—
E050.1	8/23/2022	Lead	F	1.39	0.500	2.00	µg/L	47.5	0.01	—	0.05	—	—
E050.1	8/23/2022	Manganese	F	10.1	2.00	10.0	µg/L	31.0	—	—	<0.01	—	—
E050.1	8/23/2022	Nickel	F	1.59	0.600	2.00	µg/L	47.5	—	—	<0.01	—	<0.01
E050.1	8/23/2022	Radium-226 and Radium 228	UF	6.37	—	—	pCi/L	—	0.21	—	—	—	—
E050.1	8/23/2022	Selenium	UF	2.11	1.50	5.00	µg/L	—	—	0.42	0.11	—	—
E050.1	8/23/2022	Vanadium	F	2.94	1.00	5.00	µg/L	—	0.03	—	—	—	—
E050.1	8/23/2022	Zinc	F	19.6	3.30	20.0	µg/L	47.5	<0.01	—	0.24	—	<0.01
E055	6/26/2022	Aluminum	F10µ	567	19.3	50.0	µg/L	31.0	—	—	0.82	2.1	—
E055	6/26/2022	Boron	F	31.2	15.0	50.0	µg/L	—	<0.01	—	—	—	—
E055	6/26/2022	Copper	F	5.47	0.300	2.00	µg/L	31.0	0.01	—	1.23	1.66	—
E055	6/26/2022	Dioxin	UF	4.21 E-09	—	—	µg/L	—	—	—	—	—	0.08
E055	6/26/2022	Iron	UF	1170	30.0	100.0	µg/L	—	—	—	—	1.17	—
E055	6/26/2022	Lead	F	1.51	0.500	2.00	µg/L	31.0	0.02	—	0.09	2.19	—
E055	6/26/2022	Manganese	F	8.50	2.00	10.0	µg/L	31.0	—	—	<0.01	<0.01	—
E055	6/26/2022	Nickel	F	1.42	0.600	2.00	µg/L	31.0	—	—	<0.01	0.07	<0.01
E055	6/26/2022	Total PCB	UF	0.004	—	—	µg/L	—	—	0.30	<0.01	0.30	6.63
E055	6/26/2022	Vanadium	F	2.75	1.00	5.00	µg/L	—	0.03	—	—	—	—
E055	6/26/2022	Zinc	F	16	3.30	20.0	µg/L	31.0	<0.01	—	0.29	0.38	<0.01
E055	8/5/2022	Aluminum	F10µ	5620	19.3	50.0	µg/L	23.3	—	—	12.1	30.1	—
E055	8/5/2022	Boron	F	18.2	15.0	50.0	µg/L	—	<0.01	—	—	—	—
E055	8/5/2022	Copper	F	2.52	0.300	2.00	µg/L	23.3	<0.01	—	0.74	0.98	—
E055	8/5/2022	Dioxin	UF	1.07 E-07	—	—	µg/L	—	—	—	—	—	2.11
E055	8/5/2022	Gross Alpha	UF	238	35.3	—	pCi/L	—	15.9	—	—	—	—

Table 4.1-1 (continued)

Gaging Station	Sample Date	Analyte	Field Prep Code	Result	MDL[c]/ MDA[d]	PQL[e]	Unit[f]	Hardness Used[g]	Exceedance Ratio[a,b]				
									LW	WH	AAL	CAL	HH-OO
E055	8/5/2022	Iron	UF	45700	30.0	100.0	µg/L	—	—	—	—	45.7	—
E055	8/5/2022	Lead	F	0.97	0.500	2.00	µg/L	23.3	0.01	—	0.08	1.95	—
E055	8/5/2022	Manganese	F	12.3	2.00	10.0	µg/L	23.3	—	—	<0.01	0.01	—
E055	8/5/2022	Mercury	UF	0.321	0.067	0.200	µg/L	—	0.03	0.42	—	—	—
E055	8/5/2022	Nickel	F	0.932	0.600	2.00	µg/L	23.3	—	—	<0.01	0.06	<0.01
E055	8/5/2022	Selenium	UF	8.29	1.50	5.00	µg/L	—	—	1.66	0.41	1.66	—
E055	8/5/2022	Total PCB	UF	0.111	—	—	µg/L	—	—	0.056	7.93	7.93	173
E055	8/5/2022	Vanadium	F	1.96	1.00	5.00	µg/L	—	0.02	—	—	—	—
E055	8/5/2022	Zinc	F	6.61	3.30	2.00	µg/L	23.3	<0.01	—	0.16	0.21	<0.01
E056	7/27/2022	Aluminum	F10µ	3840	19.3	50.0	µg/L	11.4	—	—	22.0	54.8	—
E056	7/27/2022	Boron	F	22.3	15.0	50.0	µg/L	—	<0.01	—	—	—	—
E056	7/27/2022	Copper	F	2.84	0.300	2.00	µg/L	11.4	<0.01	—	1.6	2.0	—
E056	7/27/2022	Dioxin	UF	3.09 E -07	—	—	µg/L	—	—	—	—	—	6.0
E056	7/27/2022	Gross Alpha	UF	94.9	2.62	—	pCi/L	—	6.3	—	—	—	—
E056	7/27/2022	Iron	UF	33400	30.0	100.0	µg/L	—	—	—	—	33.4	—
E056	7/27/2022	Lead	F	1.16	0.500	2.00	µg/L	11.4	0.01	—	0.20	5.22	—
E056	7/27/2022	Manganese	F	4.32	2.00	10.0	µg/L	11.4	—	—	<0.01	<0.01	—
E056	7/27/2022	Mercury	UF	0.966	0.067	0.200	µg/L	—	0.1	1.3	—	—	—
E056	7/27/2022	Nickel	F	0.982	0.600	2.00	µg/L	11.4	—	—	<0.01	0.12	<0.01
E056	7/27/2022	Selenium	UF	4.68	1.50	5.00	µg/L	—	—	0.94	0.23	0.94	—
E056	7/27/2022	Total PCB	UF	0.128	—	—	µg/L	—	—	9.14	0.06	9.14	200
E056	7/27/2022	Vanadium	F	2.32	1.00	5.00	µg/L	—	<0.01	—	—	—	—
E056	7/27/2022	Zinc	F	13.9	3.30	2.00	µg/L	11.4	<0.01	—	0.63	0.83	<0.01
E059.5	6/25/2022	Arsenic	F	3.95	2.00	5.00	µg/L	—	0.02	—	0.01	0.03	0.44
E059.5	6/25/2022	Boron	F	204	15.0	50.0	µg/L	—	0.04	—	—	—	—
E059.5	6/25/2022	Copper	F	3.26	0.300	2.00	µg/L	72	0.01	—	0.33	0.48	—

Table 4.1-1 (continued)

Gaging Station	Sample Date	Analyte	Field Prep Code	Result	MDL[c]/ MDA[d]	PQL[e]	Unit[f]	Hardness Used[g]	Exceedance Ratio[a,b]				
									LW	WH	AAL	CAL	HH-OO
E059.5	6/25/2022	Iron	UF	109	30.0	100.0	µg/L	—	—	—	0.11	—	—
E059.5	6/25/2022	Nickel	F	1.26	0.600	2.00	µg/L	72	__	—	<0.01	0.03	<0.01
E059.5	6/25/202	Total PCB	UF	1.60 E-04	—	—	µg/L	—	—	0.01	<0.01	0.01	0.25
E059.5	6/25/2022	Vanadium	F	14.8	1.00	5.00	µg/L	—	0.15	—	—	—	—
E059.5	6/25/2022	Zinc	F	51.2	3.30	2.00	µg/L	72	<0.01	—	0.43	0.57	<0.01
E059.5	6/27/2022	Aluminum	F10µ	24.8	19.3	50.0	µg/L	70.6	—	—	0.01	0.03	—
E059.5	6/27/2022	Arsenic	F	4.58	2.00	5.00	µg/L	—	0.02	—	0.01	0.03	0.51
E059.5	6/27/2022	Boron	F	212	15.0	50.0	µg/L	—	0.04	—	—	—	—
E059.5	6/27/2022	Copper	F	2.88	0.300	2.00	µg/L	70.6	<0.01	—	0.30	0.43	—
E059.5	6/27/2022	Dioxin	UF	8.25 E -10	__	__	µg/L	—	—	—	—	—	0.02
E059.5	6/27/2022	Iron	UF	117	30.0	100.0	µg/L	—	—	—	—	0.12	—
E059.5	6/27/2022	Nickel	F	1.29	0.600	2.00	µg/L	70.6	—	—	<0.01	0.03	<0.01
E059.5	6/27/2022	Total PCB	UF	2.09 E-04	—	—	µg/L	—	—	0.01	<0.01	0.01	0.33
E059.5	6/27/2022	Vanadium	F	14.3	—	—	µg/L	—	0.14	—	—	—	—
E059.5	6/27/2022	Zinc	F	56.1	3.30	2.00	µg/L	70.6	<0.01	—	0.48	0.64	<0.01
E059.5	7/26/2022	Aluminum	F10µ	9560	19.3	50.0	µg/L	12.8	—	—	46.7	116	—
E059.5	7/26/2022	Boron	F	24.2	15.0	50.0	µg/L	—	<0.01	—	—	—	—
E059.5	7/26/2022	Copper	F	2.76	0.300	2.00	µg/L	12.8	<0.01	—	1.42	1.79	—
E059.5	7/26/2022	Dioxin	UF	1.65E-08	—	—	µg/L	—	—	—	—	—	0.32
E059.5	7/26/2022	Gross Alpha	UF	176	6.6	—	pCi/L	—	11.7	—	—	—	—
E059.5	7/26/2022	Iron	UF	25000	30.0	100.0	µg/L	—	—	—	—	25.0	—
E059.5	7/26/2022	Lead	F	1.12	0.500	2.00	µg/L	12.8	0.01	—	0.17	4.42	—
E059.5	7/26/2022	Manganese	F	12.2	2.00	10.0	µg/L	12.8	—	—	<0.01	0.01	—
E059.5	7/26/2022	Mercury	UF	0.096	0.067	0.200	µg/L	—	0.01	0.125	—	—	—
E059.5	7/26/2022	Nickel	F	1.27	0.600	2.00	µg/L	12.8	—	—	0.02	0.14	<0.01
E059.5	7/26/2022	Selenium	UF	3.02	1.50	5.00	µg/L	—	—	0.60	0.15	0.60	—

Table 4.1-1 (continued)

Gaging Station	Sample Date	Analyte	Field Prep Code	Result	MDL[c]/ MDA[d]	PQL[e]	Unit[f]	Hardness Used[g]	Exceedance Ratio[a,b]				
									LW	WH	AAL	CAL	HH-OO
E059.5	7/26/2022	Total PCB	UF	0.011	—	—	µg/L	—	—	0.75	<0.01	0.75	16.4
E059.5	7/26/2022	Vanadium	F	3.75	1.00	5.00	µg/L	—	0.04	—	—	—	—
E059.5	7/26/2022	Zinc	F	10.9	3.30	2.00	µg/L	12.8	<0.01	—	0.44	0.58	<0.01
E059.5	7/27/2022	Aluminum	F10µ	4580	19.3	50.0	µg/L	27.9	—	—	7.69	19.2	—
E059.5	7/27/2022	Boron	F	69.7	15.0	50.0	µg/L	—	0.01	—	—	—	—
E059.5	7/27/2022	Copper	F	3.09	0.300	2.00	µg/L	27.9	<0.01	—	0.77	1.03	—
E059.5	7/27/2022	Dioxin	UF	1.99 E-09	—	—	µg/L	—	—	—	—	—	0.04
E059.5	7/27/2022	Gross Alpha	UF	14.8	2.38	—	pCi/L	—	0.99	—	—	—	—
E059.5	7/27/2022	Iron	UF	5350	30.0	100.0	µg/L	—	—	—	—	5.35	—
E059.5	7/27/2022	Lead	F	0.70	0.500	2.00	µg/L	27.9	<0.01	—	0.04	1.14	—
E059.5	7/27/2022	Manganese	F	5.20	2.00	10.0	µg/L	27.9	—	—	<0.01	<0.01	—
E059.5	7/27/2022	Nickel	F	1.22	0.600	2.00	µg/L	27.9	—	—	<0.01	0.07	<0.01
E059.5	7/27/2022	Total PCB	UF	0.003	—	—	µg/L	—	—	0.18	<0.01	0.18	3.94
E059.5	7/27/2022	Vanadium	F	7.5	1.00	5.00	µg/L	—	0.08	—	—	—	—
E059.5	7/27/2022	Zinc	F	16.5	3.30	2.00	µg/L	27.9	<0.01	—	0.33	0.43	<0.01
E059.5	8/11/2022	Aluminum	F10µ	1840	19.3	50.0	µg/L	14.8	—	—	7.36	18.4	—
E059.5	8/11/2022	Boron	F	21.5	15.0	50.0	µg/L	—	<0.01	—	—	—	—
E059.5	8/11/2022	Copper	F	2.76	0.300	2.00	µg/L	14.8	<0.01	—	1.24	1.58	—
E059.5	8/11/2022	Dioxin	UF	1.51 E-08	—	—	µg/L	—	—	—	—	—	0.30
E059.5	8/11/2022	Gross Alpha	UF	36.3	2.15	—	pCi/L	—	2.42	—	—	—	—
E059.5	8/11/2022	Iron	UF	12100	30.0	100.0	µg/L	—	—	—	—	12.1	—
E059.5	8/11/2022	Lead	F	0.61	0.500	2.00	µg/L	14.8	<0.01	—	0.08	2.03	—
E059.5	8/11/2022	Manganese	F	4.84	2.00	10.0	µg/L	14.8	—	—	<0.01	<0.01	—
E059.5	8/11/2022	Nickel	F	0.798	0.600	2.00	µg/L	14.8	—	—	<0.01	0.08	<0.01
E059.5	8/11/2022	Selenium	UF	3.38	1.50	5.00	µg/L	—	—	0.68	0.17	0.68	—
E059.5	8/11/2022	Total PCB	UF	0.02	—	—	µg/L	—	—	1.11	<0.01	1.11	24.2

Table 4.1-1 (continued)

Gaging Station	Sample Date	Analyte	Field Prep Code	Result	MDL[c]/ MDA[d]	PQL[e]	Unit[f]	Hardness Used[g]	Exceedance Ratio[a,b]				
									LW	WH	AAL	CAL	HH-OO
E059.5	8/11/2022	Vanadium	F	3.35	1.00	5.00	µg/L	—	0.03	—	—	—	—
E059.5	8/11/2022	Zinc	F	10.2	3.30	2.00	µg/L	14.8	<0.01	—	0.36	0.48	<0.01
E059.8	7/31/2022	Aluminum	F10µ	3650	19.3	50.0	µg/L	59.5	—	—	2.17	5.42	—
E059.8	7/31/2022	Arsenic	F	3.21	2.00	5.00	µg/L	—	0.02	—	<0.01	0.02	0.36
E059.8	7/31/2022	Boron	F	169	15.0	50.0	µg/L	—	0.03	—	—	—	—
E059.8	7/31/2022	Copper	F	3.25	0.300	2.00	µg/L	—	<0.01	—	0.39	0.57	—
E059.8	7/31/2022	Dioxin	UF	2.22 E-09	—	—	µg/L	—	—	—	—	—	0.04
E059.8	7/31/2022	Gross Alpha	UF	12.2	2.94	—	pCi/L	—	0.81	—	—	—	—
E059.8	7/31/2022	Iron	UF	6060	30.0	100.0	µg/L	—	—	—	—	6.06	—
E059.8	7/31/2022	Manganese	F	7.31	2.00	10.0	µg/L	59.5	—	—	<0.01	<0.01	—
E059.8	7/31/2022	Nickel	F	2.96	0.600	2.00	µg/L	59.5	—	—	0.01	0.09	<0.01
E059.8	7/31/2022	Total PCB	UF	0.002	—	—	µg/L	—	—	0.16	<0.01	0.16	3.52
E059.8	7/31/2022	Vanadium	F	7.81	1.00	5.00	µg/L	—	0.08	—	—	—	—
E059.8	7/31/2022	Zinc	F	19	3.30	2.00	µg/L	59.5	<0.01	—	0.19	0.25	<0.01

[a] Analytical results are normalized by calculating an exceedance ratio. This ratio is defined as the analytical result divided by the applicable water-quality standard. Thus, results exceeding the standard will be greater than an exceedance ratio of 1.0.

[b] LW = livestock watering, WH = wildlife habitat, AAL = acute aquatic life, CAL = chronic aquatic life, HH-OO = human health–organism only.

[c] MDL = Method detection limit.

[d] MDA = Minimum detectable activity.

[e] PQL = Practical quantitation limit or uncertainty.

[f] Unit applies to result, MDL, PQL, and screening level.

[g] The hardness measured during the storm event was used to calculate hardness-based screening levels.

[h] F10u = Filtered to 10 µm.

[i] — = Not provided by the analytical laboratory or not applicable.

[j] F = Filtered to 0.45 µm.

[k] The dioxin criteria apply to the sum of the dioxin toxicity equivalents expressed as 2,3,7,8-TCDD dioxin.

[l] UF = Unfiltered.

Table 4.2-1
Calculated SSC and Instantaneous Discharge
Determined for Each Sample Collected during 2022 in the Los Alamos/Pueblo Watershed

Gaging Station	Sample Collection Date	Sample Collection Time	Field Sample ID	Field Prep	SSC Source[a]	Calculated SSC (mg/L)	Calculated Instantaneous Discharge (ft^3/s)
E059.5	6/25/2022	15:51	WT_LAP-22-245882	UF[b]	SSC	200	6
E059.5	6/25/2022	15:53	WT_LAP-22-245883	UF	SSC	100	6
E059.5	6/25/2022	15:55	WT_LAP-22-245884	UF	SSC	100	6
E059.5	6/25/2022	15:57	WT_LAP-22-245885	UF	SSC	100	6
E059.5	6/25/2022	15:59	WT_LAP-22-245886	UF	SSC	200	6
E059.5	6/25/2022	16:03	WT_LAP-22-245888	UF	SSC	100	6
E059.5	6/25/2022	16:05	WT_LAP-22-245889	UF	SSC	200	6
E059.5	6/25/2022	16:07	WT_LAP-22-245890	UF	SSC	300	6
E059.5	6/25/2022	16:09	WT_LAP-22-245891	UF	SSC	300	6
E059.5	6/25/2022	16:11	WT_LAP-22-245892	UF	SSC	200	6
E059.5	6/25/2022	16:13	WT_LAP-22-245893	UF	SSC	200	6
E059.5	6/25/2022	16:15	WT_LAP-22-245894	UF	SSC	200	6
E059.5	6/25/2022	16:17	WT_LAP-22-245895	UF	SSC	200	6
E059.5	6/25/2022	16:19	WT_LAP-22-245896	UF	SSC	200	6
E059.5	6/25/2022	16:39	WT_LAP-22-245897	UF	SSC	200	6
E059.5	6/25/2022	16:59	WT_LAP-22-245898	UF	SSC	200	6
E059.5	6/25/2022	17:19	WT_LAP-22-245899	UF	SSC	300	7
E059.5	6/25/2022	17:39	WT_LAP-22-245900	UF	SSC	200	7
E059.5	6/25/2022	17:39	WT_LAP-22-246192	UF	SSC	400	7
E059.5	6/25/2022	17:41	WT_LAP-22-246075	UF	Estimated	400	7
E059.5	6/25/2022	17:43	WT_LAP-22-246228	F[c]	Estimated	400	7
E059.5	6/25/2022	17:43	WT_LAP-22-246246	UF	Estimated	400	7

Table 4.2-1 (continued)

Gaging Station	Sample Collection Date	Sample Collection Time	Field Sample ID	Field Prep	SSC Source[a]	Calculated SSC (mg/L)	Calculated Instantaneous Discharge (ft^3/s)
E039.1	6/26/2022	15:58	WT_LAP-22-245857	UF	SSC	500	37
E039.1	6/26/2022	16:00	WT_LAP-22-245858	UF	SSC	400	41
E039.1	6/26/2022	16:02	WT_LAP-22-245859	UF	SSC	700	38
E039.1	6/26/2022	16:04	WT_LAP-22-245860	UF	SSC	400	36
E039.1	6/26/2022	16:06	WT_LAP-22-245861	UF	SSC	300	33
E039.1	6/26/2022	16:08	WT_LAP-22-245862	UF	SSC	0	31
E039.1	6/26/2022	16:09	WT_LAP-22-246191	UF	SSC	400	30
E039.1	6/26/2022	16:10	WT_LAP-22-245863	UF	SSC	400	29
E039.1	6/26/2022	16:11	WT_LAP-22-246074	UF	Estimated	400	28
E039.1	6/26/2022	16:12	WT_LAP-22-245864	UF	SSC	400	27
E039.1	6/26/2022	16:13	WT_LAP-22-246227	F	Estimated	500	27
E039.1	6/26/2022	16:13	WT_LAP-22-246245	UF	Estimated	500	27
E039.1	6/26/2022	16:14	WT_LAP-22-245865	UF	SSC	600	26
E039.1	6/26/2022	16:16	WT_LAP-22-245866	UF	SSC	100	24
E039.1	6/26/2022	16:17	WT_LAP-22-246137	F	Estimated	200	23
E039.1	6/26/2022	16:17	WT_LAP-22-246155	UF	Estimated	200	23
E039.1	6/26/2022	16:17	WT_LAP-22-246173	F10u[d]	Estimated	200	23
E039.1	6/26/2022	16:18	WT_LAP-22-245867	UF	SSC	300	22
E039.1	6/26/2022	16:19	WT_LAP-22-246115	UF	Estimated	300	21
E039.1	6/26/2022	16:20	WT_LAP-22-245868	UF	SSC	300	20
E039.1	6/26/2022	16:21	WT_LAP-22-246090	UF	Estimated	300	20
E039.1	6/26/2022	16:22	WT_LAP-22-245869	UF	SSC	200	19
E039.1	6/26/2022	16:24	WT_LAP-22-245870	UF	SSC	100	17
E039.1	6/26/2022	16:25	WT_LAP-22-246125	UF	Estimated	200	17
E039.1	6/26/2022	16:26	WT_LAP-22-245871	UF	SSC	200	16

Table 4.2-1 (continued)

Gaging Station	Sample Collection Date	Sample Collection Time	Field Sample ID	Field Prep	SSC Source[a]	Calculated SSC (mg/L)	Calculated Instantaneous Discharge (ft^3/s)
E039.1	6/26/2022	16:27	WT_LAP-22-246209	UF	SSC	300	15
E039.1	6/26/2022	16:28	WT_LAP-22-245872	UF	SSC	0	15
E039.1	6/26/2022	16:48	WT_LAP-22-245873	UF	SSC	200	8
E039.1	6/26/2022	17:08	WT_LAP-22-245874	UF	SSC	100	10
E039.1	6/26/2022	17:28	WT_LAP-22-245875	UF	SSC	100	10
E039.1	6/26/2022	17:48	WT_LAP-22-245876	UF	SSC	0	6
E039.1	6/26/2022	18:08	WT_LAP-22-245877	UF	SSC	100	5
E040	6/26/2022	09:12	WT_LAP-22-246072	UF	Estimated	1900	19
E040	6/26/2022	09:14	WT_LAP-22-246225	F	Estimated	2100	19
E040	6/26/2022	09:14	WT_LAP-22-246243	UF	Estimated	2100	19
E040	6/26/2022	09:18	WT_LAP-22-246135	F	Estimated	2300	18
E040	6/26/2022	09:18	WT_LAP-22-246153	UF	Estimated	2300	18
E040	6/26/2022	09:18	WT_LAP-22-246171	F10u	Estimated	2300	18
E040	6/26/2022	09:20	WT_LAP-22-246189	UF	SSC	2400	18
E040	6/26/2022	09:22	WT_LAP-22-246113	UF	Estimated	2500	18
E040	6/26/2022	09:24	WT_LAP-22-246088	UF	Estimated	2600	17
E040	6/26/2022	09:28	WT_LAP-22-246123	UF	Estimated	2900	16
E040	6/26/2022	09:32	WT_LAP-22-246207	UF	SSC	3100	15
E055	6/26/2022	11:39	WT_LAP-22-246198	UF	SSC	1200	24
E055	6/26/2022	11:41	WT_LAP-22-246081	UF	Estimated	1100	23
E055	6/26/2022	11:43	WT_LAP-22-246234	F	Estimated	1100	23
E055	6/26/2022	11:43	WT_LAP-22-246252	UF	Estimated	1100	23
E055	6/26/2022	11:47	WT_LAP-22-246144	F	Estimated	1000	23
E055	6/26/2022	11:47	WT_LAP-22-246162	UF	Estimated	1000	23
E055	6/26/2022	11:47	WT_LAP-22-246180	F10u	Estimated	1000	23

Table 4.2-1 (continued)

Gaging Station	Sample Collection Date	Sample Collection Time	Field Sample ID	Field Prep	SSC Source[a]	Calculated SSC (mg/L)	Calculated Instantaneous Discharge (ft^3/s)
E055	6/26/2022	11:49	WT_LAP-22-246111	UF	Estimated	900	23
E055	6/26/2022	11:51	WT_LAP-22-246096	UF	Estimated	800	22
E055	6/26/2022	11:55	WT_LAP-22-246216	UF	SSC	700	22
E038	6/27/2022	14:09	WT_LAP-22-245833	UF	SSC	2200	102
E038	6/27/2022	14:11	WT_LAP-22-245834	UF	SSC	3000	135
E038	6/27/2022	14:13	WT_LAP-22-245835	UF	SSC	2100	125
E038	6/27/2022	14:15	WT_LAP-22-245836	UF	SSC	2000	116
E038	6/27/2022	14:17	WT_LAP-22-245837	UF	SSC	2000	100
E038	6/27/2022	14:19	WT_LAP-22-245838	UF	SSC	2100	83
E038	6/27/2022	14:20	WT_LAP-22-246190	UF	SSC	1900	76
E038	6/27/2022	14:21	WT_LAP-22-245839	UF	SSC	2100	68
E038	6/27/2022	14:22	WT_LAP-22-246073	UF	Estimated	1900	60
E038	6/27/2022	14:23	WT_LAP-22-245840	UF	SSC	1700	53
E038	6/27/2022	14:24	WT_LAP-22-246226	F	Estimated	1900	46
E038	6/27/2022	14:24	WT_LAP-22-246244	UF	Estimated	1900	46
E038	6/27/2022	14:25	WT_LAP-22-245841	UF	SSC	2000	40
E038	6/27/2022	14:27	WT_LAP-22-245842	UF	SSC	1700	32
E038	6/27/2022	14:28	WT_LAP-22-246136	F	Estimated	1700	29
E038	6/27/2022	14:28	WT_LAP-22-246154	UF	Estimated	1700	29
E038	6/27/2022	14:28	WT_LAP-22-246172	F10u	Estimated	1700	29
E038	6/27/2022	14:29	WT_LAP-22-245843	UF	SSC	1600	26
E038	6/27/2022	14:30	WT_LAP-22-246114	UF	Estimated	1500	23
E038	6/27/2022	14:31	WT_LAP-22-245844	UF	SSC	1300	21
E038	6/27/2022	14:33	WT_LAP-22-245845	UF	SSC	900	19
E038	6/27/2022	14:34	WT_LAP-22-246089	UF	Estimated	800	18

Table 4.2-1 (continued)

Gaging Station	Sample Collection Date	Sample Collection Time	Field Sample ID	Field Prep	SSC Source[a]	Calculated SSC (mg/L)	Calculated Instantaneous Discharge (ft^3/s)
E038	6/27/2022	14:35	WT_LAP-22-245846	UF	SSC	600	16
E038	6/27/2022	14:37	WT_LAP-22-245847	UF	SSC	700	15
E038	6/27/2022	14:38	WT_LAP-22-246124	UF	Estimated	700	14
E038	6/27/2022	14:39	WT_LAP-22-245848	UF	SSC	700	14
E038	6/27/2022	14:42	WT_LAP-22-246208	UF	SSC	800	12
E038	6/27/2022	14:59	WT_LAP-22-245849	UF	SSC	100	5
E038	6/27/2022	15:19	WT_LAP-22-245850	UF	SSC	100	3
E039.1	6/27/2022	14:38	WT_LAP-22-246489	UF	SSC	1200	97
E039.1	6/27/2022	14:40	WT_LAP-22-246490	UF	SSC	1100	94
E039.1	6/27/2022	14:42	WT_LAP-22-246491	UF	SSC	1000	85
E039.1	6/27/2022	14:44	WT_LAP-22-246335	UF	SSC	900	76
E039.1	6/27/2022	14:44	WT_LAP-22-246492	UF	SSC	800	76
E039.1	6/27/2022	14:46	WT_LAP-22-246452	UF	Estimated	800	67
E039.1	6/27/2022	14:46	WT_LAP-22-246493	UF	SSC	800	67
E039.1	6/27/2022	14:48	WT_LAP-22-246281	UF	Estimated	700	59
E039.1	6/27/2022	14:48	WT_LAP-22-246299	F	Estimated	700	59
E039.1	6/27/2022	14:48	WT_LAP-22-246494	UF	SSC	700	59
E039.1	6/27/2022	14:50	WT_LAP-22-246495	UF	SSC	600	52
E039.1	6/27/2022	14:52	WT_LAP-22-246353	F10u	Estimated	500	48
E039.1	6/27/2022	14:52	WT_LAP-22-246371	UF	Estimated	500	48
E039.1	6/27/2022	14:52	WT_LAP-22-246389	F	Estimated	500	48
E039.1	6/27/2022	14:52	WT_LAP-22-246496	UF	SSC	500	48
E039.1	6/27/2022	14:54	WT_LAP-22-246413	UF	Estimated	400	44
E039.1	6/27/2022	14:54	WT_LAP-22-246497	UF	SSC	400	44
E039.1	6/27/2022	14:56	WT_LAP-22-246498	UF	SSC	400	40

Table 4.2-1 (continued)

Gaging Station	Sample Collection Date	Sample Collection Time	Field Sample ID	Field Prep	SSC Source[a]	Calculated SSC (mg/L)	Calculated Instantaneous Discharge (ft^3/s)
E039.1	6/27/2022	14:58	WT_LAP-22-246439	UF	Estimated	400	37
E039.1	6/27/2022	14:58	WT_LAP-22-246499	UF	SSC	400	37
E039.1	6/27/2022	15:00	WT_LAP-22-246500	UF	SSC	300	34
E039.1	6/27/2022	15:02	WT_LAP-22-246408	UF	Estimated	400	31
E039.1	6/27/2022	15:02	WT_LAP-22-246501	UF	SSC	400	31
E039.1	6/27/2022	15:04	WT_LAP-22-246502	UF	SSC	400	29
E039.1	6/27/2022	15:06	WT_LAP-22-246317	UF	SSC	400	26
E039.1	6/27/2022	15:06	WT_LAP-22-246503	UF	SSC	400	26
E039.1	6/27/2022	15:08	WT_LAP-22-246504	UF	SSC	300	24
E039.1	6/27/2022	15:28	WT_LAP-22-246505	UF	SSC	300	11
E039.1	6/27/2022	15:48	WT_LAP-22-246506	UF	SSC	200	6
E039.1	6/27/2022	16:08	WT_LAP-22-246507	UF	SSC	200	4
E040	6/27/2022	15:20	WT_LAP-22-246411	UF	Estimated	NA[e]	26
E040	6/27/2022	15:22	WT_LAP-22-246450	UF	Estimated	NA	25
E040	6/27/2022	15:24	WT_LAP-22-246437	UF	Estimated	NA	24
E040	6/27/2022	15:26	WT_LAP-22-246315	UF	SSC	15000	23
E040	6/27/2022	15:28	WT_LAP-22-246406	UF	Estimated	NA	20
E059.5	6/27/2022	10:24	WT_LAP-22-246513	UF	SSC	800	12
E059.5	6/27/2022	10:26	WT_LAP-22-246514	UF	SSC	400	12
E059.5	6/27/2022	10:28	WT_LAP-22-246515	UF	SSC	400	12
E059.5	6/27/2022	10:30	WT_LAP-22-246516	UF	SSC	400	12
E059.5	6/27/2022	10:32	WT_LAP-22-246517	UF	SSC	400	12
E059.5	6/27/2022	10:34	WT_LAP-22-246518	UF	SSC	300	12
E059.5	6/27/2022	10:36	WT_LAP-22-246519	UF	SSC	300	12
E059.5	6/27/2022	10:38	WT_LAP-22-246520	UF	SSC	300	12

Table 4.2-1 (continued)

Gaging Station	Sample Collection Date	Sample Collection Time	Field Sample ID	Field Prep	SSC Source[a]	Calculated SSC (mg/L)	Calculated Instantaneous Discharge (ft^3/s)
E059.5	6/27/2022	10:40	WT_LAP-22-246336	UF	SSC	500	12
E059.5	6/27/2022	10:40	WT_LAP-22-246521	UF	SSC	500	12
E059.5	6/27/2022	10:42	WT_LAP-22-246453	UF	Estimated	300	12
E059.5	6/27/2022	10:42	WT_LAP-22-246522	UF	SSC	300	12
E059.5	6/27/2022	10:44	WT_LAP-22-246282	UF	Estimated	300	11
E059.5	6/27/2022	10:44	WT_LAP-22-246300	F	Estimated	300	11
E059.5	6/27/2022	10:44	WT_LAP-22-246523	UF	SSC	300	11
E059.5	6/27/2022	10:46	WT_LAP-22-246524	UF	SSC	200	11
E059.5	6/27/2022	10:48	WT_LAP-22-246354	F10u	Estimated	200	11
E059.5	6/27/2022	10:48	WT_LAP-22-246372	UF	Estimated	200	11
E059.5	6/27/2022	10:48	WT_LAP-22-246390	F	Estimated	200	11
E059.5	6/27/2022	10:48	WT_LAP-22-246525	UF	SSC	200	11
E059.5	6/27/2022	10:50	WT_LAP-22-246414	UF	Estimated	300	11
E059.5	6/27/2022	10:50	WT_LAP-22-246526	UF	SSC	300	11
E059.5	6/27/2022	10:52	WT_LAP-22-246527	UF	SSC	300	11
E059.5	6/27/2022	10:54	WT_LAP-22-246422	UF	Estimated	300	11
E059.5	6/27/2022	10:54	WT_LAP-22-246440	UF	Estimated	300	11
E059.5	6/27/2022	10:54	WT_LAP-22-246528	UF	SSC	300	11
E059.5	6/27/2022	11:02	WT_LAP-22-246318	UF	SSC	400	11
E059.5	6/27/2022	11:14	WT_LAP-22-246529	UF	SSC	300	11
E059.5	6/27/2022	11:34	WT_LAP-22-246530	UF	SSC	300	11
E059.5	6/27/2022	11:54	WT_LAP-22-246531	UF	SSC	300	11
E059.5	6/27/2022	12:14	WT_LAP-22-246532	UF	SSC	300	11
E059.5	6/27/2022	12:34	WT_LAP-22-246533	UF	SSC	300	11
E059.5	6/27/2022	12:54	WT_LAP-22-246534	UF	SSC	300	11

Table 4.2-1 (continued)

Gaging Station	Sample Collection Date	Sample Collection Time	Field Sample ID	Field Prep	SSC Source[a]	Calculated SSC (mg/L)	Calculated Instantaneous Discharge (ft³/s)
E059.5	6/27/2022	13:14	WT_LAP-22-246535	UF	SSC	300	10
E059.5	6/27/2022	13:34	WT_LAP-22-246536	UF	SSC	300	10
E059.5	7/26/2022	19:09	WT_LAP-22-247060	UF	SSC	3100	72
E059.5	7/26/2022	19:11	WT_LAP-22-246943	UF	Estimated	2800	69
E059.5	7/26/2022	19:13	WT_LAP-22-247096	F	Estimated	2700	66
E059.5	7/26/2022	19:13	WT_LAP-22-247114	UF	Estimated	2700	66
E059.5	7/26/2022	19:17	WT_LAP-22-247006	F	Estimated	2500	61
E059.5	7/26/2022	19:17	WT_LAP-22-247024	UF	Estimated	2500	61
E059.5	7/26/2022	19:17	WT_LAP-22-247042	F10u	Estimated	2500	61
E059.5	7/26/2022	19:19	WT_LAP-22-246984	UF	Estimated	2400	59
E059.5	7/26/2022	19:21	WT_LAP-22-246976	UF	Estimated	2300	57
E059.5	7/26/2022	19:23	WT_LAP-22-246959	UF	Estimated	2200	55
E059.5	7/26/2022	19:27	WT_LAP-22-247078	UF	SSC	2000	52
E059.5	7/26/2022	19:29	WT_LAP-22-246749	UF	SSC	1900	50
E059.5	7/26/2022	19:31	WT_LAP-22-246750	UF	SSC	1800	49
E038	7/27/2022	15:33	WT_LAP-22-246701	UF	SSC	4900	170
E038	7/27/2022	15:35	WT_LAP-22-246702	UF	SSC	4500	325
E038	7/27/2022	15:37	WT_LAP-22-246703	UF	SSC	3700	325
E038	7/27/2022	15:39	WT_LAP-22-246704	UF	SSC	3100	315
E038	7/27/2022	15:41	WT_LAP-22-246705	UF	SSC	2800	281
E038	7/27/2022	15:43	WT_LAP-22-246706	UF	SSC	2300	239
E038	7/27/2022	15:45	WT_LAP-22-246707	UF	SSC	2300	201
E038	7/27/2022	15:45	WT_LAP-22-247202	UF	SSC	2300	201
E038	7/27/2022	15:47	WT_LAP-22-246708	UF	SSC	2200	168
E038	7/27/2022	15:47	WT_LAP-22-247319	UF	Estimated	2200	168

Table 4.2-1 (continued)

Gaging Station	Sample Collection Date	Sample Collection Time	Field Sample ID	Field Prep	SSC Source[a]	Calculated SSC (mg/L)	Calculated Instantaneous Discharge (ft^3/s)
E038	7/27/2022	15:49	WT_LAP-22-247148	UF	Estimated	2000	139
E038	7/27/2022	15:49	WT_LAP-22-247166	F	Estimated	2000	139
E038	7/27/2022	15:51	WT_LAP-22-246710	UF	SSC	1800	112
E038	7/27/2022	15:53	WT_LAP-22-246711	UF	SSC	2100	86
E038	7/27/2022	15:53	WT_LAP-22-247220	F10u	Estimated	2100	86
E038	7/27/2022	15:53	WT_LAP-22-247238	UF	Estimated	2100	86
E038	7/27/2022	15:53	WT_LAP-22-247256	F	Estimated	2100	86
E038	7/27/2022	15:55	WT_LAP-22-246712	UF	SSC	1800	64
E038	7/27/2022	15:55	WT_LAP-22-247280	UF	Estimated	1800	64
E038	7/27/2022	15:57	WT_LAP-22-246713	UF	SSC	2000	55
E038	7/27/2022	15:57	WT_LAP-22-247306	UF	Estimated	2000	55
E038	7/27/2022	15:59	WT_LAP-22-246714	UF	SSC	1700	46
E038	7/27/2022	16:01	WT_LAP-22-246715	UF	SSC	1500	39
E038	7/27/2022	16:01	WT_LAP-22-247275	UF	Estimated	1500	39
E038	7/27/2022	16:03	WT_LAP-22-246716	UF	SSC	500	33
E038	7/27/2022	16:03	WT_LAP-22-247184	UF	SSC	1600	33
E038	7/27/2022	16:23	WT_LAP-22-246717	UF	SSC	1400	12
E038	7/27/2022	16:43	WT_LAP-22-246718	UF	SSC	200	7
E038	7/27/2022	17:03	WT_LAP-22-246719	UF	SSC	100	5
E038	7/27/2022	17:23	WT_LAP-22-246720	UF	SSC	100	5
E038	7/27/2022	17:43	WT_LAP-22-246721	UF	SSC	200	6
E038	7/27/2022	18:03	WT_LAP-22-246722	UF	SSC	100	5
E039.1	7/27/2022	16:00	WT_LAP-22-246725	UF	SSC	2200	216
E039.1	7/27/2022	16:02	WT_LAP-22-246726	UF	SSC	2100	184
E039.1	7/27/2022	16:04	WT_LAP-22-246727	UF	SSC	4700	154

Table 4.2-1 (continued)

Gaging Station	Sample Collection Date	Sample Collection Time	Field Sample ID	Field Prep	SSC Source[a]	Calculated SSC (mg/L)	Calculated Instantaneous Discharge (ft^3/s)
E039.1	7/27/2022	16:04	WT_LAP-22-247059	UF	SSC	1700	154
E039.1	7/27/2022	16:06	WT_LAP-22-246728	UF	SSC	1600	134
E039.1	7/27/2022	16:06	WT_LAP-22-246942	UF	Estimated	1600	134
E039.1	7/27/2022	16:08	WT_LAP-22-246729	UF	SSC	1500	119
E039.1	7/27/2022	16:08	WT_LAP-22-247095	F	Estimated	1500	119
E039.1	7/27/2022	16:08	WT_LAP-22-247113	UF	Estimated	1500	119
E039.1	7/27/2022	16:10	WT_LAP-22-246730	UF	SSC	1300	105
E039.1	7/27/2022	16:12	WT_LAP-22-246731	UF	SSC	1100	94
E039.1	7/27/2022	16:12	WT_LAP-22-247005	F	Estimated	1100	94
E039.1	7/27/2022	16:12	WT_LAP-22-247023	UF	Estimated	1100	94
E039.1	7/27/2022	16:12	WT_LAP-22-247041	F10u	Estimated	1100	94
E039.1	7/27/2022	16:14	WT_LAP-22-246732	UF	SSC	1100	83
E039.1	7/27/2022	16:14	WT_LAP-22-246983	UF	Estimated	1100	83
E039.1	7/27/2022	16:16	WT_LAP-22-246733	UF	SSC	900	74
E039.1	7/27/2022	16:16	WT_LAP-22-246958	UF	Estimated	900	74
E039.1	7/27/2022	16:18	WT_LAP-22-246734	UF	SSC	800	66
E039.1	7/27/2022	16:20	WT_LAP-22-246735	UF	SSC	800	58
E039.1	7/27/2022	16:20	WT_LAP-22-246993	UF	Estimated	800	58
E039.1	7/27/2022	16:22	WT_LAP-22-246736	UF	SSC	700	54
E039.1	7/27/2022	16:22	WT_LAP-22-247077	UF	SSC	800	54
E039.1	7/27/2022	16:24	WT_LAP-22-246737	UF	SSC	700	50
E039.1	7/27/2022	16:26	WT_LAP-22-246738	UF	SSC	700	47
E039.1	7/27/2022	16:28	WT_LAP-22-246739	UF	SSC	600	43
E039.1	7/27/2022	16:30	WT_LAP-22-246740	UF	SSC	600	39
E039.1	7/27/2022	16:50	WT_LAP-22-246741	UF	SSC	400	18

Table 4.2-1 (continued)

Gaging Station	Sample Collection Date	Sample Collection Time	Field Sample ID	Field Prep	SSC Source[a]	Calculated SSC (mg/L)	Calculated Instantaneous Discharge (ft^3/s)
E039.1	7/27/2022	17:10	WT_LAP-22-246742	UF	SSC	300	10
E039.1	7/27/2022	17:30	WT_LAP-22-246743	UF	SSC	200	6
E039.1	7/27/2022	17:50	WT_LAP-22-246744	UF	SSC	200	5
E039.1	7/27/2022	18:30	WT_LAP-22-246745	UF	SSC	100	5
E042.1	7/27/2022	17:07	WT_LAP-22-245929	UF	SSC	24400	41
E042.1	7/27/2022	17:08	WT_LAP-22-245930	UF	SSC	25200	40
E042.1	7/27/2022	17:10	WT_LAP-22-245931	UF	SSC	30900	39
E042.1	7/27/2022	17:10	WT_LAP-22-246195	UF	SSC	21800	39
E042.1	7/27/2022	17:12	WT_LAP-22-245932	UF	SSC	24500	37
E042.1	7/27/2022	17:12	WT_LAP-22-246078	UF	Estimated	24500	37
E042.1	7/27/2022	17:14	WT_LAP-22-246231	F	Estimated	21200	36
E042.1	7/27/2022	17:14	WT_LAP-22-246249	UF	Estimated	21200	36
E042.1	7/27/2022	17:16	WT_LAP-22-245933	UF	SSC	17800	33
E042.1	7/27/2022	17:18	WT_LAP-22-246141	F	Estimated	16900	30
E042.1	7/27/2022	17:18	WT_LAP-22-246159	UF	Estimated	16900	30
E042.1	7/27/2022	17:18	WT_LAP-22-246177	F10u	Estimated	16900	30
E042.1	7/27/2022	17:20	WT_LAP-22-245934	UF	SSC	15900	28
E042.1	7/27/2022	17:20	WT_LAP-22-246099	UF	Estimated	15900	28
E042.1	7/27/2022	17:24	WT_LAP-22-246119	UF	Estimated	13900	25
E042.1	7/27/2022	17:26	WT_LAP-22-246094	UF	Estimated	13000	23
E042.1	7/27/2022	17:30	WT_LAP-22-246110	UF	Estimated	11000	21
E042.1	7/27/2022	17:32	WT_LAP-22-246213	UF	SSC	10000	19
E042.1	7/27/2022	17:34	WT_LAP-22-245935	UF	SSC	15300	17
E042.1	7/27/2022	17:54	WT_LAP-22-245936	UF	SSC	6200	10
E042.1	7/27/2022	18:14	WT_LAP-22-245937	UF	SSC	3700	7

Table 4.2-1 (continued)

Gaging Station	Sample Collection Date	Sample Collection Time	Field Sample ID	Field Prep	SSC Source[a]	Calculated SSC (mg/L)	Calculated Instantaneous Discharge (ft^3/s)
E042.1	7/27/2022	18:34	WT_LAP-22-245938	UF	SSC	2200	4
E042.1	7/27/2022	18:54	WT_LAP-22-245939	UF	SSC	1600	3
E042.1	7/27/2022	19:34	WT_LAP-22-245940	UF	SSC	1200	1
E042.1	7/27/2022	19:54	WT_LAP-22-245941	UF	SSC	900	1
E042.1	7/27/2022	20:14	WT_LAP-22-245942	UF	SSC	700	0
E050.1	7/27/2022	17:31	WT_LAP-22-245953	UF	SSC	7600	0
E050.1	7/27/2022	17:31	WT_LAP-22-246197	UF	SSC	7300	0
E050.1	7/27/2022	17:33	WT_LAP-22-245954	UF	SSC	6200	1
E050.1	7/27/2022	17:33	WT_LAP-22-246080	UF	Estimated	6200	1
E050.1	7/27/2022	17:35	WT_LAP-22-245955	UF	SSC	6200	5
E050.1	7/27/2022	17:35	WT_LAP-22-246233	F	Estimated	6200	5
E050.1	7/27/2022	17:35	WT_LAP-22-246251	UF	Estimated	6200	5
E050.1	7/27/2022	17:37	WT_LAP-22-245956	UF	SSC	5300	7
E050.1	7/27/2022	17:39	WT_LAP-22-245957	UF	SSC	5000	9
E050.1	7/27/2022	17:39	WT_LAP-22-246143	F	Estimated	5000	9
E050.1	7/27/2022	17:39	WT_LAP-22-246161	UF	Estimated	5000	9
E050.1	7/27/2022	17:39	WT_LAP-22-246179	F10u	Estimated	5000	9
E050.1	7/27/2022	17:41	WT_LAP-22-245958	UF	SSC	4700	11
E050.1	7/27/2022	17:41	WT_LAP-22-246101	UF	Estimated	4700	11
E050.1	7/27/2022	17:43	WT_LAP-22-245959	UF	SSC	4400	12
E050.1	7/27/2022	17:45	WT_LAP-22-245960	UF	SSC	4200	13
E050.1	7/27/2022	17:45	WT_LAP-22-246121	UF	Estimated	4200	13
E050.1	7/27/2022	17:47	WT_LAP-22-245961	UF	SSC	3800	13
E050.1	7/27/2022	17:47	WT_LAP-22-246105	UF	Estimated	3800	13
E050.1	7/27/2022	17:49	WT_LAP-22-246103	UF	Estimated	3600	14

Table 4.2-1 (continued)

Gaging Station	Sample Collection Date	Sample Collection Time	Field Sample ID	Field Prep	SSC Source[a]	Calculated SSC (mg/L)	Calculated Instantaneous Discharge (ft^3/s)
E050.1	7/27/2022	17:49	WT_LAP-22-246128	UF	Estimated	3600	14
E050.1	7/27/2022	17:53	WT_LAP-22-245962	UF	SSC	3300	15
E050.1	7/27/2022	17:53	WT_LAP-22-246215	UF	SSC	3400	15
E050.1	7/27/2022	17:55	WT_LAP-22-245963	UF	SSC	3200	15
E050.1	7/27/2022	17:57	WT_LAP-22-245964	UF	SSC	3000	15
E050.1	7/27/2022	17:59	WT_LAP-22-245965	UF	SSC	3000	15
E050.1	7/27/2022	18:01	WT_LAP-22-245966	UF	SSC	2800	15
E056	7/27/2022	15:55	WT_LAP-22-246186	UF	SSC	3500	0
E056	7/27/2022	15:57	WT_LAP-22-246069	UF	Estimated	3200	2
E056	7/27/2022	15:59	WT_LAP-22-246222	F	Estimated	3000	8
E056	7/27/2022	15:59	WT_LAP-22-246240	UF	Estimated	3000	8
E056	7/27/2022	16:03	WT_LAP-22-246132	F	Estimated	2400	4
E056	7/27/2022	16:03	WT_LAP-22-246150	UF	Estimated	2400	4
E056	7/27/2022	16:03	WT_LAP-22-246168	F10u	Estimated	2400	4
E056	7/27/2022	16:05	WT_LAP-22-246107	UF	Estimated	2100	14
E056	7/27/2022	16:07	WT_LAP-22-246087	UF	Estimated	1900	14
E056	7/27/2022	16:11	WT_LAP-22-246204	UF	SSC	1300	14
E059.5	7/27/2022	17:19	WT_LAP-22-246751	UF	SSC	800	15
E059.5	7/27/2022	17:21	WT_LAP-22-246752	UF	SSC	500	17
E059.5	7/27/2022	17:23	WT_LAP-22-246753	UF	SSC	500	18
E059.5	7/27/2022	17:25	WT_LAP-22-246754	UF	SSC	500	20
E059.5	7/27/2022	17:27	WT_LAP-22-246755	UF	SSC	500	21
E059.5	7/27/2022	17:29	WT_LAP-22-246756	UF	SSC	400	22
E059.5	7/27/2022	17:31	WT_LAP-22-246757	UF	SSC	400	22
E059.5	7/27/2022	17:33	WT_LAP-22-246758	UF	SSC	400	22

Table 4.2-1 (continued)

Gaging Station	Sample Collection Date	Sample Collection Time	Field Sample ID	Field Prep	SSC Source[a]	Calculated SSC (mg/L)	Calculated Instantaneous Discharge (ft^3/s)
E059.5	7/27/2022	17:35	WT_LAP-22-246759	UF	SSC	300	22
E059.5	7/27/2022	17:37	WT_LAP-22-246760	UF	SSC	300	22
E059.5	7/27/2022	17:39	WT_LAP-22-246761	UF	SSC	400	22
E059.5	7/27/2022	17:41	WT_LAP-22-246762	UF	SSC	300	22
E059.5	7/27/2022	17:43	WT_LAP-22-246763	UF	SSC	400	22
E059.5	7/27/2022	17:44	WT_LAP-22-247204	UF	SSC	700	22
E059.5	7/27/2022	17:45	WT_LAP-22-246764	UF	SSC	400	21
E059.5	7/27/2022	17:46	WT_LAP-22-247321	UF	Estimated	400	21
E059.5	7/27/2022	17:47	WT_LAP-22-246765	UF	SSC	400	21
E059.5	7/27/2022	17:48	WT_LAP-22-247150	UF	Estimated	400	21
E059.5	7/27/2022	17:48	WT_LAP-22-247168	F	Estimated	400	21
E059.5	7/27/2022	17:49	WT_LAP-22-246766	UF	SSC	400	21
E059.5	7/27/2022	17:52	WT_LAP-22-247222	F10u	Estimated	400	20
E059.5	7/27/2022	17:52	WT_LAP-22-247240	UF	Estimated	400	20
E059.5	7/27/2022	17:52	WT_LAP-22-247258	F	Estimated	400	20
E059.5	7/27/2022	17:54	WT_LAP-22-247282	UF	Estimated	400	19
E059.5	7/27/2022	17:56	WT_LAP-22-247290	UF	Estimated	300	19
E059.5	7/27/2022	17:58	WT_LAP-22-247308	UF	Estimated	300	19
E059.5	7/27/2022	18:02	WT_LAP-22-247186	UF	SSC	300	18
E059.5	7/27/2022	18:09	WT_LAP-22-246767	UF	SSC	400	17
E059.5	7/27/2022	18:29	WT_LAP-22-246768	UF	SSC	400	16
E059.5	7/27/2022	18:49	WT_LAP-22-246769	UF	SSC	2400	50
E059.5	7/27/2022	19:09	WT_LAP-22-246770	UF	SSC	3000	47
E059.5	7/27/2022	19:29	WT_LAP-22-246771	UF	SSC	2200	42
E059.5	7/27/2022	19:49	WT_LAP-22-246772	UF	SSC	1500	36

Table 4.2-1 (continued)

Gaging Station	Sample Collection Date	Sample Collection Time	Field Sample ID	Field Prep	SSC Source[a]	Calculated SSC (mg/L)	Calculated Instantaneous Discharge (ft³/s)
E059.5	7/27/2022	20:09	WT_LAP-22-255263	UF	SSC	1000	31
E059.5	7/27/2022	20:29	WT_LAP-22-255264	UF	SSC	800	26
E059.8	7/31/2022	21:44	WT_LAP-22-245905	UF	SSC	300	3
E059.8	7/31/2022	21:46	WT_LAP-22-245906	UF	SSC	400	3
E059.8	7/31/2022	21:48	WT_LAP-22-245907	UF	SSC	400	3
E059.8	7/31/2022	21:50	WT_LAP-22-245908	UF	SSC	400	2
E059.8	7/31/2022	21:52	WT_LAP-22-245909	UF	SSC	400	2
E059.8	7/31/2022	21:54	WT_LAP-22-245910	UF	SSC	400	3
E059.8	7/31/2022	21:54	WT_LAP-22-246193	UF	SSC	300	3
E059.8	7/31/2022	21:56	WT_LAP-22-245911	UF	SSC	400	3
E059.8	7/31/2022	21:56	WT_LAP-22-246076	UF	Estimated	400	3
E059.8	7/31/2022	21:58	WT_LAP-22-245912	UF	SSC	500	2
E059.8	7/31/2022	21:58	WT_LAP-22-246229	F	Estimated	500	2
E059.8	7/31/2022	21:58	WT_LAP-22-246247	UF	Estimated	500	2
E059.8	7/31/2022	22:00	WT_LAP-22-245913	UF	SSC	400	2
E059.8	7/31/2022	22:02	WT_LAP-22-245914	UF	SSC	400	2
E059.8	7/31/2022	22:02	WT_LAP-22-246139	F	Estimated	400	2
E059.8	7/31/2022	22:02	WT_LAP-22-246157	UF	Estimated	400	2
E059.8	7/31/2022	22:02	WT_LAP-22-246175	F10u	Estimated	400	2
E059.8	7/31/2022	22:04	WT_LAP-22-245915	UF	SSC	500	2
E059.8	7/31/2022	22:04	WT_LAP-22-246117	UF	Estimated	500	2
E059.8	7/31/2022	22:06	WT_LAP-22-245916	UF	SSC	500	2
E059.8	7/31/2022	22:08	WT_LAP-22-245917	UF	SSC	400	3
E059.8	7/31/2022	22:08	WT_LAP-22-246109	UF	Estimated	400	3
E059.8	7/31/2022	22:10	WT_LAP-22-245918	UF	SSC	500	3

Table 4.2-1 (continued)

Gaging Station	Sample Collection Date	Sample Collection Time	Field Sample ID	Field Prep	SSC Source[a]	Calculated SSC (mg/L)	Calculated Instantaneous Discharge (ft^3/s)
E059.8	7/31/2022	22:12	WT_LAP-22-245919	UF	SSC	400	2
E059.8	7/31/2022	22:12	WT_LAP-22-246092	UF	Estimated	400	2
E059.8	7/31/2022	22:14	WT_LAP-22-245920	UF	SSC	400	2
E059.8	7/31/2022	22:16	WT_LAP-22-246211	UF	SSC	400	2
E059.8	7/31/2022	22:34	WT_LAP-22-245921	UF	SSC	400	3
E059.8	7/31/2022	22:54	WT_LAP-22-245922	UF	SSC	400	2
E059.8	7/31/2022	23:14	WT_LAP-22-245923	UF	SSC	300	1
E059.8	7/31/2022	23:34	WT_LAP-22-245924	UF	SSC	300	1
E059.8	7/31/2022	23:54	WT_LAP-22-245925	UF	SSC	300	1
E059.8	8/1/2022	00:14	WT_LAP-22-245926	UF	SSC	300	1
E059.8	8/1/2022	00:34	WT_LAP-22-245927	UF	SSC	300	1
E059.8	8/1/2022	00:54	WT_LAP-22-245928	UF	SSC	300	1
E055	8/5/2022	13:10	WT_LAP-22-246342	UF	SSC	5400	94
E055	8/5/2022	13:12	WT_LAP-22-246459	UF	Estimated	5200	90
E055	8/5/2022	13:14	WT_LAP-22-246288	UF	Estimated	4900	86
E055	8/5/2022	13:14	WT_LAP-22-246306	F	Estimated	4900	86
E055	8/5/2022	13:18	WT_LAP-22-246360	F10u	Estimated	4400	79
E055	8/5/2022	13:18	WT_LAP-22-246378	UF	Estimated	4400	79
E055	8/5/2022	13:18	WT_LAP-22-246396	F	Estimated	4400	79
E055	8/5/2022	13:20	WT_LAP-22-246425	UF	Estimated	4200	75
E055	8/5/2022	13:24	WT_LAP-22-246445	UF	Estimated	3700	68
E055	8/5/2022	13:30	WT_LAP-22-246324	UF	SSC	3000	57
E050.1	8/6/2022	13:08	WT_LAP-22-246419	UF	Estimated	NA	0
E050.1	8/6/2022	13:10	WT_LAP-22-246427	UF	Estimated	NA	1
E050.1	8/6/2022	13:12	WT_LAP-22-246404	UF	Estimated	NA	0

Table 4.2-1 (continued)

Gaging Station	Sample Collection Date	Sample Collection Time	Field Sample ID	Field Prep	SSC Source[a]	Calculated SSC (mg/L)	Calculated Instantaneous Discharge (ft^3/s)
E059.5	8/11/2022	17:19	WT_LAP-22-247617	UF	SSC	2000	48
E059.5	8/11/2022	17:21	WT_LAP-22-247618	UF	SSC	2000	63
E059.5	8/11/2022	17:23	WT_LAP-22-247619	UF	SSC	1800	70
E059.5	8/11/2022	17:25	WT_LAP-22-247620	UF	SSC	1500	77
E059.5	8/11/2022	17:27	WT_LAP-22-247621	UF	SSC	1500	77
E059.5	8/11/2022	17:29	WT_LAP-22-247622	UF	SSC	1300	76
E059.5	8/11/2022	17:31	WT_LAP-22-247623	UF	SSC	1100	75
E059.5	8/11/2022	17:34	WT_LAP-22-247928	UF	SSC	1000	71
E059.5	8/11/2022	17:36	WT_LAP-22-247811	UF	Estimated	1000	70
E059.5	8/11/2022	17:38	WT_LAP-22-247964	F	Estimated	900	68
E059.5	8/11/2022	17:38	WT_LAP-22-247982	UF	Estimated	900	68
E059.5	8/11/2022	17:42	WT_LAP-22-247874	F	Estimated	900	64
E059.5	8/11/2022	17:42	WT_LAP-22-247892	UF	Estimated	900	64
E059.5	8/11/2022	17:42	WT_LAP-22-247910	F10u	Estimated	900	64
E059.5	8/11/2022	17:44	WT_LAP-22-247852	UF	Estimated	800	62
E059.5	8/11/2022	17:48	WT_LAP-22-247844	UF	Estimated	700	59
E059.5	8/11/2022	17:52	WT_LAP-22-247827	UF	Estimated	700	56
E059.5	8/11/2022	17:56	WT_LAP-22-247946	UF	SSC	600	53
E039.1	8/23/2022	14:54	WT_LAP-22-247357	UF	SSC	800	67
E039.1	8/23/2022	14:56	WT_LAP-22-247358	UF	SSC	700	63
E039.1	8/23/2022	14:58	WT_LAP-22-247359	UF	SSC	700	58
E039.1	8/23/2022	14:59	WT_LAP-22-247203	UF	SSC	600	56
E039.1	8/23/2022	15:00	WT_LAP-22-247360	UF	SSC	600	53
E039.1	8/23/2022	15:01	WT_LAP-22-247320	UF	Estimated	600	52
E039.1	8/23/2022	15:02	WT_LAP-22-247361	UF	SSC	500	50

Table 4.2-1 (continued)

Gaging Station	Sample Collection Date	Sample Collection Time	Field Sample ID	Field Prep	SSC Source[a]	Calculated SSC (mg/L)	Calculated Instantaneous Discharge (ft^3/s)
E039.1	8/23/2022	15:03	WT_LAP-22-247149	UF	Estimated	500	48
E039.1	8/23/2022	15:03	WT_LAP-22-247167	F	Estimated	500	48
E039.1	8/23/2022	15:04	WT_LAP-22-247362	UF	SSC	500	47
E039.1	8/23/2022	15:06	WT_LAP-22-247363	UF	SSC	400	43
E039.1	8/23/2022	15:07	WT_LAP-22-247221	F10u	Estimated	400	42
E039.1	8/23/2022	15:07	WT_LAP-22-247239	UF	Estimated	400	42
E039.1	8/23/2022	15:07	WT_LAP-22-247257	F	Estimated	400	42
E039.1	8/23/2022	15:08	WT_LAP-22-247364	UF	SSC	400	40
E039.1	8/23/2022	15:09	WT_LAP-22-247276	UF	Estimated	400	38
E039.1	8/23/2022	15:10	WT_LAP-22-247365	UF	SSC	400	36
E039.1	8/23/2022	15:12	WT_LAP-22-247366	UF	SSC	400	34
E039.1	8/23/2022	15:13	WT_LAP-22-247281	UF	Estimated	400	32
E039.1	8/23/2022	15:14	WT_LAP-22-247367	UF	SSC	300	31
E039.1	8/23/2022	15:16	WT_LAP-22-247368	UF	SSC	300	28
E039.1	8/23/2022	15:17	WT_LAP-22-247307	UF	Estimated	300	27
E039.1	8/23/2022	15:18	WT_LAP-22-247369	UF	SSC	300	26
E039.1	8/23/2022	15:20	WT_LAP-22-247370	UF	SSC	300	24
E039.1	8/23/2022	15:21	WT_LAP-22-247185	UF	SSC	200	23
E039.1	8/23/2022	15:22	WT_LAP-22-247371	UF	SSC	300	21
E039.1	8/23/2022	15:24	WT_LAP-22-247372	UF	SSC	300	19
E039.1	8/23/2022	15:44	WT_LAP-22-247373	UF	SSC	100	9
E039.1	8/23/2022	16:04	WT_LAP-22-247374	UF	SSC	100	5
E050.1	8/23/2022	18:30	WT_LAP-22-246821	UF	SSC	800	0
E050.1	8/23/2022	18:33	WT_LAP-22-246822	UF	SSC	800	0
E050.1	8/23/2022	18:34	WT_LAP-22-247065	UF	SSC	700	0

Table 4.2-1 (continued)

Gaging Station	Sample Collection Date	Sample Collection Time	Field Sample ID	Field Prep	SSC Source[a]	Calculated SSC (mg/L)	Calculated Instantaneous Discharge (ft^3/s)
E050.1	8/23/2022	18:36	WT_LAP-22-246823	UF	SSC	700	0
E050.1	8/23/2022	18:38	WT_LAP-22-247011	F	Estimated	800	0
E050.1	8/23/2022	18:38	WT_LAP-22-247029	UF	Estimated	800	0
E050.1	8/23/2022	18:38	WT_LAP-22-247047	F10u	Estimated	800	0
E050.1	8/23/2022	18:40	WT_LAP-22-246824	UF	SSC	800	0
E050.1	8/23/2022	18:42	WT_LAP-22-246989	UF	Estimated	800	0
E050.1	8/23/2022	18:44	WT_LAP-22-246825	UF	SSC	800	0
E050.1	8/23/2022	18:46	WT_LAP-22-246996	UF	Estimated	800	0
E050.1	8/23/2022	18:48	WT_LAP-22-246826	UF	SSC	800	0
E050.1	8/23/2022	18:50	WT_LAP-22-246973	UF	Estimated	800	0
E050.1	8/23/2022	18:52	WT_LAP-22-246827	UF	SSC	700	0
E050.1	8/23/2022	18:54	WT_LAP-22-246971	UF	Estimated	700	0
E050.1	8/23/2022	18:56	WT_LAP-22-246828	UF	SSC	700	0
E050.1	8/23/2022	18:58	WT_LAP-22-246829	UF	SSC	700	0
E050.1	8/23/2022	19:00	WT_LAP-22-246830	UF	SSC	600	0
E050.1	8/23/2022	19:20	WT_LAP-22-246831	UF	SSC	600	0
E050.1	8/23/2022	19:40	WT_LAP-22-246832	UF	SSC	500	0
E050.1	8/23/2022	20:00	WT_LAP-22-246833	UF	SSC	400	0
E050.1	8/23/2022	20:20	WT_LAP-22-246834	UF	SSC	300	0

[a] SSC = Measured using ASTM method D3977-97.

[b] UF = Unfiltered.

[c] F = Filtered.

[d] F10u = Filtered using 10 micron filter.

[e] NA = Not enough data available to estimate SSC.

Table 4.3-1
Calculated Total Metals and Isotopic Uranium Concentrations Determined for each Sample Analyzed for SSC during 2022 in the Los Alamos/Pueblo Watershed

					Estimated Total Recoverable Metals Concentrations and Unfiltered Isotopic Uranium Activities																			
Gaging Station	Sample Collection Date	Sample Collection Time	Field Sample ID	Measured SSC (mg/L)	Ag (µg/L) 0.499 + 0.0000237[a] * SSC[b]	Al (µg/L) 19,895 + 3.59 * SSC	As (µg/L) 6.79 + 0.000663 * SSC	Ba (µg/L) −117 + 0.16 * SSC	Be (µg/L) 2.57 + 0.000673 * SSC	Cd (µg/L) 0.751 + 0.000254 * SSC	Cr (µg/L) 24 + 0.00255 * SSC	Cu (µg/L) 47.3 + 0.00322 * SSC	Fe (µg/L) 3489 + 5.99 * SSC	Hg (µg/L) 0.307 + 0.0000218 * SSC	Mn (µg/L) −12,962 + 2.51 * SSC	Ni (µg/L) 19.3 + 0.00344 * SSC	Pb (µg/L) 107 + 0.00864 * SSC	Se (µg/L) 4.66 + 0.000136 * SSC	Tl (µg/L) 0.621 + 0.000116 * SSC	U-234 (pCi/L) −0.856 + 0.00078[c] * SSC	U-235/236 (pCi/L) −0.131 + 0.0000474 * SSC	U-238 (pCi/L) −1.33 + 0.000802 * SSC	V (µg/L) 25.4 + 0.00739 * SSC	Zn (µg/L) −53.3 + 0.0788 * SSC
Sediment Background Value (mg/kg)					**1**	**15,400**	**3.98**	**127**	**1.31**	**0.4**	**10.5**	**11.2**	**13,800**	**0.1**	**543**	**9.38**	**19.7**	**0.3**	**0.73**	**2.59**	**0.2**	**2.29**	**19.7**	**60.2**
E059.5	6/25/2022	15:51	WT_LAP-22-245882	200	0.504	20,613	6.92	-85	2.70	0.802	24.5	47.9	4,687	0.311	-12460	20.0	108.7	4.69	0.644	-0.700	-0.122	-1.17	26.9	-37.5
E059.5	6/25/2022	15:53	WT_LAP-22-245883	100	0.501	20,254	6.86	-101	2.64	0.776	24.3	47.6	4,088	0.309	-12711	19.6	107.9	4.67	0.633	-0.778	-0.126	-1.25	26.1	-45.4
E059.5	6/25/2022	15:55	WT_LAP-22-245884	100	0.501	20,254	6.86	-101	2.64	0.776	24.3	47.6	4,088	0.309	-12711	19.6	107.9	4.67	0.633	-0.778	-0.126	-1.25	26.1	-45.4
E059.5	6/25/2022	15:57	WT_LAP-22-245885	100	0.501	20,254	6.86	-101	2.64	0.776	24.3	47.6	4,088	0.309	-12711	19.6	107.9	4.67	0.633	-0.778	-0.126	-1.25	26.1	-45.4
E059.5	6/25/2022	15:59	WT_LAP-22-245886	200	0.504	20,613	6.92	-85	2.70	0.802	24.5	47.9	4,687	0.311	-12460	20.0	108.7	4.69	0.644	-0.700	-0.122	-1.17	26.9	-37.5
E059.5	6/25/2022	16:03	WT_LAP-22-245888	100	0.501	20,254	6.86	-101	2.64	0.776	24.3	47.6	4,088	0.309	-12711	19.6	107.9	4.67	0.633	-0.778	-0.126	-1.25	26.1	-45.4
E059.5	6/25/2022	16:05	WT_LAP-22-245889	200	0.504	20,613	6.92	-85	2.70	0.802	24.5	47.9	4,687	0.311	-12460	20.0	108.7	4.69	0.644	-0.700	-0.122	-1.17	26.9	-37.5
E059.5	6/25/2022	16:07	WT_LAP-22-245890	300	0.506	20,972	6.99	-69	2.77	0.827	24.8	48.3	5,286	0.314	-12209	20.3	109.6	4.70	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E059.5	6/25/2022	16:09	WT_LAP-22-245891	300	0.506	20,972	6.99	-69	2.77	0.827	24.8	48.3	5,286	0.314	-12209	20.3	109.6	4.70	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E059.5	6/25/2022	16:11	WT_LAP-22-245892	200	0.504	20,613	6.92	-85	2.70	0.802	24.5	47.9	4,687	0.311	-12460	20.0	108.7	4.69	0.644	-0.700	-0.122	-1.17	26.9	-37.5
E059.5	6/25/2022	16:13	WT_LAP-22-245893	200	0.504	20,613	6.92	-85	2.70	0.802	24.5	47.9	4,687	0.311	-12460	20.0	108.7	4.69	0.644	-0.700	-0.122	-1.17	26.9	-37.5
E059.5	6/25/2022	16:15	WT_LAP-22-245894	200	0.504	20,613	6.92	-85	2.70	0.802	24.5	47.9	4,687	0.311	-12460	20.0	108.7	4.69	0.644	-0.700	-0.122	-1.17	26.9	-37.5
E059.5	6/25/2022	16:17	WT_LAP-22-245895	200	0.504	20,613	6.92	-85	2.70	0.802	24.5	47.9	4,687	0.311	-12460	20.0	108.7	4.69	0.644	-0.700	-0.122	-1.17	26.9	-37.5
E059.5	6/25/2022	16:19	WT_LAP-22-245896	200	0.504	20,613	6.92	-85	2.70	0.802	24.5	47.9	4,687	0.311	-12460	20.0	108.7	4.69	0.644	-0.700	-0.122	-1.17	26.9	-37.5
E059.5	6/25/2022	16:39	WT_LAP-22-245897	200	0.504	20,613	6.92	-85	2.70	0.802	24.5	47.9	4,687	0.311	-12460	20.0	108.7	4.69	0.644	-0.700	-0.122	-1.17	26.9	-37.5
E059.5	6/25/2022	16:59	WT_LAP-22-245898	200	0.504	20,613	6.92	-85	2.70	0.802	24.5	47.9	4,687	0.311	-12460	20.0	108.7	4.69	0.644	-0.700	-0.122	-1.17	26.9	-37.5
E059.5	6/25/2022	17:19	WT_LAP-22-245899	300	0.506	20,972	6.99	-69	2.77	0.827	24.8	48.3	5,286	0.314	-12209	20.3	109.6	4.70	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E059.5	6/25/2022	17:39	WT_LAP-22-245900	200	0.504	20,613	6.92	-85	2.70	0.802	24.5	47.9	4,687	0.311	-12460	20.0	108.7	4.69	0.644	-0.700	-0.122	-1.17	26.9	-37.5
E059.5	6/25/2022	17:39	WT_LAP-22-246192	400	0.508	21,331	7.06	-53	2.84	0.853	25.0	48.6	5,885	0.316	-11958	20.7	110.5	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E059.5	6/25/2022	17:59	WT_LAP-22-245901	300	0.506	20,972	6.99	-69	2.77	0.827	24.8	48.3	5,286	0.314	-12209	20.3	109.6	4.70	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E059.5	6/25/2022	17:59	WT_LAP-22-246210	300	0.506	20,972	6.99	-69	2.77	0.827	24.8	48.3	5,286	0.314	-12209	20.3	109.6	4.70	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E059.5	6/25/2022	18:59	WT_LAP-22-245904	300	0.506	20,972	6.99	-69	2.77	0.827	24.8	48.3	5,286	0.314	-12209	20.3	109.6	4.70	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E039.1	6/26/2022	15:58	WT_LAP-22-245857	500	0.511	21,690	7.12	-37	2.91	0.878	25.3	48.9	6,484	0.318	-11707	21.0	111.3	4.73	0.679	-0.466	-0.107	-0.93	29.1	-13.9
E039.1	6/26/2022	16:00	WT_LAP-22-245858	400	0.508	21,331	7.06	-53	2.84	0.853	25.0	48.6	5,885	0.316	-11958	20.7	110.5	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E039.1	6/26/2022	16:02	WT_LAP-22-245859	700	0.516	22,408	7.25	-5	3.04	0.929	25.8	49.6	7,682	0.322	-11205	21.7	113.0	4.76	0.702	-0.310	-0.098	-0.77	30.6	1.86

Table 4.3-1 (continued)

Gaging Station	Sample Collection Date	Sample Collection Time	Field Sample ID	Measured SSC (mg/L)	Estimated Total Recoverable Metals Concentrations and Unfiltered Isotopic Uranium Activities																			
					Ag (µg/L) 0.499 + 0.0000237[a] * SSC[b]	Al (µg/L) 19,895 + 3.59 * SSC	As (µg/L) 6.79 + 0.000663 * SSC	Ba (µg/L) −117 + 0.16 * SSC	Be (µg/L) 2.57 + 0.000673 * SSC	Cd (µg/L) 0.751 + 0.000254 * SSC	Cr (µg/L) 24 + 0.00255 * SSC	Cu (µg/L) 47.3 + 0.00322 * SSC	Fe (µg/L) 3489 + 5.99 * SSC	Hg (µg/L) 0.307 + 0.0000218 * SSC	Mn (µg/L) −12,962 + 2.51 * SSC	Ni (µg/L) 19.3 + 0.00344 * SSC	Pb (µg/L) 107 + 0.00864 * SSC	Se (µg/L) 4.66 + 0.000136 * SSC	Tl (µg/L) 0.621 + 0.000116 * SSC	U-234 (pCi/L) −0.856 + 0.00078[c] * SSC	U-235/236 (pCi/L) −0.131 + 0.0000474 * SSC	U-238 (pCi/L) −1.33 + 0.000802 * SSC	V (µg/L) 25.4 + 0.00739 * SSC	Zn (µg/L) −53.3 + 0.0788 * SSC
Sediment Background Value (mg/kg)					**1**	**15,400**	**3.98**	**127**	**1.31**	**0.4**	**10.5**	**11.2**	**13,800**	**0.1**	**543**	**9.38**	**19.7**	**0.3**	**0.73**	**2.59**	**0.2**	**2.29**	**19.7**	**60.2**
E039.1	6/26/2022	16:04	WT_LAP-22-245860	400	0.508	21,331	7.06	-53	2.84	0.853	25.0	48.6	5,885	0.316	-11958	20.7	110.5	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E039.1	6/26/2022	16:06	WT_LAP-22-245861	300	0.506	20,972	6.99	-69	2.77	0.827	24.8	48.3	5,286	0.314	-12209	20.3	109.6	4.70	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E039.1	6/26/2022	16:08	WT_LAP-22-245862	0	0.499	19,895	6.79	-117	2.57	0.751	24.0	47.3	3,489	0.307	-12962	19.3	107.0	4.66	0.621	-0.856	-0.131	-1.33	25.4	-53.3
E039.1	6/26/2022	16:09	WT_LAP-22-246191	400	0.508	21,331	7.06	-53	2.84	0.853	25.0	48.6	5,885	0.316	-11958	20.7	110.5	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E039.1	6/26/2022	16:10	WT_LAP-22-245863	400	0.508	21,331	7.06	-53	2.84	0.853	25.0	48.6	5,885	0.316	-11958	20.7	110.5	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E039.1	6/26/2022	16:12	WT_LAP-22-245864	400	0.508	21,331	7.06	-53	2.84	0.853	25.0	48.6	5,885	0.316	-11958	20.7	110.5	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E039.1	6/26/2022	16:14	WT_LAP-22-245865	600	0.513	22,049	7.19	-21	2.97	0.903	25.5	49.2	7,083	0.320	-11456	21.4	112.2	4.74	0.691	-0.388	-0.103	-0.85	29.8	-6.0
E039.1	6/26/2022	16:16	WT_LAP-22-245866	100	0.501	20,254	6.86	-101	2.64	0.776	24.3	47.6	4,088	0.309	-12711	19.6	107.9	4.67	0.633	-0.778	-0.126	-1.25	26.1	-45.4
E039.1	6/26/2022	16:18	WT_LAP-22-245867	300	0.506	20,972	6.99	-69	2.77	0.827	24.8	48.3	5,286	0.314	-12209	20.3	109.6	4.70	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E039.1	6/26/2022	16:20	WT_LAP-22-245868	300	0.506	20,972	6.99	-69	2.77	0.827	24.8	48.3	5,286	0.314	-12209	20.3	109.6	4.70	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E039.1	6/26/2022	16:22	WT_LAP-22-245869	200	0.504	20,613	6.92	-85	2.70	0.802	24.5	47.9	4,687	0.311	-12460	20.0	108.7	4.69	0.644	-0.700	-0.122	-1.17	26.9	-37.5
E039.1	6/26/2022	16:24	WT_LAP-22-245870	100	0.501	20,254	6.86	-101	2.64	0.776	24.3	47.6	4,088	0.309	-12711	19.6	107.9	4.67	0.633	-0.778	-0.126	-1.25	26.1	-45.4
E039.1	6/26/2022	16:26	WT_LAP-22-245871	200	0.504	20,613	6.92	-85	2.70	0.802	24.5	47.9	4,687	0.311	-12460	20.0	108.7	4.69	0.644	-0.700	-0.122	-1.17	26.9	-37.5
E039.1	6/26/2022	16:27	WT_LAP-22-246209	300	0.506	20,972	6.99	-69	2.77	0.827	24.8	48.3	5,286	0.314	-12209	20.3	109.6	4.70	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E039.1	6/26/2022	16:28	WT_LAP-22-245872	0	0.499	19,895	6.79	-117	2.57	0.751	24.0	47.3	3,489	0.307	-12962	19.3	107.0	4.66	0.621	-0.856	-0.131	-1.33	25.4	-53.3
E039.1	6/26/2022	16:48	WT_LAP-22-245873	200	0.504	20,613	6.92	-85	2.70	0.802	24.5	47.9	4,687	0.311	-12460	20.0	108.7	4.69	0.644	-0.700	-0.122	-1.17	26.9	-37.5
E039.1	6/26/2022	17:08	WT_LAP-22-245874	100	0.501	20,254	6.86	-101	2.64	0.776	24.3	47.6	4,088	0.309	-12711	19.6	107.9	4.67	0.633	-0.778	-0.126	-1.25	26.1	-45.4
E039.1	6/26/2022	17:28	WT_LAP-22-245875	100	0.501	20,254	6.86	-101	2.64	0.776	24.3	47.6	4,088	0.309	-12711	19.6	107.9	4.67	0.633	-0.778	-0.126	-1.25	26.1	-45.4
E039.1	6/26/2022	17:48	WT_LAP-22-245876	0	0.499	19,895	6.79	-117	2.57	0.751	24.0	47.3	3,489	0.307	-12962	19.3	107.0	4.66	0.621	-0.856	-0.131	-1.33	25.4	-53.3
E039.1	6/26/2022	18:08	WT_LAP-22-245877	100	0.501	20,254	6.86	-101	2.64	0.776	24.3	47.6	4,088	0.309	-12711	19.6	107.9	4.67	0.633	-0.778	-0.126	-1.25	26.1	-45.4
E040	6/26/2022	9:20	WT_LAP-22-246189	2400	0.556	28,511	8.38	267	4.19	1.361	30.1	55.0	17,865	0.359	-6938	27.6	127.7	4.99	0.899	1.016	-0.017	0.59	43.1	135.8
E040	6/26/2022	9:32	WT_LAP-22-246207	3100	0.572	31,024	8.85	379	4.66	1.538	31.9	57.3	22,058	0.375	-5181	30.0	133.8	5.08	0.981	1.562	0.016	1.16	48.3	191.0
E055	6/26/2022	11:39	WT_LAP-22-246198	1200	0.527	24,203	7.59	75	3.38	1.056	27.1	51.2	10,677	0.333	-9950	23.4	117.4	4.82	0.760	0.080	-0.074	-0.37	34.3	41.3
E055	6/26/2022	11:55	WT_LAP-22-246216	700	0.516	22,408	7.25	-5	3.04	0.929	25.8	49.6	7,682	0.322	-11205	21.7	113.0	4.76	0.702	-0.310	-0.098	-0.77	30.6	1.86
E038	6/27/2022	14:09	WT_LAP-22-245833	2200	0.551	27,793	8.25	235	4.05	1.310	29.6	54.4	16,667	0.355	-7440	26.9	126.0	4.96	0.876	0.860	-0.027	0.43	41.7	120.1
E038	6/27/2022	14:11	WT_LAP-22-245834	3000	0.570	30,665	8.78	363	4.59	1.513	31.7	57.0	21,459	0.372	-5432	29.6	132.9	5.07	0.969	1.484	0.011	1.08	47.6	183.1

Table 4.3-1 (continued)

Gaging Station	Sample Collection Date	Sample Collection Time	Field Sample ID	Measured SSC (mg/L)	Estimated Total Recoverable Metals Concentrations and Unfiltered Isotopic Uranium Activities																			
					Ag (µg/L) 0.499 + 0.0000237[a] * SSC[b]	Al (µg/L) 19,895 + 3.59 * SSC	As (µg/L) 6.79 + 0.000663 * SSC	Ba (µg/L) −117 + 0.16 * SSC	Be (µg/L) 2.57 + 0.000673 * SSC	Cd (µg/L) 0.751 + 0.000254 * SSC	Cr (µg/L) 24 + 0.00255 * SSC	Cu (µg/L) 47.3 + 0.00322 * SSC	Fe (µg/L) 3489 + 5.99 * SSC	Hg (µg/L) 0.307 + 0.0000218 * SSC	Mn (µg/L) −12,962 + 2.51 * SSC	Ni (µg/L) 19.3 + 0.00344 * SSC	Pb (µg/L) 107 + 0.00864 * SSC	Se (µg/L) 4.66 + 0.000136 * SSC	Tl (µg/L) 0.621 + 0.000116 * SSC	U-234 (pCi/L) −0.856 + 0.00078[c] * SSC	U-235/236 (pCi/L) −0.131 + 0.0000474 * SSC	U-238 (pCi/L) −1.33 + 0.000802 * SSC	V (µg/L) 25.4 + 0.00739 * SSC	Zn (µg/L) −53.3 + 0.0788 * SSC
Sediment Background Value (mg/kg)					1	15,400	3.98	127	1.31	0.4	10.5	11.2	13,800	0.1	543	9.38	19.7	0.3	0.73	2.59	0.2	2.29	19.7	60.2
E038	6/27/2022	14:13	WT_LAP-22-245835	2100	0.549	27,434	8.18	219	3.98	1.284	29.4	54.1	16,068	0.353	-7691	26.5	125.1	4.95	0.865	0.782	-0.031	0.35	40.9	112.2
E038	6/27/2022	14:15	WT_LAP-22-245836	2000	0.546	27,075	8.12	203	3.92	1.259	29.1	53.7	15,469	0.351	-7942	26.2	124.3	4.93	0.853	0.704	-0.036	0.27	40.2	104.3
E038	6/27/2022	14:17	WT_LAP-22-245837	2000	0.546	27,075	8.12	203	3.92	1.259	29.1	53.7	15,469	0.351	-7942	26.2	124.3	4.93	0.853	0.704	-0.036	0.27	40.2	104.3
E038	6/27/2022	14:19	WT_LAP-22-245838	2100	0.549	27,434	8.18	219	3.98	1.284	29.4	54.1	16,068	0.353	-7691	26.5	125.1	4.95	0.865	0.782	-0.031	0.35	40.9	112.2
E038	6/27/2022	14:20	WT_LAP-22-246190	1900	0.544	26,716	8.05	187	3.85	1.234	28.8	53.4	14,870	0.348	-8193	25.8	123.4	4.92	0.841	0.626	-0.041	0.19	39.4	96.4
E038	6/27/2022	14:21	WT_LAP-22-245839	2100	0.549	27,434	8.18	219	3.98	1.284	29.4	54.1	16,068	0.353	-7691	26.5	125.1	4.95	0.865	0.782	-0.031	0.35	40.9	112.2
E038	6/27/2022	14:23	WT_LAP-22-245840	1700	0.539	25,998	7.92	155	3.71	1.183	28.3	52.8	13,672	0.344	-8695	25.1	121.7	4.89	0.818	0.470	-0.050	0.03	38.0	80.7
E038	6/27/2022	14:25	WT_LAP-22-245841	2000	0.546	27,075	8.12	203	3.92	1.259	29.1	53.7	15,469	0.351	-7942	26.2	124.3	4.93	0.853	0.704	-0.036	0.27	40.2	104.3
E038	6/27/2022	14:27	WT_LAP-22-245842	1700	0.539	25,998	7.92	155	3.71	1.183	28.3	52.8	13,672	0.344	-8695	25.1	121.7	4.89	0.818	0.470	-0.050	0.03	38.0	80.7
E038	6/27/2022	14:29	WT_LAP-22-245843	1600	0.537	25,639	7.85	139	3.65	1.157	28.1	52.5	13,073	0.342	-8946	24.8	120.8	4.88	0.807	0.392	-0.055	-0.05	37.2	72.8
E038	6/27/2022	14:31	WT_LAP-22-245844	1300	0.530	24,562	7.65	91	3.44	1.081	27.3	51.5	11,276	0.335	-9699	23.8	118.2	4.84	0.772	0.158	-0.069	-0.29	35.0	49.1
E038	6/27/2022	14:33	WT_LAP-22-245845	900	0.520	23,126	7.39	27	3.18	0.980	26.3	50.2	8,880	0.327	-10703	22.4	114.8	4.78	0.725	-0.154	-0.088	-0.61	32.1	17.6
E038	6/27/2022	14:35	WT_LAP-22-245846	600	0.513	22,049	7.19	-21	2.97	0.903	25.5	49.2	7,083	0.320	-11456	21.4	112.2	4.74	0.691	-0.388	-0.103	-0.85	29.8	-6.02
E038	6/27/2022	14:37	WT_LAP-22-245847	700	0.516	22,408	7.25	-5	3.04	0.929	25.8	49.6	7,682	0.322	-11205	21.7	113.0	4.76	0.702	-0.310	-0.098	-0.77	30.6	1.86
E038	6/27/2022	14:39	WT_LAP-22-245848	700	0.516	22,408	7.25	-5	3.04	0.929	25.8	49.6	7,682	0.322	-11205	21.7	113.0	4.76	0.702	-0.310	-0.098	-0.77	30.6	1.86
E038	6/27/2022	14:42	WT_LAP-22-246208	800	0.518	22,767	7.32	11	3.11	0.954	26.0	49.9	8,281	0.324	-10954	22.1	113.9	4.77	0.714	-0.232	-0.093	-0.69	31.3	9.74
E038	6/27/2022	14:59	WT_LAP-22-245849	100	0.501	20,254	6.86	-101	2.64	0.776	24.3	47.6	4,088	0.309	-12711	19.6	107.9	4.67	0.633	-0.778	-0.126	-1.25	26.1	-45.4
E038	6/27/2022	15:19	WT_LAP-22-245850	100	0.501	20,254	6.86	-101	2.64	0.776	24.3	47.6	4,088	0.309	-12711	19.6	107.9	4.67	0.633	-0.778	-0.126	-1.25	26.1	-45.4
E039.1	6/27/2022	14:38	WT_LAP-22-246489	1200	0.527	24,203	7.59	75	3.38	1.056	27.1	51.2	10,677	0.333	-9950	23.4	117.4	4.82	0.760	0.080	-0.074	-0.37	34.3	41.3
E039.1	6/27/2022	14:40	WT_LAP-22-246490	1100	0.525	23,844	7.52	59	3.31	1.030	26.8	50.8	10,078	0.331	-10201	23.1	116.5	4.81	0.749	0.002	-0.079	-0.45	33.5	33.4
E039.1	6/27/2022	14:42	WT_LAP-22-246491	1000	0.523	23,485	7.45	43	3.24	1.005	26.6	50.5	9,479	0.329	-10452	22.7	115.6	4.80	0.737	-0.076	-0.084	-0.53	32.8	25.5
E039.1	6/27/2022	14:44	WT_LAP-22-246335	900	0.520	23,126	7.39	27	3.18	0.980	26.3	50.2	8,880	0.327	-10703	22.4	114.8	4.78	0.725	-0.154	-0.088	-0.61	32.1	17.6
E039.1	6/27/2022	14:44	WT_LAP-22-246492	800	0.518	22,767	7.32	11	3.11	0.954	26.0	49.9	8,281	0.324	-10954	22.1	113.9	4.77	0.714	-0.232	-0.093	-0.69	31.3	9.7
E039.1	6/27/2022	14:46	WT_LAP-22-246493	800	0.518	22,767	7.32	11	3.11	0.954	26.0	49.9	8,281	0.324	-10954	22.1	113.9	4.77	0.714	-0.232	-0.093	-0.69	31.3	9.7
E039.1	6/27/2022	14:48	WT_LAP-22-246494	700	0.516	22,408	7.25	-5	3.04	0.929	25.8	49.6	7,682	0.322	-11205	21.7	113.0	4.76	0.702	-0.310	-0.098	-0.77	30.6	1.9
E039.1	6/27/2022	14:50	WT_LAP-22-246495	600	0.513	22,049	7.19	-21	2.97	0.903	25.5	49.2	7,083	0.320	-11456	21.4	112.2	4.74	0.691	-0.388	-0.103	-0.85	29.8	-6.0
E039.1	6/27/2022	14:52	WT_LAP-22-246496	500	0.511	21,690	7.12	-37	2.91	0.878	25.3	48.9	6,484	0.318	-11707	21.0	111.3	4.73	0.679	-0.466	-0.107	-0.93	29.1	-13.9
E039.1	6/27/2022	14:54	WT_LAP-22-246497	400	0.508	21,331	7.06	-53	2.84	0.853	25.0	48.6	5,885	0.316	-11958	20.7	110.5	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E039.1	6/27/2022	14:56	WT_LAP-22-246498	400	0.508	21,331	7.06	-53	2.84	0.853	25.0	48.6	5,885	0.316	-11958	20.7	110.5	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E039.1	6/27/2022	14:58	WT_LAP-22-246499	400	0.508	21,331	7.06	-53	2.84	0.853	25.0	48.6	5,885	0.316	-11958	20.7	110.5	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8

Table 4.3-1 (continued)

Gaging Station	Sample Collection Date	Sample Collection Time	Field Sample ID	Measured SSC (mg/L)	Estimated Total Recoverable Metals Concentrations and Unfiltered Isotopic Uranium Activities																				
					Ag (µg/L) 0.499 + 0.0000237[a] * SSC[b]	Al (µg/L) 19,895 + 3.59 * SSC	As (µg/L) 6.79 + 0.000663 * SSC	Ba (µg/L) −117 + 0.16 * SSC	Be (µg/L) 2.57 + 0.000673 * SSC	Cd (µg/L) 0.751 + 0.000254 * SSC	Cr (µg/L) 24 + 0.00255 * SSC	Cu (µg/L) 47.3 + 0.00322 * SSC	Fe (µg/L) 3489 + 5.99 * SSC	Hg (µg/L) 0.307 + 0.0000218 * SSC	Mn (µg/L) −12,962 + 2.51 * SSC	Ni (µg/L) 19.3 + 0.00344 * SSC	Pb (µg/L) 107 + 0.00864 * SSC	Se (µg/L) 4.66 + 0.000136 * SSC	Tl (µg/L) 0.621 + 0.000116 * SSC	U-234 (pCi/L) −0.856 + 0.00078[c] * SSC	U-235/236 (pCi/L) −0.131 + 0.0000474 * SSC	U-238 (pCi/L) −1.33 + 0.000802 * SSC	V (µg/L) 25.4 + 0.00739 * SSC	Zn (µg/L) −53.3 + 0.0788 * SSC
Sediment Background Value (mg/kg)					**1**	**15,400**	**3.98**	**127**	**1.31**	**0.4**	**10.5**	**11.2**	**13,800**	**0.1**	**543**	**9.38**	**19.7**	**0.3**	**0.73**	**2.59**	**0.2**	**2.29**	**19.7**	**60.2**
E039.1	6/27/2022	15:00	WT_LAP-22-246500	300	0.506	20,972	6.99	-69	2.77	0.827	24.8	48.3	5,286	0.314	-12209	20.3	109.6	4.70	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E039.1	6/27/2022	15:02	WT_LAP-22-246501	400	0.508	21,331	7.06	-53	2.84	0.853	25.0	48.6	5,885	0.316	-11958	20.7	110.5	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E039.1	6/27/2022	15:04	WT_LAP-22-246502	400	0.508	21,331	7.06	-53	2.84	0.853	25.0	48.6	5,885	0.316	-11958	20.7	110.5	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E039.1	6/27/2022	15:06	WT_LAP-22-246317	400	0.508	21,331	7.06	-53	2.84	0.853	25.0	48.6	5,885	0.316	-11958	20.7	110.5	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E039.1	6/27/2022	15:06	WT_LAP-22-246503	400	0.508	21,331	7.06	-53	2.84	0.853	25.0	48.6	5,885	0.316	-11958	20.7	110.5	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E039.1	6/27/2022	15:08	WT_LAP-22-246504	300	0.506	20,972	6.99	-69	2.77	0.827	24.8	48.3	5,286	0.314	-12209	20.3	109.6	4.70	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E039.1	6/27/2022	15:28	WT_LAP-22-246505	300	0.506	20,972	6.99	-69	2.77	0.827	24.8	48.3	5,286	0.314	-12209	20.3	109.6	4.70	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E039.1	6/27/2022	15:48	WT_LAP-22-246506	200	0.504	20,613	6.92	-85	2.70	0.802	24.5	47.9	4,687	0.311	-12460	20.0	108.7	4.69	0.644	-0.700	-0.122	-1.17	26.9	-37.5
E039.1	6/27/2022	16:08	WT_LAP-22-246507	200	0.504	20,613	6.92	-85	2.70	0.802	24.5	47.9	4,687	0.311	-12460	20.0	108.7	4.69	0.644	-0.700	-0.122	-1.17	26.9	-37.5
E040	6/27/2022	15:26	WT_LAP-22-246315	15000	0.855	73,745	16.74	2283	12.67	4.561	62.3	95.6	93,339	0.634	24688	70.9	236.6	6.70	2.361	10.844	0.580	10.70	136.3	1128.7
E059.5	6/27/2022	10:24	WT_LAP-22-246513	800	0.518	22,767	7.32	11	3.11	0.954	26.0	49.9	8,281	0.324	-10954	22.1	113.9	4.77	0.714	-0.232	-0.093	-0.69	31.3	9.7
E059.5	6/27/2022	10:26	WT_LAP-22-246514	400	0.508	21,331	7.06	-53	2.84	0.853	25.0	48.6	5,885	0.316	-11958	20.7	110.5	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E059.5	6/27/2022	10:28	WT_LAP-22-246515	400	0.508	21,331	7.06	-53	2.84	0.853	25.0	48.6	5,885	0.316	-11958	20.7	110.5	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E059.5	6/27/2022	10:30	WT_LAP-22-246516	400	0.508	21,331	7.06	-53	2.84	0.853	25.0	48.6	5,885	0.316	-11958	20.7	110.5	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E059.5	6/27/2022	10:32	WT_LAP-22-246517	400	0.508	21,331	7.06	-53	2.84	0.853	25.0	48.6	5,885	0.316	-11958	20.7	110.5	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E059.5	6/27/2022	10:34	WT_LAP-22-246518	300	0.506	20,972	6.99	-69	2.77	0.827	24.8	48.3	5,286	0.314	-12209	20.3	109.6	4.70	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E059.5	6/27/2022	10:36	WT_LAP-22-246519	300	0.506	20,972	6.99	-69	2.77	0.827	24.8	48.3	5,286	0.314	-12209	20.3	109.6	4.70	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E059.5	6/27/2022	10:38	WT_LAP-22-246520	300	0.506	20,972	6.99	-69	2.77	0.827	24.8	48.3	5,286	0.314	-12209	20.3	109.6	4.70	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E059.5	6/27/2022	10:40	WT_LAP-22-246336	500	0.511	21,690	7.12	-37	2.91	0.878	25.3	48.9	6,484	0.318	-11707	21.0	111.3	4.73	0.679	-0.466	-0.107	-0.93	29.1	-13.9
E059.5	6/27/2022	10:40	WT_LAP-22-246521	500	0.511	21,690	7.12	-37	2.91	0.878	25.3	48.9	6,484	0.318	-11707	21.0	111.3	4.73	0.679	-0.466	-0.107	-0.93	29.1	-13.9
E059.5	6/27/2022	10:42	WT_LAP-22-246522	300	0.506	20,972	6.99	-69	2.77	0.827	24.8	48.3	5,286	0.314	-12209	20.3	109.6	4.70	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E059.5	6/27/2022	10:44	WT_LAP-22-246523	300	0.506	20,972	6.99	-69	2.77	0.827	24.8	48.3	5,286	0.314	-12209	20.3	109.6	4.70	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E059.5	6/27/2022	10:46	WT_LAP-22-246524	200	0.504	20,613	6.92	-85	2.70	0.802	24.5	47.9	4,687	0.311	-12460	20.0	108.7	4.69	0.644	-0.700	-0.122	-1.17	26.9	-37.5
E059.5	6/27/2022	10:48	WT_LAP-22-246525	200	0.504	20,613	6.92	-85	2.70	0.802	24.5	47.9	4,687	0.311	-12460	20.0	108.7	4.69	0.644	-0.700	-0.122	-1.17	26.9	-37.5
E059.5	6/27/2022	10:50	WT_LAP-22-246526	300	0.506	20,972	6.99	-69	2.77	0.827	24.8	48.3	5,286	0.314	-12209	20.3	109.6	4.70	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E059.5	6/27/2022	10:52	WT_LAP-22-246527	300	0.506	20,972	6.99	-69	2.77	0.827	24.8	48.3	5,286	0.314	-12209	20.3	109.6	4.70	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E059.5	6/27/2022	10:54	WT_LAP-22-246528	300	0.506	20,972	6.99	-69	2.77	0.827	24.8	48.3	5,286	0.314	-12209	20.3	109.6	4.70	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E059.5	6/27/2022	11:02	WT_LAP-22-246318	400	0.508	21,331	7.06	-53	2.84	0.853	25.0	48.6	5,885	0.316	-11958	20.7	110.5	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E059.5	6/27/2022	11:14	WT_LAP-22-246529	300	0.506	20,972	6.99	-69	2.77	0.827	24.8	48.3	5,286	0.314	-12209	20.3	109.6	4.70	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E059.5	6/27/2022	11:34	WT_LAP-22-246530	300	0.506	20,972	6.99	-69	2.77	0.827	24.8	48.3	5,286	0.314	-12209	20.3	109.6	4.70	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E059.5	6/27/2022	11:54	WT_LAP-22-246531	300	0.506	20,972	6.99	-69	2.77	0.827	24.8	48.3	5,286	0.314	-12209	20.3	109.6	4.70	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E059.5	6/27/2022	12:14	WT_LAP-22-246532	300	0.506	20,972	6.99	-69	2.77	0.827	24.8	48.3	5,286	0.314	-12209	20.3	109.6	4.70	0.656	-0.622	-0.117	-1.09	27.6	-29.7

Table 4.3-1 (continued)

Gaging Station	Sample Collection Date	Sample Collection Time	Field Sample ID	Measured SSC (mg/L)	Estimated Total Recoverable Metals Concentrations and Unfiltered Isotopic Uranium Activities																			
					Ag (µg/L) 0.499 + 0.0000237[a] * SSC[b]	Al (µg/L) 19,895 + 3.59 * SSC	As (µg/L) 6.79 + 0.000663 * SSC	Ba (µg/L) −117 + 0.16 * SSC	Be (µg/L) 2.57 + 0.000673 * SSC	Cd (µg/L) 0.751 + 0.000254 * SSC	Cr (µg/L) 24 + 0.00255 * SSC	Cu (µg/L) 47.3 + 0.00322 * SSC	Fe (µg/L) 3489 + 5.99 * SSC	Hg (µg/L) 0.307 + 0.0000218 * SSC	Mn (µg/L) −12,962 + 2.51 * SSC	Ni (µg/L) 19.3 + 0.00344 * SSC	Pb (µg/L) 107 + 0.00864 * SSC	Se (µg/L) 4.66 + 0.000136 * SSC	Tl (µg/L) 0.621 + 0.000116 * SSC	U-234 (pCi/L) −0.856 + 0.00078[c] * SSC	U-235/236 (pCi/L) −0.131 + 0.0000474 * SSC	U-238 (pCi/L) −1.33 + 0.000802 * SSC	V (µg/L) 25.4 + 0.00739 * SSC	Zn (µg/L) −53.3 + 0.0788 * SSC
				Sediment Background Value (mg/kg)	**1**	**15,400**	**3.98**	**127**	**1.31**	**0.4**	**10.5**	**11.2**	**13,800**	**0.1**	**543**	**9.38**	**19.7**	**0.3**	**0.73**	**2.59**	**0.2**	**2.29**	**19.7**	**60.2**
E059.5	6/27/2022	12:34	WT_LAP-22-246533	300	0.506	20,972	6.99	-69	2.77	0.827	24.8	48.3	5,286	0.314	-12209	20.3	109.6	4.70	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E059.5	6/27/2022	12:54	WT_LAP-22-246534	300	0.506	20,972	6.99	-69	2.77	0.827	24.8	48.3	5,286	0.314	-12209	20.3	109.6	4.70	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E059.5	6/27/2022	13:14	WT_LAP-22-246535	300	0.506	20,972	6.99	-69	2.77	0.827	24.8	48.3	5,286	0.314	-12209	20.3	109.6	4.70	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E059.5	6/27/2022	13:34	WT_LAP-22-246536	300	0.506	20,972	6.99	-69	2.77	0.827	24.8	48.3	5,286	0.314	-12209	20.3	109.6	4.70	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E059.5	7/26/2022	19:09	WT_LAP-22-247060	3100	0.572	31,024	8.85	379	4.66	1.538	31.9	57.3	22,058	0.375	-5181	30.0	133.8	5.08	0.981	1.562	0.016	1.16	48.3	191.0
E059.5	7/26/2022	19:27	WT_LAP-22-247078	2000	0.546	27,075	8.12	203	3.92	1.259	29.1	53.7	15,469	0.351	-7942	26.2	124.3	4.93	0.853	0.704	-0.036	0.27	40.2	104.3
E059.5	7/26/2022	19:29	WT_LAP-22-246749	1900	0.544	26,716	8.05	187	3.85	1.234	28.8	53.4	14,870	0.348	-8193	25.8	123.4	4.92	0.841	0.626	-0.041	0.19	39.4	96.4
E059.5	7/26/2022	19:31	WT_LAP-22-246750	1800	0.542	26,357	7.98	171	3.78	1.208	28.6	53.1	14,271	0.346	-8444	25.5	122.6	4.90	0.830	0.548	-0.046	0.11	38.7	88.5
E038	7/27/2022	15:33	WT_LAP-22-246701	4900	0.615	37,486	10.04	667	5.87	1.996	36.5	63.1	32,840	0.414	-663	36.2	149.3	5.33	1.189	2.966	0.101	2.60	61.6	332.8
E038	7/27/2022	15:35	WT_LAP-22-246702	4500	0.606	36,050	9.77	603	5.60	1.894	35.5	61.8	30,444	0.405	-1667	34.8	145.9	5.27	1.143	2.654	0.082	2.28	58.7	301.3
E038	7/27/2022	15:37	WT_LAP-22-246703	3700	0.587	33,178	9.24	475	5.06	1.691	33.4	59.2	25,652	0.388	-3675	32.0	139.0	5.16	1.050	2.030	0.044	1.64	52.7	238.3
E038	7/27/2022	15:39	WT_LAP-22-246704	3100	0.572	31,024	8.85	379	4.66	1.538	31.9	57.3	22,058	0.375	-5181	30.0	133.8	5.08	0.981	1.562	0.016	1.16	48.3	191.0
E038	7/27/2022	15:41	WT_LAP-22-246705	2800	0.565	29,947	8.65	331	4.45	1.462	31.1	56.3	20,261	0.368	-5934	28.9	131.2	5.04	0.946	1.328	0.002	0.92	46.1	167.3
E038	7/27/2022	15:43	WT_LAP-22-246706	2300	0.554	28,152	8.31	251	4.12	1.335	29.9	54.7	17,266	0.357	-7189	27.2	126.9	4.97	0.888	0.938	-0.022	0.51	42.4	127.9
E038	7/27/2022	15:45	WT_LAP-22-246707	2300	0.554	28,152	8.31	251	4.12	1.335	29.9	54.7	17,266	0.357	-7189	27.2	126.9	4.97	0.888	0.938	-0.022	0.51	42.4	127.9
E038	7/27/2022	15:45	WT_LAP-22-247202	2300	0.554	28,152	8.31	251	4.12	1.335	29.9	54.7	17,266	0.357	-7189	27.2	126.9	4.97	0.888	0.938	-0.022	0.51	42.4	127.9
E038	7/27/2022	15:47	WT_LAP-22-246708	2200	0.551	27,793	8.25	235	4.05	1.310	29.6	54.4	16,667	0.355	-7440	26.9	126.0	4.96	0.876	0.860	-0.027	0.43	41.7	120.1
E038	7/27/2022	15:51	WT_LAP-22-246710	1800	0.542	26,357	7.98	171	3.78	1.208	28.6	53.1	14,271	0.346	-8444	25.5	122.6	4.90	0.830	0.548	-0.046	0.11	38.7	88.5
E038	7/27/2022	15:53	WT_LAP-22-246711	2100	0.549	27,434	8.18	219	3.98	1.284	29.4	54.1	16,068	0.353	-7691	26.5	125.1	4.95	0.865	0.782	-0.031	0.35	40.9	112.2
E038	7/27/2022	15:55	WT_LAP-22-246712	1800	0.542	26,357	7.98	171	3.78	1.208	28.6	53.1	14,271	0.346	-8444	25.5	122.6	4.90	0.830	0.548	-0.046	0.11	38.7	88.5
E038	7/27/2022	15:57	WT_LAP-22-246713	2000	0.546	27,075	8.12	203	3.92	1.259	29.1	53.7	15,469	0.351	-7942	26.2	124.3	4.93	0.853	0.704	-0.036	0.27	40.2	104.3
E038	7/27/2022	15:59	WT_LAP-22-246714	1700	0.539	25,998	7.92	155	3.71	1.183	28.3	52.8	13,672	0.344	-8695	25.1	121.7	4.89	0.818	0.470	-0.050	0.03	38.0	80.7
E038	7/27/2022	16:01	WT_LAP-22-246715	1500	0.535	25,280	7.78	123	3.58	1.132	27.8	52.1	12,474	0.340	-9197	24.5	120.0	4.86	0.795	0.314	-0.060	-0.13	36.5	64.9
E038	7/27/2022	16:03	WT_LAP-22-246716	500	0.511	21,690	7.12	-37	2.91	0.878	25.3	48.9	6,484	0.318	-11707	21.0	111.3	4.73	0.679	-0.466	-0.107	-0.93	29.1	-13.9
E038	7/27/2022	16:03	WT_LAP-22-247184	1600	0.537	25,639	7.85	139	3.65	1.157	28.1	52.5	13,073	0.342	-8946	24.8	120.8	4.88	0.807	0.392	-0.055	-0.05	37.2	72.8
E038	7/27/2022	16:23	WT_LAP-22-246717	1400	0.532	24,921	7.72	107	3.51	1.107	27.6	51.8	11,875	0.338	-9448	24.1	119.1	4.85	0.783	0.236	-0.065	-0.21	35.7	57.0
E038	7/27/2022	16:43	WT_LAP-22-246718	200	0.504	20,613	6.92	-85	2.70	0.802	24.5	47.9	4,687	0.311	-12460	20.0	108.7	4.69	0.644	-0.700	-0.122	-1.17	26.9	-37.5
E038	7/27/2022	17:03	WT_LAP-22-246719	100	0.501	20,254	6.86	-101	2.64	0.776	24.3	47.6	4,088	0.309	-12711	19.6	107.9	4.67	0.633	-0.778	-0.126	-1.25	26.1	-45.4
E038	7/27/2022	17:23	WT_LAP-22-246720	100	0.501	20,254	6.86	-101	2.64	0.776	24.3	47.6	4,088	0.309	-12711	19.6	107.9	4.67	0.633	-0.778	-0.126	-1.25	26.1	-45.4
E038	7/27/2022	17:43	WT_LAP-22-246721	200	0.504	20,613	6.92	-85	2.70	0.802	24.5	47.9	4,687	0.311	-12460	20.0	108.7	4.69	0.644	-0.700	-0.122	-1.17	26.9	-37.5
E038	7/27/2022	18:03	WT_LAP-22-246722	100	0.501	20,254	6.86	-101	2.64	0.776	24.3	47.6	4,088	0.309	-12711	19.6	107.9	4.67	0.633	-0.778	-0.126	-1.25	26.1	-45.4
E039.1	7/27/2022	16:00	WT_LAP-22-246725	2200	0.551	27,793	8.25	235	4.05	1.310	29.6	54.4	16,667	0.355	-7440	26.9	126.0	4.96	0.876	0.860	-0.027	0.43	41.7	120.1
E039.1	7/27/2022	16:02	WT_LAP-22-246726	2100	0.549	27,434	8.18	219	3.98	1.284	29.4	54.1	16,068	0.353	-7691	26.5	125.1	4.95	0.865	0.782	-0.031	0.35	40.9	112.2

Table 4.3-1 (continued)

Gaging Station	Sample Collection Date	Sample Collection Time	Field Sample ID	Measured SSC (mg/L)	Estimated Total Recoverable Metals Concentrations and Unfiltered Isotopic Uranium Activities																			
					Ag (µg/L) 0.499 + 0.0000237[a] * SSC[b]	Al (µg/L) 19,895 + 3.59 * SSC	As (µg/L) 6.79 + 0.000663 * SSC	Ba (µg/L) −117 + 0.16 * SSC	Be (µg/L) 2.57 + 0.000673 * SSC	Cd (µg/L) 0.751 + 0.000254 * SSC	Cr (µg/L) 24 + 0.00255 * SSC	Cu (µg/L) 47.3 + 0.00322 * SSC	Fe (µg/L) 3489 + 5.99 * SSC	Hg (µg/L) 0.307 + 0.0000218 * SSC	Mn (µg/L) −12,962 + 2.51 * SSC	Ni (µg/L) 19.3 + 0.00344 * SSC	Pb (µg/L) 107 + 0.00864 * SSC	Se (µg/L) 4.66 + 0.000136 * SSC	Tl (µg/L) 0.621 + 0.000116 * SSC	U-234 (pCi/L) −0.856 + 0.00078[c] * SSC	U-235/236 (pCi/L) −0.131 + 0.0000474 * SSC	U-238 (pCi/L) −1.33 + 0.000802 * SSC	V (µg/L) 25.4 + 0.00739 * SSC	Zn (µg/L) −53.3 + 0.0788 * SSC
Sediment Background Value (mg/kg)					**1**	**15,400**	**3.98**	**127**	**1.31**	**0.4**	**10.5**	**11.2**	**13,800**	**0.1**	**543**	**9.38**	**19.7**	**0.3**	**0.73**	**2.59**	**0.2**	**2.29**	**19.7**	**60.2**
E039.1	7/27/2022	16:04	WT_LAP-22-246727	4700	0.610	36,768	9.91	635	5.73	1.945	36.0	62.4	31,642	0.409	-1165	35.5	147.6	5.30	1.166	2.810	0.092	2.44	60.1	317.1
E039.1	7/27/2022	16:04	WT_LAP-22-247059	1700	0.539	25,998	7.92	155	3.71	1.183	28.3	52.8	13,672	0.344	-8695	25.1	121.7	4.89	0.818	0.470	-0.050	0.03	38.0	80.7
E039.1	7/27/2022	16:06	WT_LAP-22-246728	1600	0.537	25,639	7.85	139	3.65	1.157	28.1	52.5	13,073	0.342	-8946	24.8	120.8	4.88	0.807	0.392	-0.055	-0.05	37.2	72.8
E039.1	7/27/2022	16:08	WT_LAP-22-246729	1500	0.535	25,280	7.78	123	3.58	1.132	27.8	52.1	12,474	0.340	-9197	24.5	120.0	4.86	0.795	0.314	-0.060	-0.13	36.5	64.9
E039.1	7/27/2022	16:10	WT_LAP-22-246730	1300	0.530	24,562	7.65	91	3.44	1.081	27.3	51.5	11,276	0.335	-9699	23.8	118.2	4.84	0.772	0.158	-0.069	-0.29	35.0	49.1
E039.1	7/27/2022	16:12	WT_LAP-22-246731	1100	0.525	23,844	7.52	59	3.31	1.030	26.8	50.8	10,078	0.331	-10201	23.1	116.5	4.81	0.749	0.002	-0.079	-0.45	33.5	33.4
E039.1	7/27/2022	16:14	WT_LAP-22-246732	1100	0.525	23,844	7.52	59	3.31	1.030	26.8	50.8	10,078	0.331	-10201	23.1	116.5	4.81	0.749	0.002	-0.079	-0.45	33.5	33.4
E039.1	7/27/2022	16:16	WT_LAP-22-246733	900	0.520	23,126	7.39	27	3.18	0.980	26.3	50.2	8,880	0.327	-10703	22.4	114.8	4.78	0.725	-0.154	-0.088	-0.61	32.1	17.6
E039.1	7/27/2022	16:18	WT_LAP-22-246734	800	0.518	22,767	7.32	11	3.11	0.954	26.0	49.9	8,281	0.324	-10954	22.1	113.9	4.77	0.714	-0.232	-0.093	-0.69	31.3	9.74
E039.1	7/27/2022	16:20	WT_LAP-22-246735	800	0.518	22,767	7.32	11	3.11	0.954	26.0	49.9	8,281	0.324	-10954	22.1	113.9	4.77	0.714	-0.232	-0.093	-0.69	31.3	9.74
E039.1	7/27/2022	16:22	WT_LAP-22-246736	700	0.516	22,408	7.25	-5	3.04	0.929	25.8	49.6	7,682	0.322	-11205	21.7	113.0	4.76	0.702	-0.310	-0.098	-0.77	30.6	1.86
E039.1	7/27/2022	16:22	WT_LAP-22-247077	800	0.518	22,767	7.32	11	3.11	0.954	26.0	49.9	8,281	0.324	-10954	22.1	113.9	4.77	0.714	-0.232	-0.093	-0.69	31.3	9.74
E039.1	7/27/2022	16:24	WT_LAP-22-246737	700	0.516	22,408	7.25	-5	3.04	0.929	25.8	49.6	7,682	0.322	-11205	21.7	113.0	4.76	0.702	-0.310	-0.098	-0.77	30.6	1.86
E039.1	7/27/2022	16:26	WT_LAP-22-246738	700	0.516	22,408	7.25	-5	3.04	0.929	25.8	49.6	7,682	0.322	-11205	21.7	113.0	4.76	0.702	-0.310	-0.098	-0.77	30.6	1.86
E039.1	7/27/2022	16:28	WT_LAP-22-246739	600	0.513	22,049	7.19	-21	2.97	0.903	25.5	49.2	7,083	0.320	-11456	21.4	112.2	4.74	0.691	-0.388	-0.103	-0.85	29.8	-6.02
E039.1	7/27/2022	16:30	WT_LAP-22-246740	600	0.513	22,049	7.19	-21	2.97	0.903	25.5	49.2	7,083	0.320	-11456	21.4	112.2	4.74	0.691	-0.388	-0.103	-0.85	29.8	-6.02
E039.1	7/27/2022	16:50	WT_LAP-22-246741	400	0.508	21,331	7.06	-53	2.84	0.853	25.0	48.6	5,885	0.316	-11958	20.7	110.5	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E039.1	7/27/2022	17:10	WT_LAP-22-246742	300	0.506	20,972	6.99	-69	2.77	0.827	24.8	48.3	5,286	0.314	-12209	20.3	109.6	4.70	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E039.1	7/27/2022	17:30	WT_LAP-22-246743	200	0.504	20,613	6.92	-85	2.70	0.802	24.5	47.9	4,687	0.311	-12460	20.0	108.7	4.69	0.644	-0.700	-0.122	-1.17	26.9	-37.5
E039.1	7/27/2022	17:50	WT_LAP-22-246744	200	0.504	20,613	6.92	-85	2.70	0.802	24.5	47.9	4,687	0.311	-12460	20.0	108.7	4.69	0.644	-0.700	-0.122	-1.17	26.9	-37.5
E039.1	7/27/2022	18:30	WT_LAP-22-246745	100	0.501	20,254	6.86	-101	2.64	0.776	24.3	47.6	4,088	0.309	-12711	19.6	107.9	4.67	0.633	-0.778	-0.126	-1.25	26.1	-45.4
E042.1	7/27/2022	17:07	WT_LAP-22-245929	24400	1.077	107,491	22.97	3787	18.99	6.949	86.2	125.9	149,645	0.839	48282	103.2	317.8	7.98	3.45	18.2	1.026	18.24	205.7	1869.4
E042.1	7/27/2022	17:08	WT_LAP-22-245930	25200	1.096	110,363	23.50	3915	19.53	7.152	88.3	128.4	154,437	0.856	50290	106.0	324.7	8.09	3.54	18.8	1.063	18.88	211.6	1932.5
E042.1	7/27/2022	17:10	WT_LAP-22-245931	30900	1.231	130,826	27.28	4827	23.37	8.600	102.8	146.8	188,580	0.981	64597	125.6	374.0	8.86	4.21	23.2	1.334	23.45	253.8	2381.6
E042.1	7/27/2022	17:10	WT_LAP-22-246195	21800	1.016	98,157	21.24	3371	17.24	6.288	79.6	117.5	134,071	0.782	41756	94.3	295.4	7.62	3.15	16.1	0.902	16.15	186.5	1664.5
E042.1	7/27/2022	17:12	WT_LAP-22-245932	24500	1.080	107,850	23.03	3803	19.06	6.974	86.5	126.2	150,244	0.841	48533	103.6	318.7	7.99	3.46	18.3	1.030	18.32	206.5	1877.3
E042.1	7/27/2022	17:16	WT_LAP-22-245933	17800	0.921	83,797	18.59	2731	14.55	5.272	69.4	104.6	110,111	0.695	31716	80.5	260.8	7.08	2.69	13.0	0.713	12.95	156.9	1349.3
E042.1	7/27/2022	17:20	WT_LAP-22-245934	15900	0.876	76,976	17.33	2427	13.27	4.790	64.5	98.5	98,730	0.654	26947	74.0	244.4	6.82	2.47	11.5	0.623	11.42	142.9	1199.6
E042.1	7/27/2022	17:32	WT_LAP-22-246213	10000	0.736	55,795	13.42	1483	9.30	3.291	49.5	79.5	63,389	0.525	12138	53.7	193.4	6.02	1.78	6.94	0.343	6.69	99.3	734.7
E042.1	7/27/2022	17:34	WT_LAP-22-245935	15300	0.862	74,822	16.93	2331	12.87	4.637	63.0	96.6	95,136	0.641	25441	71.9	239.2	6.74	2.40	11.1	0.594	10.94	138.5	1152.3
E042.1	7/27/2022	17:54	WT_LAP-22-245936	6200	0.646	42,153	10.90	875	6.74	2.326	39.8	67.3	40,627	0.442	2600	40.6	160.6	5.50	1.34	3.98	0.163	3.64	71.2	435.3
E042.1	7/27/2022	18:14	WT_LAP-22-245937	3700	0.587	33,178	9.24	475	5.06	1.691	33.4	59.2	25,652	0.388	-3675	32.0	139.0	5.16	1.050	2.030	0.044	1.64	52.7	238.3
E042.1	7/27/2022	18:34	WT_LAP-22-245938	2200	0.551	27,793	8.25	235	4.05	1.310	29.6	54.4	16,667	0.355	-7440	26.9	126.0	4.96	0.876	0.860	-0.027	0.43	41.7	120.1

Table 4.3-1 (continued)

Gaging Station	Sample Collection Date	Sample Collection Time	Field Sample ID	Measured SSC (mg/L)	Estimated Total Recoverable Metals Concentrations and Unfiltered Isotopic Uranium Activities																			
					Ag (µg/L) 0.499 + 0.0000237[a] * SSC[b]	Al (µg/L) 19,895 + 3.59 * SSC	As (µg/L) 6.79 + 0.000663 * SSC	Ba (µg/L) −117 + 0.16 * SSC	Be (µg/L) 2.57 + 0.000673 * SSC	Cd (µg/L) 0.751 + 0.000254 * SSC	Cr (µg/L) 24 + 0.00255 * SSC	Cu (µg/L) 47.3 + 0.00322 * SSC	Fe (µg/L) 3489 + 5.99 * SSC	Hg (µg/L) 0.307 + 0.0000218 * SSC	Mn (µg/L) −12,962 + 2.51 * SSC	Ni (µg/L) 19.3 + 0.00344 * SSC	Pb (µg/L) 107 + 0.00864 * SSC	Se (µg/L) 4.66 + 0.000136 * SSC	Tl (µg/L) 0.621 + 0.000116 * SSC	U-234 (pCi/L) −0.856 + 0.00078[c] * SSC	U-235/236 (pCi/L) −0.131 + 0.0000474 * SSC	U-238 (pCi/L) −1.33 + 0.000802 * SSC	V (µg/L) 25.4 + 0.00739 * SSC	Zn (µg/L) −53.3 + 0.0788 * SSC
Sediment Background Value (mg/kg)					**1**	**15,400**	**3.98**	**127**	**1.31**	**0.4**	**10.5**	**11.2**	**13,800**	**0.1**	**543**	**9.38**	**19.7**	**0.3**	**0.73**	**2.59**	**0.2**	**2.29**	**19.7**	**60.2**
E042.1	7/27/2022	18:54	WT_LAP-22-245939	1600	0.537	25,639	7.85	139	3.65	1.157	28.1	52.5	13,073	0.342	-8946	24.8	120.8	4.88	0.807	0.392	-0.055	-0.05	37.2	72.8
E042.1	7/27/2022	19:34	WT_LAP-22-245940	1200	0.527	24,203	7.59	75	3.38	1.056	27.1	51.2	10,677	0.333	-9950	23.4	117.4	4.82	0.760	0.080	-0.074	-0.37	34.3	41.3
E042.1	7/27/2022	19:54	WT_LAP-22-245941	900	0.520	23,126	7.39	27	3.18	0.980	26.3	50.2	8,880	0.327	-10703	22.4	114.8	4.78	0.725	-0.154	-0.088	-0.61	32.1	17.6
E042.1	7/27/2022	20:14	WT_LAP-22-245942	700	0.516	22,408	7.25	-5	3.04	0.929	25.8	49.6	7,682	0.322	-11205	21.7	113.0	4.76	0.702	-0.310	-0.098	-0.77	30.6	1.9
E050.1	7/27/2022	17:31	WT_LAP-22-245953	7600	0.679	47,179	11.83	1099	7.68	2.681	43.4	71.8	49,013	0.473	6114	45.4	172.7	5.69	1.503	5.07	0.229	4.77	81.6	545.6
E050.1	7/27/2022	17:31	WT_LAP-22-246197	7300	0.672	46,102	11.63	1051	7.48	2.605	42.6	70.8	47,216	0.466	5361	44.4	170.1	5.65	1.468	4.84	0.215	4.52	79.3	521.9
E050.1	7/27/2022	17:33	WT_LAP-22-245954	6200	0.646	42,153	10.90	875	6.74	2.326	39.8	67.3	40,627	0.442	2600	40.6	160.6	5.50	1.340	3.98	0.163	3.64	71.2	435.3
E050.1	7/27/2022	17:35	WT_LAP-22-245955	6200	0.646	42,153	10.90	875	6.74	2.326	39.8	67.3	40,627	0.442	2600	40.6	160.6	5.50	1.340	3.98	0.163	3.64	71.2	435.3
E050.1	7/27/2022	17:37	WT_LAP-22-245956	5300	0.625	38,922	10.30	731	6.14	2.097	37.5	64.4	35,236	0.423	341	37.5	152.8	5.38	1.236	3.28	0.120	2.92	64.6	364.3
E050.1	7/27/2022	17:39	WT_LAP-22-245957	5000	0.618	37,845	10.11	683	5.94	2.021	36.8	63.4	33,439	0.416	-412	36.5	150.2	5.34	1.201	3.04	0.106	2.68	62.4	340.7
E050.1	7/27/2022	17:41	WT_LAP-22-245958	4700	0.610	36,768	9.91	635	5.73	1.945	36.0	62.4	31,642	0.409	-1165	35.5	147.6	5.30	1.166	2.81	0.092	2.44	60.1	317.1
E050.1	7/27/2022	17:43	WT_LAP-22-245959	4400	0.603	35,691	9.71	587	5.53	1.869	35.2	61.5	29,845	0.403	-1918	34.4	145.0	5.26	1.131	2.58	0.078	2.20	57.9	293.4
E050.1	7/27/2022	17:45	WT_LAP-22-245960	4200	0.599	34,973	9.57	555	5.40	1.818	34.7	60.8	28,647	0.399	-2420	33.7	143.3	5.23	1.108	2.42	0.068	2.04	56.4	277.7
E050.1	7/27/2022	17:47	WT_LAP-22-245961	3800	0.589	33,537	9.31	491	5.13	1.716	33.7	59.5	26,251	0.390	-3424	32.4	139.8	5.18	1.062	2.11	0.049	1.72	53.5	246.1
E050.1	7/27/2022	17:53	WT_LAP-22-245962	3300	0.577	31,742	8.98	411	4.79	1.589	32.4	57.9	23,256	0.379	-4679	30.7	135.5	5.11	1.004	1.72	0.025	1.32	49.8	206.7
E050.1	7/27/2022	17:53	WT_LAP-22-246215	3400	0.580	32,101	9.04	427	4.86	1.615	32.7	58.2	23,855	0.381	-4428	31.0	136.4	5.12	1.015	1.80	0.030	1.40	50.5	214.6
E050.1	7/27/2022	17:55	WT_LAP-22-245963	3200	0.575	31,383	8.91	395	4.72	1.564	32.2	57.6	22,657	0.377	-4930	30.3	134.6	5.10	0.992	1.64	0.021	1.24	49.0	198.9
E050.1	7/27/2022	17:57	WT_LAP-22-245964	3000	0.570	30,665	8.78	363	4.59	1.513	31.7	57.0	21,459	0.372	-5432	29.6	132.9	5.07	0.969	1.48	0.011	1.08	47.6	183.1
E050.1	7/27/2022	17:59	WT_LAP-22-245965	3000	0.570	30,665	8.78	363	4.59	1.513	31.7	57.0	21,459	0.372	-5432	29.6	132.9	5.07	0.969	1.48	0.011	1.08	47.6	183.1
E050.1	7/27/2022	18:01	WT_LAP-22-245966	2800	0.565	29,947	8.65	331	4.45	1.462	31.1	56.3	20,261	0.368	-5934	28.9	131.2	5.04	0.946	1.33	0.002	0.92	46.1	167.3
E056	7/27/2022	15:55	WT_LAP-22-246186	3500	0.582	32,460	9.11	443	4.93	1.640	32.9	58.6	24,454	0.383	-4177	31.3	137.2	5.14	1.027	1.87	0.035	1.48	51.3	222.5
E056	7/27/2022	16:11	WT_LAP-22-246204	1300	0.530	24,562	7.65	91	3.44	1.081	27.3	51.5	11,276	0.335	-9699	23.8	118.2	4.84	0.772	0.158	-0.069	-0.29	35.0	49.1
E059.5	7/27/2022	17:19	WT_LAP-22-246751	800	0.518	22,767	7.32	11	3.11	0.954	26.0	49.9	8,281	0.324	-10954	22.1	113.9	4.77	0.714	-0.232	-0.093	-0.69	31.3	9.7
E059.5	7/27/2022	17:21	WT_LAP-22-246752	500	0.511	21,690	7.12	-37	2.91	0.878	25.3	48.9	6,484	0.318	-11707	21.0	111.3	4.73	0.679	-0.466	-0.107	-0.93	29.1	-13.9
E059.5	7/27/2022	17:23	WT_LAP-22-246753	500	0.511	21,690	7.12	-37	2.91	0.878	25.3	48.9	6,484	0.318	-11707	21.0	111.3	4.73	0.679	-0.466	-0.107	-0.93	29.1	-13.9
E059.5	7/27/2022	17:25	WT_LAP-22-246754	500	0.511	21,690	7.12	-37	2.91	0.878	25.3	48.9	6,484	0.318	-11707	21.0	111.3	4.73	0.679	-0.466	-0.107	-0.93	29.1	-13.9
E059.5	7/27/2022	17:27	WT_LAP-22-246755	500	0.511	21,690	7.12	-37	2.91	0.878	25.3	48.9	6,484	0.318	-11707	21.0	111.3	4.73	0.679	-0.466	-0.107	-0.93	29.1	-13.9
E059.5	7/27/2022	17:29	WT_LAP-22-246756	400	0.508	21,331	7.06	-53	2.84	0.853	25.0	48.6	5,885	0.316	-11958	20.7	110.5	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E059.5	7/27/2022	17:31	WT_LAP-22-246757	400	0.508	21,331	7.06	-53	2.84	0.853	25.0	48.6	5,885	0.316	-11958	20.7	110.5	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E059.5	7/27/2022	17:33	WT_LAP-22-246758	400	0.508	21,331	7.06	-53	2.84	0.853	25.0	48.6	5,885	0.316	-11958	20.7	110.5	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E059.5	7/27/2022	17:35	WT_LAP-22-246759	300	0.506	20,972	6.99	-69	2.77	0.827	24.8	48.3	5,286	0.314	-12209	20.3	109.6	4.70	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E059.5	7/27/2022	17:37	WT_LAP-22-246760	300	0.506	20,972	6.99	-69	2.77	0.827	24.8	48.3	5,286	0.314	-12209	20.3	109.6	4.70	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E059.5	7/27/2022	17:39	WT_LAP-22-246761	400	0.508	21,331	7.06	-53	2.84	0.853	25.0	48.6	5,885	0.316	-11958	20.7	110.5	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8

Table 4.3-1 (continued)

Gaging Station	Sample Collection Date	Sample Collection Time	Field Sample ID	Measured SSC (mg/L)	Estimated Total Recoverable Metals Concentrations and Unfiltered Isotopic Uranium Activities																			
					Ag (µg/L) 0.499 + 0.0000237[a] * SSC[b]	Al (µg/L) 19,895 + 3.59 * SSC	As (µg/L) 6.79 + 0.000663 * SSC	Ba (µg/L) −117 + 0.16 * SSC	Be (µg/L) 2.57 + 0.000673 * SSC	Cd (µg/L) 0.751 + 0.000254 * SSC	Cr (µg/L) 24 + 0.00255 * SSC	Cu (µg/L) 47.3 + 0.00322 * SSC	Fe (µg/L) 3489 + 5.99 * SSC	Hg (µg/L) 0.307 + 0.0000218 * SSC	Mn (µg/L) −12,962 + 2.51 * SSC	Ni (µg/L) 19.3 + 0.00344 * SSC	Pb (µg/L) 107 + 0.00864 * SSC	Se (µg/L) 4.66 + 0.000136 * SSC	Tl (µg/L) 0.621 + 0.000116 * SSC	U-234 (pCi/L) −0.856 + 0.00078[c] * SSC	U-235/236 (pCi/L) −0.131 + 0.0000474 * SSC	U-238 (pCi/L) −1.33 + 0.000802 * SSC	V (µg/L) 25.4 + 0.00739 * SSC	Zn (µg/L) −53.3 + 0.0788 * SSC
Sediment Background Value (mg/kg)					1	15,400	3.98	127	1.31	0.4	10.5	11.2	13,800	0.1	543	9.38	19.7	0.3	0.73	2.59	0.2	2.29	19.7	60.2
E059.5	7/27/2022	17:41	WT_LAP-22-246762	300	0.506	20,972	6.99	-69	2.77	0.827	24.8	48.3	5,286	0.314	-12209	20.3	109.6	4.70	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E059.5	7/27/2022	17:43	WT_LAP-22-246763	400	0.508	21,331	7.06	-53	2.84	0.853	25.0	48.6	5,885	0.316	-11958	20.7	110.5	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E059.5	7/27/2022	17:44	WT_LAP-22-247204	700	0.516	22,408	7.25	-5	3.04	0.929	25.8	49.6	7,682	0.322	-11205	21.7	113.0	4.76	0.702	-0.310	-0.098	-0.77	30.6	1.9
E059.5	7/27/2022	17:45	WT_LAP-22-246764	400	0.508	21,331	7.06	-53	2.84	0.853	25.0	48.6	5,885	0.316	-11958	20.7	110.5	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E059.5	7/27/2022	17:47	WT_LAP-22-246765	400	0.508	21,331	7.06	-53	2.84	0.853	25.0	48.6	5,885	0.316	-11958	20.7	110.5	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E059.5	7/27/2022	17:49	WT_LAP-22-246766	400	0.508	21,331	7.06	-53	2.84	0.853	25.0	48.6	5,885	0.316	-11958	20.7	110.5	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E059.5	7/27/2022	18:02	WT_LAP-22-247186	300	0.506	20,972	6.99	-69	2.77	0.827	24.8	48.3	5,286	0.314	-12209	20.3	109.6	4.70	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E059.5	7/27/2022	18:09	WT_LAP-22-246767	400	0.508	21,331	7.06	-53	2.84	0.853	25.0	48.6	5,885	0.316	-11958	20.7	110.5	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E059.5	7/27/2022	18:29	WT_LAP-22-246768	400	0.508	21,331	7.06	-53	2.84	0.853	25.0	48.6	5,885	0.316	-11958	20.7	110.5	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E059.5	7/27/2022	18:49	WT_LAP-22-246769	2400	0.556	28,511	8.38	267	4.19	1.361	30.1	55.0	17,865	0.359	-6938	27.6	127.7	4.99	0.899	1.016	-0.017	0.59	43.1	135.8
E059.5	7/27/2022	19:09	WT_LAP-22-246770	3000	0.570	30,665	8.78	363	4.59	1.513	31.7	57.0	21,459	0.372	-5432	29.6	132.9	5.07	0.969	1.484	0.011	1.08	47.6	183.1
E059.5	7/27/2022	19:29	WT_LAP-22-246771	2200	0.551	27,793	8.25	235	4.05	1.310	29.6	54.4	16,667	0.355	-7440	26.9	126.0	4.96	0.876	0.860	-0.027	0.43	41.7	120.1
E059.5	7/27/2022	19:49	WT_LAP-22-246772	1500	0.535	25,280	7.78	123	3.58	1.132	27.8	52.1	12,474	0.340	-9197	24.5	120.0	4.86	0.795	0.314	-0.060	-0.13	36.5	64.9
E059.5	7/27/2022	20:09	WT_LAP-22-255263	1000	0.523	23,485	7.45	43	3.24	1.005	26.6	50.5	9,479	0.329	-10452	22.7	115.6	4.80	0.737	-0.076	-0.084	-0.53	32.8	25.5
E059.5	7/27/2022	20:29	WT_LAP-22-255264	800	0.518	22,767	7.32	11	3.11	0.954	26.0	49.9	8,281	0.324	-10954	22.1	113.9	4.77	0.714	-0.232	-0.093	-0.69	31.3	9.7
E059.8	7/31/2022	21:44	WT_LAP-22-245905	300	0.506	20,972	6.99	-69	2.77	0.827	24.8	48.3	5,286	0.314	-12209	20.3	109.6	4.70	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E059.8	7/31/2022	21:46	WT_LAP-22-245906	400	0.508	21,331	7.06	-53	2.84	0.853	25.0	48.6	5,885	0.316	-11958	20.7	110.5	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E059.8	7/31/2022	21:48	WT_LAP-22-245907	400	0.508	21,331	7.06	-53	2.84	0.853	25.0	48.6	5,885	0.316	-11958	20.7	110.5	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E059.8	7/31/2022	21:50	WT_LAP-22-245908	400	0.508	21,331	7.06	-53	2.84	0.853	25.0	48.6	5,885	0.316	-11958	20.7	110.5	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E059.8	7/31/2022	21:52	WT_LAP-22-245909	400	0.508	21,331	7.06	-53	2.84	0.853	25.0	48.6	5,885	0.316	-11958	20.7	110.5	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E059.8	7/31/2022	21:54	WT_LAP-22-245910	400	0.508	21,331	7.06	-53	2.84	0.853	25.0	48.6	5,885	0.316	-11958	20.7	110.5	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E059.8	7/31/2022	21:54	WT_LAP-22-246193	300	0.506	20,972	6.99	-69	2.77	0.827	24.8	48.3	5,286	0.314	-12209	20.3	109.6	4.70	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E059.8	7/31/2022	21:56	WT_LAP-22-245911	400	0.508	21,331	7.06	-53	2.84	0.853	25.0	48.6	5,885	0.316	-11958	20.7	110.5	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E059.8	7/31/2022	21:58	WT_LAP-22-245912	500	0.511	21,690	7.12	-37	2.91	0.878	25.3	48.9	6,484	0.318	-11707	21.0	111.3	4.73	0.679	-0.466	-0.107	-0.93	29.1	-13.9
E059.8	7/31/2022	22:00	WT_LAP-22-245913	400	0.508	21,331	7.06	-53	2.84	0.853	25.0	48.6	5,885	0.316	-11958	20.7	110.5	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E059.8	7/31/2022	22:02	WT_LAP-22-245914	400	0.508	21,331	7.06	-53	2.84	0.853	25.0	48.6	5,885	0.316	-11958	20.7	110.5	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E059.8	7/31/2022	22:04	WT_LAP-22-245915	500	0.511	21,690	7.12	-37	2.91	0.878	25.3	48.9	6,484	0.318	-11707	21.0	111.3	4.73	0.679	-0.466	-0.107	-0.93	29.1	-13.9
E059.8	7/31/2022	22:06	WT_LAP-22-245916	500	0.511	21,690	7.12	-37	2.91	0.878	25.3	48.9	6,484	0.318	-11707	21.0	111.3	4.73	0.679	-0.466	-0.107	-0.93	29.1	-13.9
E059.8	7/31/2022	22:08	WT_LAP-22-245917	400	0.508	21,331	7.06	-53	2.84	0.853	25.0	48.6	5,885	0.316	-11958	20.7	110.5	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E059.8	7/31/2022	22:10	WT_LAP-22-245918	500	0.511	21,690	7.12	-37	2.91	0.878	25.3	48.9	6,484	0.318	-11707	21.0	111.3	4.73	0.679	-0.466	-0.107	-0.93	29.1	-13.9
E059.8	7/31/2022	22:12	WT_LAP-22-245919	400	0.508	21,331	7.06	-53	2.84	0.853	25.0	48.6	5,885	0.316	-11958	20.7	110.5	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E059.8	7/31/2022	22:14	WT_LAP-22-245920	400	0.508	21,331	7.06	-53	2.84	0.853	25.0	48.6	5,885	0.316	-11958	20.7	110.5	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E059.8	7/31/2022	22:16	WT_LAP-22-246211	400	0.508	21,331	7.06	-53	2.84	0.853	25.0	48.6	5,885	0.316	-11958	20.7	110.5	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8

Table 4.3-1 (continued)

Gaging Station	Sample Collection Date	Sample Collection Time	Field Sample ID	Measured SSC (mg/L)	Estimated Total Recoverable Metals Concentrations and Unfiltered Isotopic Uranium Activities																			
					Ag (µg/L) 0.499 + 0.0000237[a] * SSC[b]	Al (µg/L) 19,895 + 3.59 * SSC	As (µg/L) 6.79 + 0.000663 * SSC	Ba (µg/L) −117 + 0.16 * SSC	Be (µg/L) 2.57 + 0.000673 * SSC	Cd (µg/L) 0.751 + 0.000254 * SSC	Cr (µg/L) 24 + 0.00255 * SSC	Cu (µg/L) 47.3 + 0.00322 * SSC	Fe (µg/L) 3489 + 5.99 * SSC	Hg (µg/L) 0.307 + 0.0000218 * SSC	Mn (µg/L) −12,962 + 2.51 * SSC	Ni (µg/L) 19.3 + 0.00344 * SSC	Pb (µg/L) 107 + 0.00864 * SSC	Se (µg/L) 4.66 + 0.000136 * SSC	Tl (µg/L) 0.621 + 0.000116 * SSC	U-234 (pCi/L) −0.856 + 0.00078[c] * SSC	U-235/236 (pCi/L) −0.131 + 0.0000474 * SSC	U-238 (pCi/L) −1.33 + 0.000802 * SSC	V (µg/L) 25.4 + 0.00739 * SSC	Zn (µg/L) −53.3 + 0.0788 * SSC
Sediment Background Value (mg/kg)					1	15,400	3.98	127	1.31	0.4	10.5	11.2	13,800	0.1	543	9.38	19.7	0.3	0.73	2.59	0.2	2.29	19.7	60.2
E059.8	7/31/2022	22:34	WT_LAP-22-245921	400	0.508	21,331	7.06	-53	2.84	0.853	25.0	48.6	5,885	0.316	-11958	20.7	110.5	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E059.8	7/31/2022	22:54	WT_LAP-22-245922	400	0.508	21,331	7.06	-53	2.84	0.853	25.0	48.6	5,885	0.316	-11958	20.7	110.5	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E059.8	7/31/2022	23:14	WT_LAP-22-245923	300	0.506	20,972	6.99	-69	2.77	0.827	24.8	48.3	5,286	0.314	-12209	20.3	109.6	4.70	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E059.8	7/31/2022	23:34	WT_LAP-22-245924	300	0.506	20,972	6.99	-69	2.77	0.827	24.8	48.3	5,286	0.314	-12209	20.3	109.6	4.70	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E059.8	7/31/2022	23:54	WT_LAP-22-245925	300	0.506	20,972	6.99	-69	2.77	0.827	24.8	48.3	5,286	0.314	-12209	20.3	109.6	4.70	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E059.8	8/1/2022	0:14	WT_LAP-22-245926	300	0.506	20,972	6.99	-69	2.77	0.827	24.8	48.3	5,286	0.314	-12209	20.3	109.6	4.70	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E059.8	8/1/2022	0:34	WT_LAP-22-245927	300	0.506	20,972	6.99	-69	2.77	0.827	24.8	48.3	5,286	0.314	-12209	20.3	109.6	4.70	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E059.8	8/1/2022	0:54	WT_LAP-22-245928	300	0.506	20,972	6.99	-69	2.77	0.827	24.8	48.3	5,286	0.314	-12209	20.3	109.6	4.70	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E055	8/5/2022	13:10	WT_LAP-22-246342	5400	0.627	39,281	10.37	747	6.20	2.123	37.8	64.7	35,835	0.425	592	37.9	153.7	5.39	1.247	3.36	0.125	3.00	65.3	372.2
E055	8/5/2022	13:30	WT_LAP-22-246324	3000	0.570	30,665	8.78	363	4.59	1.513	31.7	57.0	21,459	0.372	-5432	29.6	132.9	5.07	0.969	1.48	0.011	1.08	47.6	183.1
E059.5	8/11/2022	17:19	WT_LAP-22-247617	2000	0.546	27,075	8.12	203	3.92	1.259	29.1	53.7	15,469	0.351	-7942	26.2	124.3	4.93	0.853	0.704	-0.036	0.27	40.2	104.3
E059.5	8/11/2022	17:21	WT_LAP-22-247618	2000	0.546	27,075	8.12	203	3.92	1.259	29.1	53.7	15,469	0.351	-7942	26.2	124.3	4.93	0.853	0.704	-0.036	0.27	40.2	104.3
E059.5	8/11/2022	17:23	WT_LAP-22-247619	1800	0.542	26,357	7.98	171	3.78	1.208	28.6	53.1	14,271	0.346	-8444	25.5	122.6	4.90	0.830	0.548	-0.046	0.11	38.7	88.5
E059.5	8/11/2022	17:25	WT_LAP-22-247620	1500	0.535	25,280	7.78	123	3.58	1.132	27.8	52.1	12,474	0.340	-9197	24.5	120.0	4.86	0.795	0.314	-0.060	-0.13	36.5	64.9
E059.5	8/11/2022	17:27	WT_LAP-22-247621	1500	0.535	25,280	7.78	123	3.58	1.132	27.8	52.1	12,474	0.340	-9197	24.5	120.0	4.86	0.795	0.314	-0.060	-0.13	36.5	64.9
E059.5	8/11/2022	17:29	WT_LAP-22-247622	1300	0.530	24,562	7.65	91	3.44	1.081	27.3	51.5	11,276	0.335	-9699	23.8	118.2	4.84	0.772	0.158	-0.069	-0.29	35.0	49.1
E059.5	8/11/2022	17:31	WT_LAP-22-247623	1100	0.525	23,844	7.52	59	3.31	1.030	26.8	50.8	10,078	0.331	-10201	23.1	116.5	4.81	0.749	0.002	-0.079	-0.45	33.5	33.4
E059.5	8/11/2022	17:34	WT_LAP-22-247928	1000	0.523	23,485	7.45	43	3.24	1.005	26.6	50.5	9,479	0.329	-10452	22.7	115.6	4.80	0.737	-0.076	-0.084	-0.53	32.8	25.5
E059.5	8/11/2022	17:56	WT_LAP-22-247946	600	0.513	22,049	7.19	-21	2.97	0.903	25.5	49.2	7,083	0.320	-11456	21.4	112.2	4.74	0.691	-0.388	-0.103	-0.85	29.8	-6.02
E039.1	8/23/2022	14:54	WT_LAP-22-247357	800	0.518	22,767	7.32	11	3.11	0.954	26.0	49.9	8,281	0.324	-10954	22.1	113.9	4.77	0.714	-0.232	-0.093	-0.69	31.3	9.74
E039.1	8/23/2022	14:56	WT_LAP-22-247358	700	0.516	22,408	7.25	-5	3.04	0.929	25.8	49.6	7,682	0.322	-11205	21.7	113.0	4.76	0.702	-0.310	-0.098	-0.77	30.6	1.86
E039.1	8/23/2022	14:58	WT_LAP-22-247359	700	0.516	22,408	7.25	-5	3.04	0.929	25.8	49.6	7,682	0.322	-11205	21.7	113.0	4.76	0.702	-0.310	-0.098	-0.77	30.6	1.86
E039.1	8/23/2022	14:59	WT_LAP-22-247203	600	0.513	22,049	7.19	-21	2.97	0.903	25.5	49.2	7,083	0.320	-11456	21.4	112.2	4.74	0.691	-0.388	-0.103	-0.85	29.8	-6.02
E039.1	8/23/2022	15:00	WT_LAP-22-247360	600	0.513	22,049	7.19	-21	2.97	0.903	25.5	49.2	7,083	0.320	-11456	21.4	112.2	4.74	0.691	-0.388	-0.103	-0.85	29.8	-6.02
E039.1	8/23/2022	15:02	WT_LAP-22-247361	500	0.511	21,690	7.12	-37	2.91	0.878	25.3	48.9	6,484	0.318	-11707	21.0	111.3	4.73	0.679	-0.466	-0.107	-0.93	29.1	-13.9
E039.1	8/23/2022	15:04	WT_LAP-22-247362	500	0.511	21,690	7.12	-37	2.91	0.878	25.3	48.9	6,484	0.318	-11707	21.0	111.3	4.73	0.679	-0.466	-0.107	-0.93	29.1	-13.9
E039.1	8/23/2022	15:06	WT_LAP-22-247363	400	0.508	21,331	7.06	-53	2.84	0.853	25.0	48.6	5,885	0.316	-11958	20.7	110.5	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E039.1	8/23/2022	15:08	WT_LAP-22-247364	400	0.508	21,331	7.06	-53	2.84	0.853	25.0	48.6	5,885	0.316	-11958	20.7	110.5	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E039.1	8/23/2022	15:10	WT_LAP-22-247365	400	0.508	21,331	7.06	-53	2.84	0.853	25.0	48.6	5,885	0.316	-11958	20.7	110.5	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E039.1	8/23/2022	15:12	WT_LAP-22-247366	400	0.508	21,331	7.06	-53	2.84	0.853	25.0	48.6	5,885	0.316	-11958	20.7	110.5	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E039.1	8/23/2022	15:14	WT_LAP-22-247367	300	0.506	20,972	6.99	-69	2.77	0.827	24.8	48.3	5,286	0.314	-12209	20.3	109.6	4.70	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E039.1	8/23/2022	15:16	WT_LAP-22-247368	300	0.506	20,972	6.99	-69	2.77	0.827	24.8	48.3	5,286	0.314	-12209	20.3	109.6	4.70	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E039.1	8/23/2022	15:18	WT_LAP-22-247369	300	0.506	20,972	6.99	-69	2.77	0.827	24.8	48.3	5,286	0.314	-12209	20.3	109.6	4.70	0.656	-0.622	-0.117	-1.09	27.6	-29.7

Table 4.3-1 (continued)

Gaging Station	Sample Collection Date	Sample Collection Time	Field Sample ID	Measured SSC (mg/L)	Estimated Total Recoverable Metals Concentrations and Unfiltered Isotopic Uranium Activities																			
					Ag (µg/L) 0.499 + 0.0000237[a] * SSC[b]	Al (µg/L) 19,895 + 3.59 * SSC	As (µg/L) 6.79 + 0.000663 * SSC	Ba (µg/L) −117 + 0.16 * SSC	Be (µg/L) 2.57 + 0.000673 * SSC	Cd (µg/L) 0.751 + 0.000254 * SSC	Cr (µg/L) 24 + 0.00255 * SSC	Cu (µg/L) 47.3 + 0.00322 * SSC	Fe (µg/L) 3489 + 5.99 * SSC	Hg (µg/L) 0.307 + 0.0000218 * SSC	Mn (µg/L) −12,962 + 2.51 * SSC	Ni (µg/L) 19.3 + 0.00344 * SSC	Pb (µg/L) 107 + 0.00864 * SSC	Se (µg/L) 4.66 + 0.000136 * SSC	Tl (µg/L) 0.621 + 0.000116 * SSC	U-234 (pCi/L) −0.856 + 0.00078[c] * SSC	U-235/236 (pCi/L) −0.131 + 0.0000474 * SSC	U-238 (pCi/L) −1.33 + 0.000802 * SSC	V (µg/L) 25.4 + 0.00739 * SSC	Zn (µg/L) −53.3 + 0.0788 * SSC
Sediment Background Value (mg/kg)					**1**	**15,400**	**3.98**	**127**	**1.31**	**0.4**	**10.5**	**11.2**	**13,800**	**0.1**	**543**	**9.38**	**19.7**	**0.3**	**0.73**	**2.59**	**0.2**	**2.29**	**19.7**	**60.2**
E039.1	8/23/2022	15:20	WT_LAP-22-247370	300	0.506	20,972	6.99	-69	2.77	0.827	24.8	48.3	5,286	0.314	-12209	20.3	109.6	4.70	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E039.1	8/23/2022	15:21	WT_LAP-22-247185	200	0.504	20,613	6.92	-85	2.70	0.802	24.5	47.9	4,687	0.311	-12460	20.0	108.7	4.69	0.644	-0.700	-0.122	-1.17	26.9	-37.5
E039.1	8/23/2022	15:22	WT_LAP-22-247371	300	0.506	20,972	6.99	-69	2.77	0.827	24.8	48.3	5,286	0.314	-12209	20.3	109.6	4.70	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E039.1	8/23/2022	15:24	WT_LAP-22-247372	300	0.506	20,972	6.99	-69	2.77	0.827	24.8	48.3	5,286	0.314	-12209	20.3	109.6	4.70	0.656	-0.622	-0.117	-1.09	27.6	-29.7
E039.1	8/23/2022	15:44	WT_LAP-22-247373	100	0.501	20,254	6.86	-101	2.64	0.776	24.3	47.6	4,088	0.309	-12711	19.6	107.9	4.67	0.633	-0.778	-0.126	-1.25	26.1	-45.4
E039.1	8/23/2022	16:04	WT_LAP-22-247374	100	0.501	20,254	6.86	-101	2.64	0.776	24.3	47.6	4,088	0.309	-12711	19.6	107.9	4.67	0.633	-0.778	-0.126	-1.25	26.1	-45.4
E050.1	8/23/2022	18:30	WT_LAP-22-246821	800	0.518	22,767	7.32	11	3.11	0.954	26.0	49.9	8,281	0.324	-10954	22.1	113.9	4.77	0.714	-0.232	-0.093	-0.69	31.3	9.74
E050.1	8/23/2022	18:33	WT_LAP-22-246822	800	0.518	22,767	7.32	11	3.11	0.954	26.0	49.9	8,281	0.324	-10954	22.1	113.9	4.77	0.714	-0.232	-0.093	-0.69	31.3	9.74
E050.1	8/23/2022	18:34	WT_LAP-22-247065	700	0.516	22,408	7.25	-5	3.04	0.929	25.8	49.6	7,682	0.322	-11205	21.7	113.0	4.76	0.702	-0.310	-0.098	-0.77	30.6	1.86
E050.1	8/23/2022	18:36	WT_LAP-22-246823	700	0.516	22,408	7.25	-5	3.04	0.929	25.8	49.6	7,682	0.322	-11205	21.7	113.0	4.76	0.702	-0.310	-0.098	-0.77	30.6	1.86
E050.1	8/23/2022	18:40	WT_LAP-22-246824	800	0.518	22,767	7.32	11	3.11	0.954	26.0	49.9	8,281	0.324	-10954	22.1	113.9	4.77	0.714	-0.232	-0.093	-0.69	31.3	9.74
E050.1	8/23/2022	18:44	WT_LAP-22-246825	800	0.518	22,767	7.32	11	3.11	0.954	26.0	49.9	8,281	0.324	-10954	22.1	113.9	4.77	0.714	-0.232	-0.093	-0.69	31.3	9.74
E050.1	8/23/2022	18:48	WT_LAP-22-246826	800	0.518	22,767	7.32	11	3.11	0.954	26.0	49.9	8,281	0.324	-10954	22.1	113.9	4.77	0.714	-0.232	-0.093	-0.69	31.3	9.74
E050.1	8/23/2022	18:52	WT_LAP-22-246827	700	0.516	22,408	7.25	-5	3.04	0.929	25.8	49.6	7,682	0.322	-11205	21.7	113.0	4.76	0.702	-0.310	-0.098	-0.77	30.6	1.86
E050.1	8/23/2022	18:56	WT_LAP-22-246828	700	0.516	22,408	7.25	-5	3.04	0.929	25.8	49.6	7,682	0.322	-11205	21.7	113.0	4.76	0.702	-0.310	-0.098	-0.77	30.6	1.86
E050.1	8/23/2022	18:58	WT_LAP-22-246829	700	0.516	22,408	7.25	-5	3.04	0.929	25.8	49.6	7,682	0.322	-11205	21.7	113.0	4.76	0.702	-0.310	-0.098	-0.77	30.6	1.86
E050.1	8/23/2022	19:00	WT_LAP-22-246830	600	0.513	22,049	7.19	-21	2.97	0.903	25.5	49.2	7,083	0.320	-11456	21.4	112.2	4.74	0.691	-0.388	-0.103	-0.85	29.8	-6.02
E050.1	8/23/2022	19:20	WT_LAP-22-246831	600	0.513	22,049	7.19	-21	2.97	0.903	25.5	49.2	7,083	0.320	-11456	21.4	112.2	4.74	0.691	-0.388	-0.103	-0.85	29.8	-6.02
E050.1	8/23/2022	19:40	WT_LAP-22-246832	500	0.511	21,690	7.12	-37	2.91	0.878	25.3	48.9	6,484	0.318	-11707	21.0	111.3	4.73	0.679	-0.466	-0.107	-0.93	29.1	-13.9
E050.1	8/23/2022	20:00	WT_LAP-22-246833	400	0.508	21,331	7.06	-53	2.84	0.853	25.0	48.6	5,885	0.316	-11958	20.7	110.5	4.71	0.667	-0.544	-0.112	-1.01	28.4	-21.8
E050.1	8/23/2022	20:20	WT_LAP-22-246834	300	0.506	20,972	6.99	-69	2.77	0.827	24.8	48.3	5,286	0.314	-12209	20.3	109.6	4.70	0.656	-0.622	-0.117	-1.09	27.6	-29.7

Note: Cells are shaded gray when SSC-estimated metals and isotopic uranium concentrations (µg/L or pCi/L) exceed background concentrations expected in sediment.

[a] Unit of inorganic slope is µg/L/mg/L.

[b] Unit of SSC measurement is mg/L.

[c] Unit of radioisotope slope is pCi/L/mg/L.

Table 6.1-1
Significant Geomorphic Changes and Associated Peak Discharges

Date	Gaging Station	Peak Discharge (ft^3/s)	Noted Erosion in Geomorphic Changes Section of the Corresponding Year's Annual Report
8/5/2010	E039.1	275	The DP Canyon GCS was not damaged during storms in 2010.
8/5/2010	E056	243	Three Pueblo Canyon cross-vane structures were extensively damaged.
8/16/2010	E039.1	306	The DP Canyon GCS was not damaged during storms in 2010.
8/16/2010	E056	256	Three Pueblo Canyon cross-vane structures were extensively damaged.
8/16/2010	E059	243	Three Pueblo Canyon cross-vane structures were extensively damaged.
8/19/2011	E039.1	267	No noted major erosion/stream-altering events
8/19/2011	E040	153	No noted major erosion/stream-altering events
8/19/2011	E038	181	No noted major erosion/stream-altering events
8/21/2011	E039.1	281	No noted major erosion/stream-altering events
8/21/2011	E038	229	No noted major erosion/stream-altering events
8/21/2011	E040	208	No noted major erosion/stream-altering events
8/22/2011	E042.1	171	No noted major erosion/stream-altering events
7/11/2012	E042.1	290	Net sediment deposition for 2012 in the DP Canyon GCS area is greater than that recorded in 2011; this sediment deposition includes both channel aggradation and overbank deposition.
7/11/2012	E050.1	117	Net sediment deposition for 2012 in the DP Canyon GCS area is greater than that recorded in 2011; this sediment deposition includes both channel aggradation and overbank deposition.
8/3/2012	E042.1	211	Net sediment deposition for 2012 in the DP Canyon GCS area is greater than that recorded in 2011; this sediment deposition includes both channel aggradation and overbank deposition.
8/3/2012	E050.1	168	Net sediment deposition for 2012 in the DP Canyon GCS area is greater than that recorded in 2011; this sediment deposition includes both channel aggradation and overbank deposition.
8/3/2012	E026	130	Net sediment deposition for 2012 in the DP Canyon GCS area is greater than that recorded in 2011; this sediment deposition includes both channel aggradation and overbank deposition.
7/12/2013	E038	330	The engineered structures in Los Alamos and DP Canyons appear to have enhanced sediment deposition in these areas.
7/12/2013	E039.1	330	The engineered structures in Los Alamos and DP Canyons appear to have enhanced sediment deposition in these areas.
7/12/2013	E040	260	The engineered structures in Los Alamos and DP Canyons appear to have enhanced sediment deposition in these areas.

Table 6.1-1 (continued)

Date	Station	Peak Discharge (ft³/s)	Noted Erosion in Geomorphic Changes Section of the Corresponding Year's Annual Report
9/12/2013	E026	400	Although the September 2013 flood event resulted in significant erosion in most surveyed areas in Pueblo Canyon, the magnitude of the erosion was likely reduced by the sediment mitigation structures and willow plantings.
9/12/2013	E056	260	Although the September 2013 flood event resulted in significant erosion in most surveyed areas in Pueblo Canyon, the magnitude of the erosion was likely reduced by the sediment mitigation structures and willow plantings.
7/15/2014	E038	270	The net deposition observed in Los Alamos and DP Canyons was likely enhanced by the sediment mitigation structures.
7/31/2014	E039.1	250	The net deposition observed in Los Alamos and DP Canyons was likely enhanced by the sediment mitigation structures.
7/31/2014	E040	240	The net deposition observed in Los Alamos and DP Canyons was likely enhanced by the sediment mitigation structures.
7/15/2014	E040	270	The net deposition observed in Los Alamos and DP Canyons was likely enhanced by the sediment mitigation structures.
7/31/2014	E042.1	210	The net deposition observed in Los Alamos and DP Canyons was likely enhanced by the sediment mitigation structures.
7/31/2014	E050.1	201	The net deposition observed in Los Alamos and DP Canyons was likely enhanced by the sediment mitigation structures.
7/31/2015	E040	240	Minor erosion noted
7/31/2015	E039.1	220	Minor erosion noted
7/8/2017	E038	205	The LA/P watershed underwent minor geomorphologic changes during the 2017 monsoon season.
7/8/2017	E039.1	150	The LA/P watershed underwent minor geomorphologic changes during the 2017 monsoon season.
7/8/2017	E040	101	The LA/P watershed underwent minor geomorphologic changes during the 2017 monsoon season.
7/27/2022	E038	325	The LA/P watershed underwent minor geomorphologic changes during the 2022 monsoon season.
7/27/2022	E039.1	304	The LA/P watershed underwent minor geomorphologic changes during the 2022 monsoon season.
7/27/2022	E040	162	The LA/P watershed underwent minor geomorphologic changes during the 2022 monsoon season.

Note: There were no large storm events in 2016 or 2018–2021.

Table 6.3-1
2023 Los Alamos/Pueblo Stormwater Sampling Locations and Trip Level Information

Gaging Station	EIM[a] Location ID	Sampler Trip Mechanism	Trip Discharge June 1, 2023 (ft^3/s)	Trip Discharge After One Sample is Collected (ft^3/s)
CO101038[b]	CO101038	Liquid-level actuator	n/a[c]	n/a
CO111041[b]	CO111041	Liquid-level actuator	n/a	n/a
E026	Los Alamos below Ice Rink	Gaging station discharge	2	5
E030	Los Alamos above DP Canyon	Gaging station discharge	25	50
E038	DP above TA-21	Gaging station discharge	50	100
E039.1	DP below grade ctrl structure	Gaging station discharge	25	50
E040	DP above Los Alamos Canyon	Gaging station discharge	25	50
E042.1	Los Alamos above low-head weir	Gaging station discharge	25	50
E050.1	Los Alamos below low-head weir	Liquid-level actuator	n/a	n/a
E055	Pueblo above Acid	Gaging station discharge	25	50
E055.5	South Fork of Acid Canyon	Gaging station discharge	25	50
E056	Acid above Pueblo	Gaging station discharge	25	50
E059.5	E059.5 Pueblo below LAC WWTF	Gaging station discharge	2 above base flow	5 above base flow
E059.8	E059.8 Pueblo Below Wetlands	Gaging station discharge	2	5
E060.1	Pueblo below GCS	Liquid-level actuator	n/a	n/a

[a] EIM = Environmental Information Management System.

[b] LA-2 ponds or upper LA detention basins.

[c] n/a = Not applicable.

Table 6.3-2
Sampling Sequence for Collection of Stormwater Samples at the Detention Basins and Vegetative Buffer below the SWMU 01-001(f) Drainage

Sample Bottle (1 L)	CO101038, CO111041	
	Start Time (min) 12-Bottle ISCO	Analytical Suite
1	Trigger	SSC particle size
2	Trigger + 2	PCBs (UF[a]) Part 1[b]
3	Trigger + 4	DOC[c] (F[d]), alkalinity + pH (UF)
4	Trigger + 6	PCBs (UF) Part 2
5	Trigger + 8	TAL metals[e] + boron + uranium + hardness (F/UF), total recoverable aluminum (F10μ[f])
6	Trigger +10	Gross alpha (UF)
7	Trigger +12	SSC
8	Trigger +14	Extra bottle
9	Trigger +16	Extra bottle
10	Trigger +18	Extra bottle
11	Trigger +20	Extra bottle
12	Trigger +22	Extra bottle

[a] UF = Unfiltered.

[b] Bottles 2 and 4 are to be sent to the lab together for one PCB analysis.

[c] DOC = Dissolved organic carbon.

[d] F = Filtered through a 0.45-μm membrane.

[e] TAL metals are Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Hg, K, Mg, Mn, Na, Ni, Pb, Sb, Se, Tl, V, and Zn; hardness is calculated from Ca and Mg, components of the TAL list.

[f] F10μ = Filtered through a 10-μm membrane.

Table 6.3-3
Sampling Sequence for Collection of Stormwater Samples at E026, E030, E055, E055.5, and E056

Sample Bottle (1 L)	Start Time (min) 12-Bottle ISCO	E026 and E030 Analytical Suites	Sample Bottle	Start Time (min) 12-Bottle ISCO	E055, E055.5, and E056 Analytical Suites
1	Max+10	SSC particle size	1	Max+10	SSC; particle size
2	Max+12	PCBs (UF[a]) Part 1[b]	2	Max+12	PCBs (UF) Part 1
3	Max+14	DOC[c] (F[d]), alkalinity + pH (UF)	3	Max+14	DOC (F), alkalinity + pH (UF)
4	Max+16	PCBs (UF) Part 2	4	Max+16	PCBs (UF) Part 2
5	Max+18	TAL metals[e] + boron + uranium + hardness (F/UF), total recoverable aluminum (F10µ[f])	5	Max+18	TAL metals + boron + uranium + hardness (F/UF), total recoverable aluminum (F10µ)
6	Max+20	Dioxins and furans (UF) Part 1	6	Max+20	Americium-241 (UF), isotopic plutonium (UF)
7	Max+22	Dioxins and furans (UF) Part 2	7	Max+22	Gamma spectroscopy (UF), gross alpha (UF) Part 1
8	Max+24	Strontium-90 (UF)	8	Max+24	Gamma spectroscopy (UF), gross alpha (UF) Part 2
9	Max+26	Gamma spectroscopy[g] (UF), gross alpha (UF),	9	Max+26	SSC
10	Max+28	Isotopic plutonium (UF)	10	Max+28	Extra bottle
11	Max+30	SSC	11	Max+30	Extra bottle
12	Max+32	Extra bottle	12	Max+32	Extra bottle

[a] UF = Unfiltered.

[b] Bottles 2 and 4 are to be sent to the lab together for one PCB analysis.

[c] DOC = Dissolved organic carbon.

[d] F = Filtered through a 0.45-µm membrane.

[e] TAL metals are: Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Hg, K, Mg, Mn, Na, Ni, Pb, Sb, Se, Tl, V, and Zn; hardness is calculated from Ca and Mg, components of the TAL list.

[f] F10µ = Filtered through a 10-µm membrane.

[g] Gamma spectroscopy = Ac-228, Be-7, Bi-212, Bi-214, Cs-134, Cs-137, Co-60, gross gamma, I-131, Pb-212, Pb-214, K-40, Pa-234, Na-22, Tl-208, and Th-234.

Table 6.3-4
Sampling Sequence for Collection of Stormwater Samples at E038, E039.1, and E040

Sample Bottle (1 L)	Start Time (min) 12-Bottle ISCO	E038, E039.1, and E040	E038 and E039.1	
		Analytical Suites	Start Time (min) 24-Bottle ISCO	Analytical Suites 24-Bottle ISCO 1-L Poly Wedge
1	Max+10	SSC particle size	Trigger	SSC
2	Max+12	PCBs (UF[a]) Part 1[b]	Trigger+2	SSC
3	Max+14	DOC[c] (F[d]), alkalinity + pH (UF)	Trigger+4	SSC
4	Max+16	PCBs (UF) Part 2	Trigger+6	SSC
5	Max+18	TAL metals[e] + boron + uranium + hardness (F/UF), total recoverable aluminum (F10µ[f])	Trigger+8	SSC
6	Max+20	Strontium-90 (UF)	Trigger+10	SSC
7	Max+22	Gamma spectroscopy[g] (UF), gross alpha (UF) Part 1	Trigger+12	SSC
8	Max+24	Gamma spectroscopy[g] (UF), gross alpha (UF) Part 2	Trigger+14	SSC
9	Max+26	Isotopic plutonium (UF)	Trigger+16	SSC
10	Max+28	SSC	Trigger+18	SSC
11	Max+30	Extra bottle	Trigger+20	SSC
12	Max+32	Extra bottle	Trigger+22	SSC
13	n/a[h]	n/a	Trigger+24	SSC
14	n/a	n/a	Trigger+26	SSC
15	n/a	n/a	Trigger+28	SSC
16	n/a	n/a	Trigger+30	SSC
17	n/a	n/a	Trigger+50	SSC
18	n/a	n/a	Trigger+70	SSC
19	n/a	n/a	Trigger+90	SSC
20	n/a	n/a	Trigger+110	SSC
21	n/a	n/a	Trigger+130	SSC
22	n/a	n/a	Trigger+150	SSC
23	n/a	n/a	Trigger+170	SSC
24	n/a	n/a	Trigger+190	SSC

[a] UF = Unfiltered.

[b] Bottles 2 and 4 are to be sent to the lab together for one PCB analysis.

[c] DOC = Dissolved organic carbon.

[d] F = Filtered through a 0.45-µm membrane.

[e] TAL metals are: Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Hg, K, Mg, Mn, Na, Ni, Pb, Sb, Se, Tl, V, and Zn; hardness is calculated from Ca and Mg, components of the TAL list.

[f] F10µ = Filtered through a 10-µm membrane.

[g] Gamma spectroscopy = Ac-228, Be-7, Bi-212, Bi-214, Cs-134, Cs-137, Co-60, gross gamma, I-131, Pb-212, Pb-214, K-40, Pa-234, Na-22, Tl-208, and Th-234.

[h] n/a = Not applicable.

Table 6.3-5
Sampling Sequence for Collection of Stormwater Samples at E042.1

Sample Bottle (1 L)	Start Time (min) 12-Bottle ISCO	Analytical Suites 12-Bottle ISCO	Start Time (min) 24-Bottle ISCO	Analytical Suites 24-Bottle ISCO 1-L Poly Wedge
1	Max+10	SSC particle size	Trigger	SSC
2	Max+12	PCBs (UF[a]) Part 1[b]	Trigger+2	SSC
3	Max+14	DOC[c] (F[d]), alkalinity + pH (UF)	Trigger+4	SSC
4	Max+16	PCBs (UF) Part 2	Trigger+6	SSC
5	Max+18	TAL metals[e] + boron + uranium + hardness (F/UF), total recoverable aluminum (F10µ[f])	Trigger+8	SSC
6	Max+20	Dioxins and furans (UF) Part 1	Trigger+10	SSC
7	Max+22	Dioxins and furans (UF) Part 2	Trigger+12	SSC
8	Max+24	Strontium 90 (UF)	Trigger+14	SSC
9	Max+26	Gamma spectroscopy[g] (UF), gross alpha (UF) Part 1	Trigger+16	SSC
10	Max+28	Gamma spectroscopy[g] (UF), gross alpha (UF) Part 2	Trigger+18	SSC
11	Max+60	Americium-241 (UF), isotopic plutonium (UF)	Trigger+20	SSC
12	Max+62	SCC	Trigger+22	SSC
13	n/a[h]	n/a	Trigger+24	SSC
14	n/a	n/a	Trigger+26	SSC
15	n/a	n/a	Trigger+28	SSC
16	n/a	n/a	Trigger+30	SSC
17	n/a	n/a	Trigger+50	SSC
18	n/a	n/a	Trigger+70	SSC
19	n/a	n/a	Trigger+90	SSC
20	n/a	n/a	Trigger+110	SSC
21	n/a	n/a	Trigger+130	SSC
22	n/a	n/a	Trigger+150	SSC
23	n/a	n/a	Trigger+170	SSC
24	n/a	n/a	Trigger+190	SSC

[a] UF = Unfiltered.

[b] Bottles 2 and 4 are to be sent to the lab together for one PCB analysis.

[c] DOC = Dissolved organic carbon.

[d] F = Filtered through a 0.45-µm membrane.

[e] TAL metals are: Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Hg, K, Mg, Mn, Na, Ni, Pb, Sb, Se, Tl, V, and Zn; hardness is calculated from Ca and Mg, components of the TAL list.

[f] F10µ = Filtered through a 10-µm membrane.

[g] Gamma spectroscopy = Ac-228, Be-7, Bi-212, Bi-214, Cs-134, Cs-137, Co-60, gross gamma, I-131, Pb-212, Pb-214, K-40, Pa-234, Na-22, Tl-208, and Th-234.

[h] n/a = Not applicable.

Table 6.3-6
Sampling Sequence for Collection of Stormwater Samples at E059.5 and E059.8

Sample Bottle (1 L)	Start Time (min) 12-Bottle ISCO	Analytical Suites 12-Bottle ISCO	Start Time (min) 24-Bottle ISCO	Analytical Suites 24-Bottle ISCO 1-L Poly Wedge
1	Max+10	SSC particle size	Trigger	SSC
2	Max+12	PCBs (UF[a]) Part 1[b]	Trigger+2	SSC
3	Max+14	DOC[c] (F[d]), alkalinity + pH (UF)	Trigger+4	SSC
4	Max+16	PCBs (UF) Part 2	Trigger+6	SSC
5	Max+18	TAL metals[e] + boron + uranium + hardness (F/UF), total recoverable aluminum (F10μ[f])	Trigger+8	SSC
6	Max+20	Strontium-90 (UF)	Trigger+10	SSC
7	Max+22	Americium-241 (UF), isotopic plutonium (UF)	Trigger+12	SSC
8	Max+24	Gamma spectroscopy[g] (UF), gross alpha (UF) Part 1	Trigger+14	SSC
9	Max+26	Gamma spectroscopy[g] (UF), gross alpha (UF) Part 2	Trigger+16	SSC
10	Max+28	SSC	Trigger+18	SSC
11	Max+60	Extra bottle	Trigger+20	SSC
12	Max+62	Extra bottle	Trigger+22	SSC
13	n/a[h]	n/a	Trigger+24	SSC
14	n/a	n/a	Trigger+26	SSC
15	n/a	n/a	Trigger+28	SSC
16	n/a	n/a	Trigger+30	SSC
17	n/a	n/a	Trigger+50	SSC
18	n/a	n/a	Trigger+70	SSC
19	n/a	n/a	Trigger+90	SSC
20	n/a	n/a	Trigger+110	SSC
21	n/a	n/a	Trigger+130	SSC
22	n/a	n/a	Trigger+150	SSC
23	n/a	n/a	Trigger+170	SSC
24	n/a	n/a	Trigger+190	SSC

[a] UF = Unfiltered.

[b] Bottles 2 and 4 are to be sent to the lab together for one PCB analysis.

[c] DOC = Dissolved organic carbon.

[d] F = Filtered through a 0.45-μm membrane.

[e] TAL metals are: Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Hg, K, Mg, Mn, Na, Ni, Pb, Sb, Se, Tl, V, and Zn; hardness is calculated from Ca and Mg, components of the TAL list.

[f] F10μ = Filtered through a 10-μm membrane.

[g] Gamma spectroscopy = Ac-228, Be-7, Bi-212, Bi-214, Cs-134, Cs-137, Co-60, gross gamma, I-131, Pb-212, Pb-214, K-40, Pa-234, Na-22, Tl-208, and Th-234.

[h] n/a = Not applicable.

Table 6.3-7
Sampling Sequence for Collection of Stormwater Samples at E050.1 and E060.1

Sample Bottle (1 L)	Start Time (min) 12-Bottle ISCO	Analytical Suites 12-Bottle ISCO	Start Time (min) 24-Bottle ISCO	Analytical Suites 24-Bottle ISCO 1-L Poly Wedge
1	Max+10	SSC particle size	Trigger	SSC
2	Max+12	PCBs (UF[a]) Part 1[b]	Trigger+2	SSC
3	Max+14	DOC[c] (F[d]), alkalinity + pH (UF)	Trigger+4	SSC
4	Max+16	PCBs (UF) Part 2	Trigger+6	SSC
5	Max+18	TAL metals[e] + boron + uranium + hardness (F/UF), total recoverable aluminum (F10µ[f])	Trigger+8	SSC
6	Max+20	Dioxins and furans (UF) Part 1	Trigger+12	SSC
7	Max+22	Dioxins and furans (UF) Part 2	Trigger+14	SSC
8	Max+24	Strontium-90 (UF)	Trigger+16	SSC
9	Max+26	Gamma spectroscopy[g] (UF), gross alpha (UF), gross beta (UF)	Trigger+18	SSC
10	Max+28	Isotopic plutonium (UF), americium-241 (UF), isotopic uranium (UF) Part 1	Trigger+20	Radium-226/radium-228 (UF) Part 1
11	Max+60	Isotopic plutonium (UF), americium-241 (UF), isotopic uranium (UF) Part 2	Trigger+22	Radium-226/radium-228 (UF) Part 2
12	Max+62	SSC	Trigger+24	SSC
13	n/a[h]	n/a	Trigger+26	SSC
14	n/a	n/a	Trigger+28	SSC
15	n/a	n/a	Trigger+30	SSC
16	n/a	n/a	Trigger+50	SSC
17	n/a	n/a	Trigger+70	SSC
18	n/a	n/a	Trigger+90	SSC
29	n/a	n/a	Trigger+110	SSC
20	n/a	n/a	Trigger+130	SSC
21	n/a	n/a	Trigger+150	SSC
21	n/a	n/a	Trigger+170	SSC
23	n/a	n/a	Trigger+190	SSC
24	n/a	n/a	Trigger+210	SSC

[a] UF = Unfiltered.

[b] Bottles 2 and 4 are to be sent to the lab together for one PCB analysis.

[c] DOC = Dissolved organic carbon.

[d] F = Filtered through a 0.45-µm membrane.

[e] TAL metals are: Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Hg, K, Mg, Mn, Na, Ni, Pb, Sb, Se, Tl, V, and Zn; hardness is calculated from Ca and Mg, components of the TAL list.

[f] F10µ = Filtered through a 10-µm membrane.

[g] Gamma spectroscopy = Ac-228, Be-7, Bi-212, Bi-214, Cs-134, Cs-137, Co-60, gross gamma, I-131, Pb-212, Pb-214, K-40, Pa-234, Na-22, Tl-208, and Th-234.

[h] n/a = Not applicable.

Appendix A

Acronyms and Abbreviations

A-1.0 ACRONYMS AND ABBREVIATIONS

3-D	three-dimensional
AAL	acute aquatic life
ASER	Annual Site Environmental Report
ASTM	American Society for Testing and Materials
BDDB	Buckman Direct Diversion Board
BLM	biotic ligand model
CAL	chronic aquatic life
cfs	cubic foot per second
Consent Order	Compliance Order on Consent
DEM	digital elevation model
DOC	dissolved organic carbon
DOE	Department of Energy (U.S.)
DP	Delta Prime
DSM	digital surface model
EIM	Environmental Information Management System
EPA	Environmental Protection Agency (U.S.)
F	filtered
GCS	grade-control structure
GIS	Geographic Information System
GPS	Global Positioning System
HH-OO	human health–organism only
IMWP	Interim Measure Work Plan to Mitigate Contaminated Sediment Transport in Los Alamos and Pueblo Canyons
Individual Permit	National Pollutant Discharge Elimination System Permit No. NM0030759
Laboratory	Los Alamos National Laboratory
LAC	Los Alamos Canyon
LANL	Los Alamos National Laboratory
LA/P	Los Alamos and Pueblo (watershed)
LiDAR	light detection and ranging
LW	livestock watering
M	mean
MDA	minimum detectable activity

MDL	method detection limit
MOU	memorandum of understanding
N3B	Newport News Nuclear BWXT-Los Alamos, LLC
NAVD 88	North American Vertical Datum of 1988
NDVI	normalized difference vegetation index
NIR	near infrared
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NPDES	National Pollutant Discharge Elimination System
PCB	polychlorinated biphenyl
PQL	practical quantitation limit
RPD	relative percent difference
SD	standard deviation
SDE	spatial database engine
SIMWP	Supplemental Interim Measures Work Plan to Mitigate Contaminated Sediment Transport in Los Alamos and Pueblo Canyons
SSC	suspended sediment concentration
SWMU	solid waste management unit
T2S	Tech2 Solutions
TAL	target analyte list (EPA)
TCDD[2,3,7,8]	2,3,7,8 tetrachlorodibenzo-p-dioxin
TIN	triangular irregular network
UF	unfiltered
VNIR	visual through near-infrared
WH	wildlife habitat
WWTF	wastewater treatment facility

Appendix B

2022 Geomorphic and Vegetation Changes at Sediment Transport Mitigation Sites in the Los Alamos/Pueblo Canyon Watershed

B-1.0 INTRODUCTION

This appendix evaluates geomorphic change that occurred between 2018 and 2021 at sediment transport mitigation sites in the Los Alamos/Pueblo Canyon watershed, and vegetation change that occurred between 2019 and 2022 within the Pueblo wetland. Geomorphic change was evaluated using aerial light detection and ranging (LiDAR) data collected in November 2018 and October 2021. Vegetation change was evaluated using hyperspectral data collected in September 2019 and September 2022. Ground-based and aerial-based survey data in Los Alamos, Pueblo, and Delta Prime (DP) Canyons were reported previously (LANL 2011, 200902; LANL 2012, 218411; LANL 2015, 600439; LANL 2016, 601433; LANL 2017, 602343; LANL 2018, 603023; N3B 2019, 700419; N3B 2021, 701997). Figure B-1.0-1 shows Los Alamos/Pueblo Canyon watershed sediment transport mitigation sites discussed in this appendix.

The current methodology, using triennial aerial geomorphic (LiDAR) and vegetation (hyperspectral image collection) surveys to detect variability and help evaluate the stability of the Los Alamos and Pueblo watershed, was originally outlined in the “2019 Monitoring Plan for Los Alamos and Pueblo Watershed” (N3B 2019, 700418), and replaced biennial aerial-based LiDAR surveys plus annual ground-based Global Positioning System (GPS) surveys of the channel thalweg, channel bank, and vegetation. The next geomorphic and vegetative surveys are planned for 2025, results for both geomorphic and vegetative change will be presented in the 2025 Los Alamos/Pueblo watershed monitoring report.

B-2.0 AERIAL LIDAR SURVEY METHODS OF THE LOS ALAMOS/PUEBLO CANYON WATERSHED

LiDAR surveying uses lasers which are directed at a surface and the resulting reflections are used to calculate the distance to the surface. Aerial LiDAR surveying involves mounting the LiDAR equipment on an airplane and flying a known course while directing lasers at the ground surface to generate a three-dimensional (3-D) point cloud of the surface.

Aerial LiDAR surveying is the most practical method to evaluate topographic change over large areas such as the watercourses of Los Alamos and Pueblo Canyons. Other survey techniques require extensive fieldwork, making the surveying cost-prohibitive, and provide only estimates of the overall area of interest, resulting in large propagated error estimates of topographic change. While there are difficulties associated with accurately capturing the ground land surface over particular land covers (dense vegetation, steep elevation gradient, and water) using aerial-based LiDAR surveys instead of ground-based transect surveys, the time-saving benefits of aerial-based surveys far outweighs these disadvantages. The collection of vegetation data along with the geomorphic data and ground-truth surveying will help remedy these issues.

Aerial LiDAR surveys of the Los Alamos and Pueblo Canyon watersheds were performed to collect geomorphic data in 2018 and again in 2021. The LiDAR surveys provide a detailed representation of the land surface for the entire watershed, and geomorphic change was identified by comparing the 2018 and 2021 LiDAR survey data.

B-2.1 Aerial LiDAR Survey Data Collection and Processing

The 2018 LiDAR data were collected with a RIEGL 1560i LiDAR sensor and a Phase One digital frame camera mounted on a fixed-wing aircraft. LiDAR was acquired with a point density of 6 points per square meter. Figure B-2.1-1 presents the point density for this survey in the Los Alamos and Pueblo Canyon watershed. See Attachment B-1 (on CD included with this document) for a detailed description of the LiDAR collection process in 2018.

The 2021 LiDAR data were collected with a Galaxy T2000 LiDAR sensor mounted on a fixed-wing aircraft. The point density (points per square meter) in the Los Alamos and Pueblo Canyon watershed is presented in Figure B-2.1-2. The Galaxy T2000 scanner collects points at a density of 6.8 points per square meter, and, to ensure that point-density thresholds were met, double coverage was planned into the LiDAR flights (see Attachment B-5 [on CD included with this document] for a detailed description of coverage over the area of interest and the flight plan). Ground points were collected to accompany the aerial survey in 2021. Attachment B-2 provides details as to how the ground-survey points were used to calibrate and quality-check the LiDAR flights. The complete summary of the ground survey and the survey points is included as Attachment B-5 (on CD included with this document).

B-2.2 Digital Elevation Model Generation and Geomorphic Change Estimation Procedures

A raster-based change-detection approach was performed for the 2018 and 2021 data sets. A digital elevation model (DEM) was created through DEM differencing by comparing elevations from 2018 and 2021. The change-detection DEM represents the vertical difference between the 2021 and 2018 ground elevations; further detail of the data processing is included in Attachment B-2. Negative values (2021 elevation is less than 2018 elevation) indicate areas of erosion or sediment loss; positive values (2021 elevation is greater than 2018 elevation) indicate areas of aggradation or sediment accumulation. These thresholds are based on the absolute vertical accuracy of LiDAR quality Level 1 data, which is approximately 10 cm. However, when change detection between two data sets is calculated, the vertical accuracy decreases to about 14 cm (or approximately 0.55 ft) because of error propagation.

A vector-based change-detection approach was also performed for the 2018 and 2021 data sets. This approach used only the “ground”-classified points from the LiDAR point cloud, and implemented a vertical threshold of 1 ft of change and a point-cluster size of 800 ft^2. The vertical and point-size clusters were selected to avoid false positives from change that was related to either vertical or horizontal error. Additional details regarding the collection of LiDAR data, developments of surface and change-detection DEMs, and change-detection vector data can be found in the LiDAR data delivery report (Attachment B-2).

While aerial-based surveys are more accurate than ground-based transect surveys at detecting changes in the land surface, it is important to note the limitations of LiDAR analysis in densely vegetated areas or near steep cliffs, both of which are present in the Los Alamos and Pueblo watershed. In areas of dense vegetation (e.g., reed canary grass or dense tree canopy), the improper assignment of vegetation points as ground-classified points is more likely than in areas of sparse vegetation cover. When these “ground” (actually vegetation) points are used as part of the 3-D point cloud to generate the ground-surface DEM, they contribute to elevation-change anomalies. The change calculations will therefore identify some elevation changes that result from changes in vegetation height rather than from changes in the ground surface caused by either channel processes (e.g., sediment erosion or deposition) or other geomorphic processes occurring outside the channel itself. The 2022 aerial vegetation survey data helps highlight some areas within the geomorphic data where change is more likely associated with the presence of dense vegetation.

Areas of steep elevation gradients are typically characterized by cliffs, steep embankments, and large boulders, which are not captured particularly well within the LiDAR data sets. Therefore, large amounts of elevation change may be observed although no real topographic change has occurred at the canyon edges. For this reason, the change-detection DEM analysis was limited to areas within the 100-yr post-fire floodplains.

Finally, water is opaque to LiDAR; therefore, sediment erosion/deposition features that are submerged at the time of surveying are not captured. This can cause the change-detection algorithms to generate areas of significant change, although no real change has occurred.

B-2.3 Airborne- and Terrestrial-Based Vegetation Survey Methods of the Pueblo Canyon Wetlands

On September 21, 2019, aerial hyperspectral data was collected for the Pueblo Canyon wetland area using an AISA EAGLE II Visual through Near Infrared (VNIR) hyperspectral imaging sensor (128 spectral bands) system paired with an Oxford Solutions 2+ 2^{nd} generation GPS and affixed to a Cessna 172 Skyhawk. Additional details regarding the 2019 hyperspectral imagery data collection, processing, and quality control can be found in Attachment B-3. On September 3 and 4, 2022, a second round of aerial and ground-based hyperspectral data was collected using an AISA Kestrel 10 VNIR Hyperspectral Imaging Sensor (400–1000 nm, 178 bands) paired with an Oxford Solutions Survey+ 2nd Generation Global Positioning System and Inertial Navigation System with TerraStar-C real time kinetic correction, both affixed to a Cessna 172 Skyhawk. Ground-truth data was collected on August 11 and 12, 2022, using a mobile device equipped with ESRI Field Maps and paired with a GNSS receiver and a Riegl terrestrial LiDAR system collected ground-based LiDAR scans. Additional details regarding the 2022 hyperspectral imagery data collection, processing, and quality control can be found in Attachment B-4.

Upon completion of airborne survey and ground-truthing efforts, several software packages including ENVI/IDL, CALIGEO, ATCOR4, and proprietary software and algorithms were used to process the hyperspectral imagery. This included radiometric calibration, atmospheric correction, cross-track and global illumination correction, geometric correction, and orthorectification. The ground-truth GPS data of known vegetation species was overlaid on the corrected imagery to extract unique spectral signatures for each species. The resulting spectral library guided a Supervised Classification algorithm that identified six distinct classes of land cover: canary reed grass, willow, cattail, other vegetation, surface water, and nonvegetated.

The terrestrial LiDAR data was processed and used to create a DEM, colorized bitmap image, and point-density raster image. However, due to its limited oblique viewing angle, inability to penetrate dense vegetation, and variable point density; the data did not provide full spatial coverage of the wetland (Attachment B-4). Instead, the terrestrial LiDAR was used to verify accuracy of the aerial LiDAR-derived vegetation density and height data.

B-3.0 HYDROLOGIC EVENTS DURING 2022 MONSOON SEASON

In 2022, ten sample-triggering storm events occurred in Los Alamos and Pueblo Canyon wetlands. The largest stormwater runoff events in 2022 at the sediment transport mitigation sites in the Los Alamos and Pueblo Canyon watershed were:

- Pueblo Canyon (gaging stations E055, E059.5, E059.8, and E060.1): June 25, June 26, June 27, July 26, July 27, July 31, August 5, and August 11;
- DP Canyon (gaging stations E038 and E039.1): June 26, June 27, July 27, and August 23; and
- Los Alamos Canyon (gaging stations E026, E030, E042.1 and E050.1): July 27, August 6, and August 23.

See section 3 of this report for additional details.

The 2022 peak discharges were above average for 7 out of 13 gage stations, a contrast with the drought conditions prevalent in the previous two years (Table B-3.0-1). Despite wetter conditions in 2022, minimal geomorphic change was observed throughout the wetlands, though conditions will continue to be monitored in future inspections and LiDAR surveys.

B-4.0 RESULTS

The 2022 monsoonal season resulted in minimal changes to geomorphology within the Los Alamos and Pueblo Canyon watershed. This was confirmed by both the change detection in LiDAR survey results between 2018 and 2021 and the biennial surveys of the grade control structures (GCSs) (see Appendix C for details of the survey findings). The 2022 vegetation hyperspectral and field surveys revealed notable species composition change within the wetland between 2019 and 2022. Decreases in canary reed grass and willow populations were observed, as well as an increase of a newly observed goosefoot species. The 2020–2021 drought and grazing of feral cattle within the wetland are believed to be the primary drivers of these changes.

B-4.1 Thalweg and Channel Banks

The LiDAR data were used to derive the thalweg from both the 2018 and 2021 DEMs extending from E059.5 to E060.1 (Figure B-4.1-1 and Figure B-4.1-2). The channel thalweg vertical profile, shown in Figure B-4.1-3, compares the 2018 and 2021 LiDAR-derived thalwegs. The greatest change in thalweg elevation was an apparent increase of 2-4 ft below the Pueblo Canyon drop structure, propagating downstream to the Pueblo Canyon GCS, due to lateral thalweg migration and vegetation impacts near the drop structure rather than to sediment deposition or streambed aggradation. The average amount of vertical change in the thalweg was an increase of 0.3 ft, with the median amount of vertical change being similar at 0.4 ft increase. One area upstream of the Pueblo Canyon drop structure showed significant change (greater than 1 ft vertical or 800 ft^2 horizontal), attributed to the presence of standing water in the 2018 survey.

Thalwegs derived from the DEMs demonstrate that, on average, the thalweg migrated laterally approximately 22 ft in areas that shifted. Of the total thalweg length (9145 ft), 3720 ft (or 41% of the total length) showed a distinct change between 2018 and 2021. Small lateral shifts in the thalweg are normal as the channel establishes preferential flow paths and new sediment erosion/deposition occurs. The greatest lateral shifts occurred in the dense wetland area upstream of the Pueblo Canyon drop structure. Historically, this area has had a dynamic, nearly braided, preferential flow path, so this behavior is expected. Vertical and lateral change in the thalweg observed between 2018 and 2021 are indicative of a stable system and conditions will continue to be monitored for any significant change.

Channel banks for 2018 and 2021 were derived using the DEMs for the respective years. Overall, the channel banks are stable and show mostly minor changes in bank position over the Pueblo Canyon monitoring area from 2018 to 2021 (Figure B-4.1-4). As another indicator of geomorphic stability, while the thalweg experienced minor lateral and vertical migration between 2018 and 2021, it remained within the channel banks as identified from the aerial imagery.

B-4.2 Pueblo Canyon Background Area above the Wastewater Treatment Facility

The Pueblo Canyon background area is the stream reach above the wastewater treatment facility (WWTF) (Figure B-1.0-1). It serves as a reference reach to identify change in the upper Pueblo Canyon watershed that may result in additional sediment migration downstream. The geomorphic elevation changes in this reach were minimal near the stream and its direct banks (Figure B-4.2-1), and are an indication of a stable system.

B-4.3 Pueblo Canyon E059.5 to WWTF (Upper Willow Planting Area)

The Pueblo Canyon reach, identified as E059.5 to the WWTF, includes the area previously identified as the upper willow planting area (Figure B-1.0-1). A large flood event in 2008 caused major erosion in this area, and willows were planted in 2009 to stabilize the channel. The comparison of geomorphic changes detected in the LiDAR surveys in 2018 and 2021 showed minimal elevation variations within the stream and channel banks (Figure B-4.3-1).

B-4.4 Pueblo Canyon E059.8 to E059.5 (Pueblo Canyon Drop Structure)

The Pueblo Canyon reach, identified as E059.8 to E059.5, includes the area previously identified as the lower willow planting area, as well as the Pueblo Canyon drop structure (Figure B-1.0-1). A headcut in this area (near gaging station E059.8) propagated upstream during the very large flood event in 2013. In 2014 to 2015, the Pueblo Canyon stabilization structure was constructed to prevent further headcut propagation or erosion, and willows were planted to stabilize the channel. The comparison of geomorphic changes detected in the LiDAR surveys in 2018 and 2021 showed one significant area of change, defined as greater than 1 ft vertical change over 800 ft^2. This area is upstream of the Pueblo Canyon drop structure on the river's left, looking downstream (Figure B-4.4-1). This change was a net loss in elevation between 2018 and 2021, attributed to standing water that was present during the 2018 LiDAR survey but was not present during the 2021 LiDAR survey due to exceptional drought conditions in the intervening years. The remainder of the reach showed minimal elevation variations within the stream and channel banks.

B-4.5 Pueblo Canyon E060.1 to E059.8 (Pueblo Canyon GCS)

The furthest downstream Pueblo Canyon reach extends from E059.8 to E060.1, and includes the Pueblo Canyon GCS (Figure B-1.0-1). A headcut in this area (near gaging station E060.1) propagated upstream during a large flood event in 2008. In 2009 to 2010, the Pueblo Canyon GCS was constructed to prevent further headcut propagation or erosion. The comparison of geomorphic changes detected in the LiDAR surveys in 2018 and 2021 showed minimal elevation variations within the stream and channel banks (Figure B-4.5-1). Overall, the Pueblo Canyon GCS area has been geomorphically stable with only minor changes since 2018.

B-4.6 Upper Los Alamos Canyon Detention Basins

The Upper Los Alamos Canyon sediment detention basins are located at the base of the drainage below Solid Waste Management Unit 01-001(f) (also known as LA-SMA-2.1 or Hillside 140), and are shown in Figure B-1.0-1. The comparison of geomorphic changes detected in the LiDAR surveys in 2018 and 2021 showed one significant area of elevation loss within the detention basins, because of the presence of standing water that was present in the 2018 LiDAR survey but was not present in the 2021 LiDAR survey due to exceptional drought conditions in the intervening years (Figure B-4.6-1). Within the sediment detention basins, there was some evidence of sedimentation, which is expected in basins designed to capture and retain sediment. This is supported by the findings in the biannual GCS inspections (Appendix C). There were minor elevation variations within the stream and channel banks. Overall, the Los Alamos Canyon detention basin area has been geomorphically stable with only minor changes since 2018.

B-4.7 Los Alamos Canyon Low-Head Weir and Associated Basins

The Los Alamos Canyon low-head weir and the associated sediment detention basins are located upstream of the confluence of Los Alamos Canyon with Pueblo Canyon, near the intersection of NM 4 and Omega Road (Figure B-1.0-1). The three basins and weir were constructed after the Cerro Grande Fire in 2000 to retain sediment and reduce the energy of stormwater runoff, which may cause erosion downstream. Between 2018 and 2021, there were two significant areas of change: sedimentation (elevation gain) in the upper and middle basins, and apparent erosion (elevation loss) in the lower basin (Figure B-4.7-1). Sediment accumulation occurred in the two upper sediment basins, indicating that these basins are performing as designed. The elevation loss in the lower basin is because of the presence of standing water during the 2018 LiDAR survey that was not present in the 2021 LiDAR survey because of exceptional drought conditions in the intervening years. Changes in elevation below the weir were minimal and indicate that the weir is functioning well, with sediment accumulating upstream of the weir and minimal erosion occurring downstream of the weir.

B-4.7.1 Los Alamos Canyon Low-Head Weir Basins' Stage/Storage Relationship

The storage capacity of the sediment detention basins above the Los Alamos low-head weir was determined using the 2014 LiDAR data in North American Vertical Datum of 1988 (NAVD 88) (Table B-4.7-1). The available storage remaining in the sediment detention basins was determined with a stage/storage table using the 2014 LiDAR data. The sediment detention basins were cleaned out in April 2014, so the sediment storage volume from the 2014 LiDAR, collected in June 2014, is used as a baseline for total available sediment storage in the basins. The current capacity of each basin was measured in ArcGIS using the 2021 LiDAR. Note that the middle basin is within the ponding area of the lower basin.

In Table B-4.7-2, the percent of sediment storage remaining (shown in Figure B-4.7-2), and percent of basin capacity (shown in Figure B-4.7-3) were calculated for the lower basin. This analysis assumed that the upper and middle basins are at capacity based on 2015 inspection notes. The staff-plate readings were assigned an elevation based on the LiDAR elevation of the top of the low-head weir spillway, and level and rod readings were collected in the field.

The detention basins' available sediment storage volume was determined from the 2014, 2018, and 2021 LiDAR data in the NAVD 88 datum, and for 2022 based on the staff-plate reading. Available sediment storage volumes were determined for each year by creating a triangular irregular network (TIN) surface from the point cloud LiDAR data in ArcGIS, then creating a top-of-basin polygon from the 6358.7-ft contour polyline. The low-head weir spillway elevation was verified to be 6358.7 ft for 2014, 2018, and 2021. The "Polygon Volume" tool was then used to determine the available sediment storage between the top-of-basin polygon and the TIN surface for each year.

The 2018 to 2021 change-detection vector data indicated that there was a total erosion volume of 2,916 ft^3 and a total aggradation volume of 14,751 ft^3 in the basins. The erosion volume was determined to be from standing water, which translated to capacity being artificially added to the measured available sediment storage volume for 2018. The aggradation volume is close to the difference of 10,794 ft^3 between the available sediment storage volume in 2018 and in 2021. Table B-4.7-3 presents the volume of available storage, the percent storage remaining, and the percent of basin capacity.

A staff-plate reading of 1.76 ft was collected at the Los Alamos low-head weir during the October 2022 inspection, which correlates to an available storage volume remaining of 55%. This matched the 2021 LiDAR measurement method, showing that the stage/storage analysis is accurate in estimating the remaining capacity. Staff-plate readings will continue to be collected annually following the monsoon season, and LiDAR of the low-head weir is planned for 2025 unless a significant event causing significant erosion or deposition within the watershed occurs, in which case LiDAR will be flown following that event.

B-4.8 DP Canyon GCS and Upstream Wetland Area

The DP Canyon GCS area of interest includes the GCS itself, upstream to the upper end of the wetland area above the GCS (Figure B-1.0-1). The DP Canyon GCS was constructed in 2009 to 2010 to stabilize a headcut that formed after a large storm event in 2008. The comparison of geomorphic changes detected in the LiDAR surveys in 2018 and 2021 showed minimal elevation variations near the stream and channel banks, showing minor erosion and deposition in the wetland area and minor erosion along the upstream end of the GCS (Figure B-4.8-1). All elevation changes near the stream were less than 1 ft of gain or loss. The elevation change occurring in the wetland area may be an artifact of the dense vegetation, showing vegetation growth and senescence rather than actual ground-level change. The minor sediment deposition along the structure is most likely from streamflow overtopping the GCS. Overall, the DP Canyon GCS area has been geomorphically stable with only minor changes since 2018.

B-4.9 Geomorphic Change within the Pueblo Wetland Area

Above the Pueblo Canyon drop structure, both positive and negative elevation changes were well distributed with the exception of the previously mentioned area of standing water to the northeast of the drop structure which is associated with a decrease in water level (Figure B-4.9-1, Inset A). Below the drop structure, decreases along the channel banks immediately below the structure may be more related to vegetation change than to erosion, and increases further downstream may be attributed to the establishment of vegetation in previously unstable areas of thalweg migration (Figure B-4.9-1, Inset B).

Elevation change within the main wetland area of interest ranged from -2.97 to +3.82, with most values (M = 0.10, SD = 0.41) below the vertical accuracy threshold of 0.5 ft (Figure B-4.9-2).

B-4.10 Pueblo Wetland Vegetation

Some variation was detected in the vegetation classifications between the 2019 and 2022 hyperspectral surveys. The 2019 data identified six classes of land cover: canary reed grass, willow, mixed willow/canary reed grass, surface water, other, and non-vegetated. The 2022 data identified the addition of a cattail class and the elimination of the mixed willow/canary reed grass class (Table B-4.10-1).

The 2022 survey (Figure B-4.10-1) revealed that canary reed grass is still the dominant wetland species, covering approximately 32% (313,208 ft^2) of the total wetland area of interest, though it also saw the largest decline with an estimated 35% (166,022 ft^2) loss in cover since 2019 (Figure B-4.10-2). This decrease was counterbalanced by an increase in the other vegetation class which saw a 32% (136,535 ft^2) increase in area, now covering 56% (557,312 ft^2) of the total wetland area of interest (Figure B-4.10-2). A field survey that looked at areas that were previously classified as canary reed grass and now classified as other vegetation were areas where a newly observed species of goosefoot had overgrown the canary reed grass. Future field surveys will continue to monitor and try to identify the exact species of goosefoot present in the wetland. Other notable changes included a 42% (35,373 ft^2) increase in the non-vegetated class and a 91% (5,093 ft^2) decrease in the willow class. A field survey revealed that willows were still present within the wetland, though they had been heavily grazed to around 2 ft in height and were likely concealed by taller vegetation during the hyperspectral survey (Figure 4.10-3). Persistent drought conditions throughout 2020 and 2021 is most likely the main driver of vegetation change within the wetland, though grazing of feral cattle is likely contributing to loss of reed canary grass and willows.

A normalized difference vegetation index (NDVI) was generated, using both the 2019 and 2022 hyperspectral data, to quantify photosynthetic activity, or greenness, within the wetland. NDVI measures the difference between near-infrared (NIR) and red light, calculated with the formula NDVI = (NIR-Red) / (NIR + Red); values for NDVI range from -1 to 1. Higher NDVI values are typically associated with areas of healthy and dense vegetation, though seasonality and vegetation type can impact values.

In 2019, NDVI values within the wetland ranged from 0.08 to 0.87. In 2022, NDVI values within the wetland ranged from 0.0 to 0.95, with areas dominated by canary reed grass having higher values (Figure B-4.10-4). A change analysis that looked at differences in NDVI values from 2019 to 2022 (Figure B-4.10-5) revealed slight decreases in values in the canary reed grass areas upstream of the Pueblo Canyon drop structure, likely associated with the replacement or overstory of goosefoot species. Moderate to high increases in NDVI observed below the structure along the main channel are likely associated with the establishment of other species of vegetation. Between 2019 and 2022, the average NDVI for areas classified as reed canary grass areas increased by 17%, and areas classified as willow increased by 34% (Table B-4.10-2). Overall, NDVI showed minimal increases (M = 0.18, SD = 0.20) between the two years (Figure B-4.10-6).

Vegetation height was calculated based on the difference between LiDAR-derived DEM and digital surface model (DSM) elevation data. DSMs are developed from the first LiDAR signal returned to the sensor and represents surface elevation of objects such as buildings and vegetation. The 2018 and 2021 aerial LiDAR provided greater coverage and more detail than the terrestrial LiDAR, and was better suited to determine vegetation height. The terrestrial LiDAR was instead used to verify accuracy of the aerial LiDAR-derived vegetation height data. Vegetation height within the wetland, based on the 2021 LiDAR, ranged from 0.0–74.4 ft, with most values falling below 0.5 ft (Figure B-4.10-7). Change analysis of vegetation height data between 2018 and 2021 revealed minimal change (M = -0.03, SD = 2.87) within the wetland (Figure B-4.10-8, Figure B-4.10-9 and Table B-4.10-2), though some decreases were observed along the left channel bank, and increases along the right channel bank, where steep embankments can limit LiDAR accuracy (Figure B-4.10.8). The average height in areas classified as reed canary grass decreased by 48% between the 2018 and 2021 LiDAR surveys, which can be likely attributed to cattle grazing (Table B-4.10-2); the average height in the small area where willows were not grazed increased by 51% in the same period (Table B-4.10-2).

Vegetation density is measured as a ratio of aboveground LiDAR returns to the total number of returns that range from 0.0 to 1.0, where 0.0 represents no canopy and 1.0 a very dense canopy. In 2021, vegetation density in the Pueblo wetland was low, with most areas measured at 0.2 or below (Figure B-4.10-10). Vegetation change analysis between 2018 and 2021 revealed an overall decrease (M = -0.30, SD = 0.32) within the wetland, mostly evident in areas that were previously classified as reed canary grass and now classified as other vegetation (Figure B-4.10-11, Inset A and Figure B-4.10-12). Areas below the drop structure that were previously classified as non-vegetated showed an increase in density (Figure B-4.10-11, Inset B). The average vegetation density for areas classified as reed canary grass decreased by 76% and areas classified as willows decreased by 48% between the 2018 and 2021 LiDAR surveys, underscoring the impacts that grazing and drought have had on the wetland (Table B-4.10-2).

B-5.0 CONCLUSIONS AND RECOMMENDATIONS

In 2022, stormwater runoff peak discharge exceeded 100 cubic feet per second at six gaging stations within Los Alamos/Pueblo watershed, marking a significant shift from the drought conditions of the previous two years. Despite the wetter monsoon season, geomorphic change was determined to be minimal both within the greater watershed and the Pueblo wetland area. However, notable vegetation changes were observed between the 2019 and 2022 hyperspectral imagery surveys.

Thalweg movement observed between the 2018 and 2021 LiDAR surveys showed small areas of lateral and vertical migration, attributed to normal channel evolution following the 2013 flood event. Channel banks derived from the 2018 and 2021 LiDAR data indicate minimal changes, and provides further evidence of the general stability of the system.

Change-detection DEMs derived from the 2018 and 2021 LiDAR surveys identified three areas with significant change (greater than 1 ft vertical and 800 ft^2 horizontal):

(1) upstream of the Pueblo Canyon drop structure (Figure B-4.4-1),

(2) basin 1 of the upper Los Alamos detention basins (Figure B-4.6-1), and

(3) the sediment detention basin associated with the Los Alamos low-head weir (Figure B-4.7-1)

Decreased water levels due to the 2020–2021 drought explain elevation losses observed at these three locations. Overall, the low magnitude of geomorphic change detected between the 2018 and 2021 LiDAR surveys provides evidence that the Los Alamos and Pueblo Canyon watershed is stable and that the sediment transport mitigations are functioning as designed.

The 2022 hyperspectral imagery revealed notable species-composition change within the Pueblo wetland. Most evident were areas, previously classified as canary reed grass, being replaced or covered over by a newly observed goosefoot species, currently classified as other vegetation. Also notable was a marked decrease in areas classified as willows, though field surveys revealed they were still present but had been heavily grazed by cattle. The density of reed canary grass and willow vegetation decreased between 2018 and 2021. The 2020–2021 drought and the grazing of feral cattle are believed to be the primary drivers of vegetation change within the wetland. Additional evaluations of vegetation health and height revealed minimal change, and the absence of any significant geomorphological change suggests that overall the wetland remains in stable condition.

If no large storm events create significant geomorphic change, both aerial LiDAR and hyperspectral imagery data collections will be performed every third year, with the next surveys scheduled for 2025. The vegetation surveys assess the extent and species composition of wetland vegetation, as well as the overall health of the vegetation and vegetation height. The stability of wetland vegetation is tightly connected to geomorphic stability. Being able to display these data together is especially helpful in interpreting the geomorphic change-detection results, as the presence of dense vegetation may impact the accuracy of the analysis.

B-6.0 REFERENCES AND MAP DATA SOURCES

B-6.1 References

The following reference list includes documents cited in this appendix. 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 (N3B) (IDs 700000 and above).

LANL (Los Alamos National Laboratory), February 2011. "Baseline Geomorphic Conditions at Sediment Transport Mitigation Sites in the Los Alamos and Pueblo Canyon Watersheds, Revision 1," Los Alamos National Laboratory document LA-UR-11-0936, Los Alamos, New Mexico. (LANL 2011, 200902)

LANL (Los Alamos National Laboratory), May 2012. "2011 Geomorphic Changes at Sediment Transport Mitigation Sites in the Los Alamos and Pueblo Canyon Watersheds," Los Alamos National Laboratory document LA-UR-12-21330, Los Alamos, New Mexico. (LANL 2012, 218411)

LANL (Los Alamos National Laboratory), May 2015. "2014 Monitoring Report for Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project," Los Alamos National Laboratory document LA-UR-15-21413, Los Alamos, New Mexico. (LANL 2015, 600439)

LANL (Los Alamos National Laboratory), April 2016. "2015 Monitoring Report for Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project," Los Alamos National Laboratory document LA-UR-16-22705, Los Alamos, New Mexico. (LANL 2016, 601433)

LANL (Los Alamos National Laboratory), April 2017. "2016 Monitoring Report for Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project," Los Alamos National Laboratory document LA-UR-17-23308, Los Alamos, New Mexico. (LANL 2017, 602343)

LANL (Los Alamos National Laboratory), April 2018. "2017 Monitoring Report for Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project," Los Alamos National Laboratory document LA-UR-18-23237, Los Alamos, New Mexico. (LANL 2018, 603023)

N3B (Newport News Nuclear BWXT-Los Alamos, LLC), April 2019. "2018 Monitoring Report for Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project," Newport News Nuclear BWXT-Los Alamos, LLC, document EM2019-0106, Los Alamos, New Mexico. (N3B 2019, 700419)

N3B (Newport News Nuclear BWXT-Los Alamos, LLC), April 2019. "2019 Monitoring Plan for Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project," Newport News Nuclear BWXT-Los Alamos, LLC, document EM2019-0132, Los Alamos, New Mexico. (N3B 2019, 700418)

N3B (Newport News Nuclear BWXT-Los Alamos, LLC), April 2022. "2021 Monitoring Report and 2022 Monitoring Plan for Los Alamos/Pueblo Watershed Sediment Transport Mitigation Project," Newport News Nuclear BWXT-Los Alamos, LLC, document EM2022-0002, Los Alamos, New Mexico. (N3B 2022, 701997)

B-6.2 Map Data Sources

The following list provides data sources for maps included in this appendix.

Grade control structure: As published, N3B/T2S, GIS projects folder; \\N3B-fs01\N3B-shares) (Q: GIS DATA) Project: 12-Projects\12-0019\shp\dissolve_cad_export.shp; Information assumed to have originated from TPMC and was transferred to N3B/T2S sometime during the 2018 timeframe. Data as published, 2019.

Canyon Reaches: As published; Triad SDE Spatial Geodatabase: GISPUBPRD1\PUB.regulatory\PUB.canyon_reaches; February 2022.

Drainage features: As published; Triad SDE Spatial Geodatabase: GISPUBPRD1\PUB.Hydrology\PUB.EM_sw_watercourse; February 2022.

Cascade Pool: As published, N3B/T2S, GIS projects folder; \\N3B-fs01\N3B-shares) (Q: GIS DATA) Project: 14-0015\shp\sandia_wetlands\cascade_pool.shp; Information assumed to have originated from TPMC and was transferred to N3B/T2S sometime during the 2018 timeframe. Data as published, February 2022.

Culvert: As published, N3B/T2S, GIS projects folder; \\N3B-fs01\N3B-shares) (Q: GIS DATA) Project: 14-0015\shp\sandia_wetlands\site_culverts.shp; Data as published, February 2022.

Tech Areas: As published; Triad SDE Spatial Geodatabase: GISPUBPRD1\PUB.Boundaries\PUB.tecareas; December 2020.

Buildings: As published, County of Los Alamos GIS Server: (https://gis.losalamosnm.us/securegis/rest/services/basemaps/basemap/FeatureServer); February 2022.

Paved Road: As published; Triad SDE Spatial Geodatabase: GISPUBPRD1\PUB.Infrastructure\PUB.paved_rds_arc; February 2022.

Unpaved Road: As published; Triad SDE Spatial Geodatabase: GISPUBPRD1\PUB.Infrastructure\PUB.paved_rds_arc, February 2022.

Former Los Alamos County landfill: As published, N3B/T2S, GIS projects folder; \\N3B-fs01\N3B-shares) (Q: GIS DATA) Project: 14-0015; project_data.gdb; former_LA_landfill; February 2022.

Fences: As published; Triad SDE Spatial Geodatabase: GISPUBPRD1\PUB.Infrastructure\PUB.fences_arc; December 2020.

Index and Terrain Contours (All Intervals): As published, N3B/T2S, GIS projects folder; \\N3B-fs01\N3B-shares) (Q: GIS DATA) Project: 20-0002; project_data.gdb; line feature dataset; site_contour; All contours generated from the 2021 Geotiff data as collected and processed by TetraTech's Geoinformatics Group; N3B/T2S, GIS projects folder; \\N3B-fs01\N3B-shares) Q:\GIS Drive\Lidar_2021\2021\03_DEM (change detection area)\NAVD88\GeoTIFF\. February 2022.

Detention basin 1-ft contour: As published, N3B/T2S, GIS projects folder; \\N3B-fs01\N3B-shares) (Q: GIS DATA) Project: 22-0002; project_data.gdb; line feature dataset; clip_upper_LA_basin_2021_dem, February 2022.

2018 2021 change detection in elevation: As published, N3B/T2S, GIS projects folder; \\N3B-fs01\N3B-shares) (Q: GIS DATA) Lidar_2021\2021\04_Change_Detection\dz_difference. Data as collected and processed by TetraTech's Geoinformatics Group, February 2022.

2018 2021 change detection (vector representation): As published, N3B/T2S, GIS projects folder; \\N3B fs01\N3B-shares) (Q: GIS DATA) Lidar_2021\2021\04_Change_Detection\shapefile/ change_detection.shp. Data as collected and processed by TetraTech's Geoinformatics Group, February 2022.

Gaging stations (point features): As published; EIM data pull, February 2022.

Pueblo wetlands boundary: As published, N3B/T2S, GIS projects folder; \\N3B-fs01\N3B-shares) (Q: GIS DATA) Project: 22-0002; project_data.gdb; poly feature dataset; dissolve_la_pueblo; Information assumed to have originated from TPMC and was transferred to N3B/T2S sometime during the 2018 timeframe. Data as published, February 2022.

Thalweg 2018: As published, N3B/T2S, GIS projects folder; \\N3B-fs01\N3B-shares) (Q: GIS DATA) Project: 20-0002; project_data.gdb; line feature dataset; pueblo_2018_thalweg; Information assumed field collected/verified by handheld GPS sometime during or before 2018. As published, February 2022.

Thalweg 2021: As published, N3B/T2S, GIS projects folder; \\N3B-fs01\N3B-shares) (Q: GIS DATA) Project: 20-0002; project_data.gdb; line feature dataset; pueblo_2021_thalweg; Information assumed field collected/verified by handheld GPS sometime during or before 2018. As published, February 2022.

2017 Thalweg GPS: As published, N3B/T2S, GIS projects folder; \\N3B-fs01\N3B-shares) (Q: GIS DATA) Project: 20-0002; project_data.gdb; point feature dataset; gps_trace_2017_thalweg; Information assumed field collected/verified by handheld GPS sometime during or before 2018. As published, February 2022.

2016 Thalweg 2016 GPS: As published, N3B/T2S, GIS projects folder; \\N3B-fs01\N3B-shares) (Q: GIS DATA) Project: 20-0002; project_data.gdb; point feature dataset; gps_trace_2016_thalweg; Information assumed field collected/verified by handheld GPS sometime during or before 2018. As published, February 2022.

2015 Thalweg 2015 GPS: As published, N3B/T2S, GIS projects folder; \\N3B-fs01\N3B-shares) (Q: GIS DATA) Project: 20-0002; project_data.gdb; point feature dataset; gps_trace_2015_thalweg; Information assumed field collected/verified by handheld GPS sometime during or before 2018. As published, February 2022.

Banktops 2018: As published, N3B/T2S, GIS projects folder; \\N3B-fs01\N3B-shares) (Q: GIS DATA) Project: 20-0002; project_data.gdb; line feature dataset; banktop_digitize_2018; As published, February 2022.

Banktops 2021: As published, N3B/T2S, GIS projects folder; \\N3B-fs01\N3B-shares) (Q: GIS DATA) Project: 20-0002; project_data.gdb; line feature dataset; banktop_digitize_2021; As published, February 2022.

LiDAR AOI: As published, N3B/T2S, GIS projects folder; \\N3B-fs01\N3B-shares) (Q: GIS DATA) Project: 20-0002; project_data.gdb; poly_feature_dataset; new_aoi; February 2022.

Regional area: As published; Triad SDE Spatial Geodatabase: GISPUBPRD1\PUB.Boundaries\PUB.regional_area; February 2022.

Watershed: As published; Triad SDE Spatial Geodatabase: GISPUBPRD1\PUB.Hydrology\PUB.Watersheds, February 2022.

Cattail (2019): As Pulbished,N3B/T2S, GIS projects folder; \\N3B-fs01\N3B-shares) (Q: GIS DATA) LANL Hyperspectral Data; Species_Distribution; West_AOI; W_Catttail.shp; December 2019.

Non-vegetated (2019): As Pulbished,N3B/T2S, GIS projects folder; \\N3B-fs01\N3B-shares) (Q: GIS DATA) LANL Hyperspectral Data; Species_Distribution; West_AOI; W_Non-Vegetated.shp; December 2019.

Other vegetation (2019): As Pulbished,N3B/T2S, GIS projects folder; \\N3B-fs01\N3B-shares) (Q: GIS DATA) LANL Hyperspectral Data; Species_Distribution; West_AOI; W_Other_Vegetation.shp; December 2019.

Surface Water (2019): As Pulbished,N3B/T2S, GIS projects folder; \\N3B-fs01\N3B-shares) (Q: GIS DATA) LANL Hyperspectral Data; Species_Distribution; West_AOI; W_Surface_Water.shp; December 2019.

Willow (2019): As Pulbished,N3B/T2S, GIS projects folder; \\N3B-fs01\N3B-shares) (Q: GIS DATA) LANL Hyperspectral Data; Species_Distribution; West_AOI; W_Willow.shp; December 2019.

Cattail (2022): As published, N3b/T2S, GIS projects folder; \\N3B-fs01\N3B-shares) (Q: GIS DATA) sandia_pueblo_vegetation_data_2022; la_pueblo_veg_2022; La_Pueblo; Analysis_Shapefiles; Cattail_La_Pueblo.shp; November 2023.

Non-vegetated (2022): As published, N3B/T2S, GIS projects folder; \\N3B-fs01\N3B-shares) (Q: GIS DATA) sandia_pueblo_vegetation_data_2022; la_pueblo_veg_2022; La_Pueblo; Analysis_Shapefiles; Non-Vegetated_La_Pueblo.shp; November 2023.

Other vegetation (2022): As published, N3B/T2S, GIS projects folder; \\N3B-fs01\N3B-shares) (Q: GIS DATA) sandia_pueblo_vegetation_data_2022; la_pueblo_veg_2022; La_Pueblo; Analysis_Shapefiles; Other_Vegetation_La_Pueblo.shp; November 2023.

Reed Canary Grass (2022): As published, N3B/T2S, GIS projects folder; \\N3B-fs01\N3B-shares) (Q: GIS DATA) sandia_pueblo_vegetation_data_2022; la_pueblo_veg_2022; La_Pueblo; Analysis_Shapefiles; Reed_Canary_Grass_La_Pueblo.shp: November 2023.

Surface Water (2022): As published, N3B/T2S, GIS projects folder; \\N3B-fs01\N3B-shares) (Q: GIS DATA) sandia_pueblo_vegetation_data_2022; la_pueblo_veg_2022; La_Pueblo; Analysis_Shapefiles; Surface_Water_La_Pueblo.shp; November 2023.

Willow (2022): As published, N3B/T2S, GIS projects folder; \\N3B-fs01\N3B-shares) (Q: GIS DATA) sandia_pueblo_vegetation_data_2022; la_pueblo_veg_2022; La_Pueblo; Analysis_Shapefiles; Willow_La_Pueblo.shp; November 2023.

LA_Pueblo Vegetation Indices (NDVI): As published, N3B/T2S, GIS projects folder; \\N3B-fs01\N3B-shares) (Q: GIS DATA) sandia_pueblo_vegetation_data_2022; la_pueblo_veg_2022; La_Pueblo_Vegetation_Indices.7z; November 2023.

LA_Pueblo Vegetative Height: As published, N3B/T2S, GIS projects folder; \\N3B-fs01\N3B-shares) (Q: GIS DATA) sandia_pueblo_vegetation_data_2022; Vegetative_Height_Revised_Airborne_LiDAR; November 2023.

LA_Pueblo Vegetative Density: As published, N3B/T2S, GIS projects folder; \\N3B-fs01\N3B-shares) (Q: GIS DATA) sandia_pueblo_vegetation_data_2022; La_Pueblo_Vegetative_Density_Heat_Map_revised_Dec-2022_Airborne_LiDAR; December 2023.

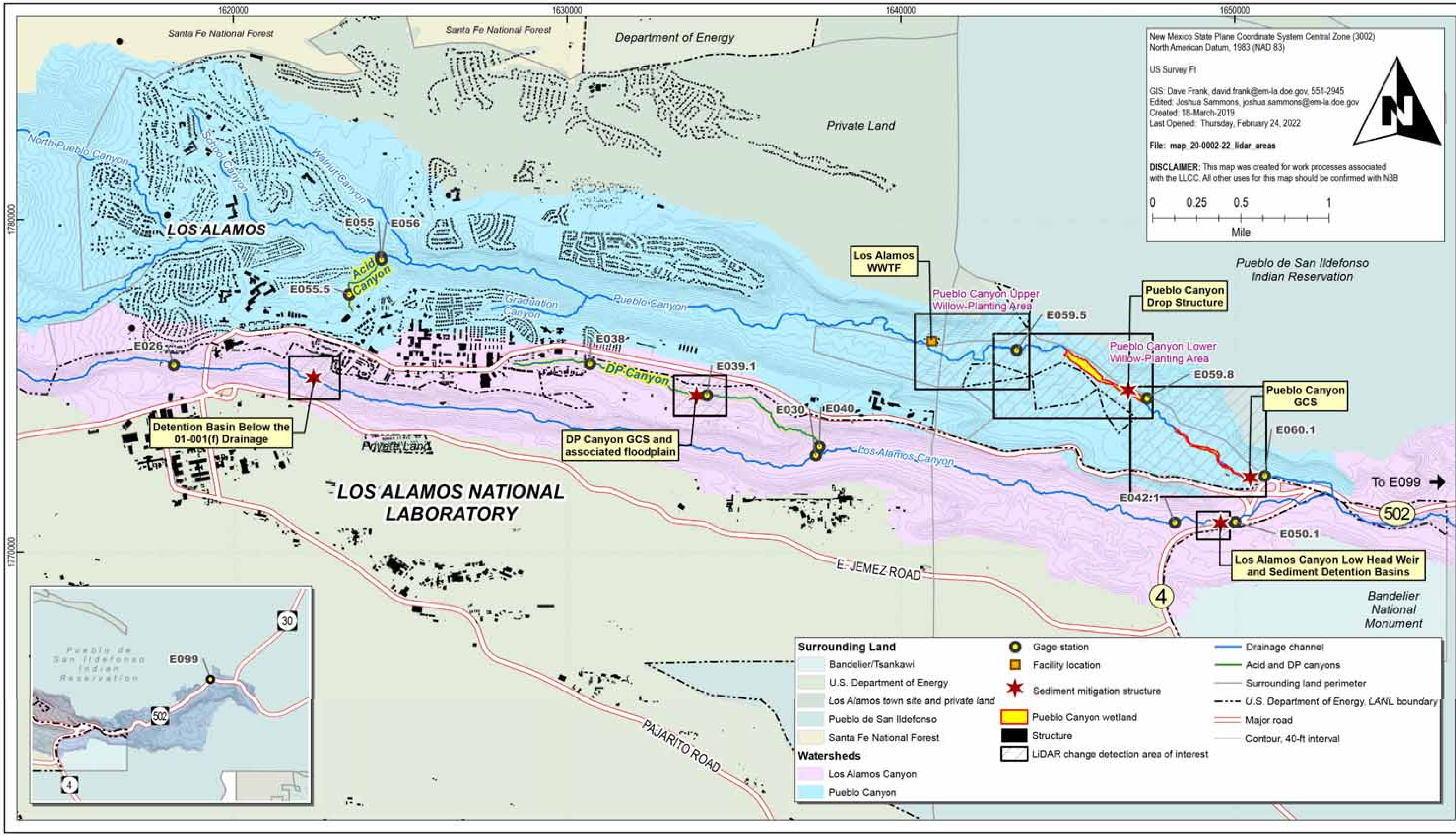


Figure B-1.0-1 Los Alamos/Pueblo Canyon watershed sediment transport mitigation sites and associated areas of interest

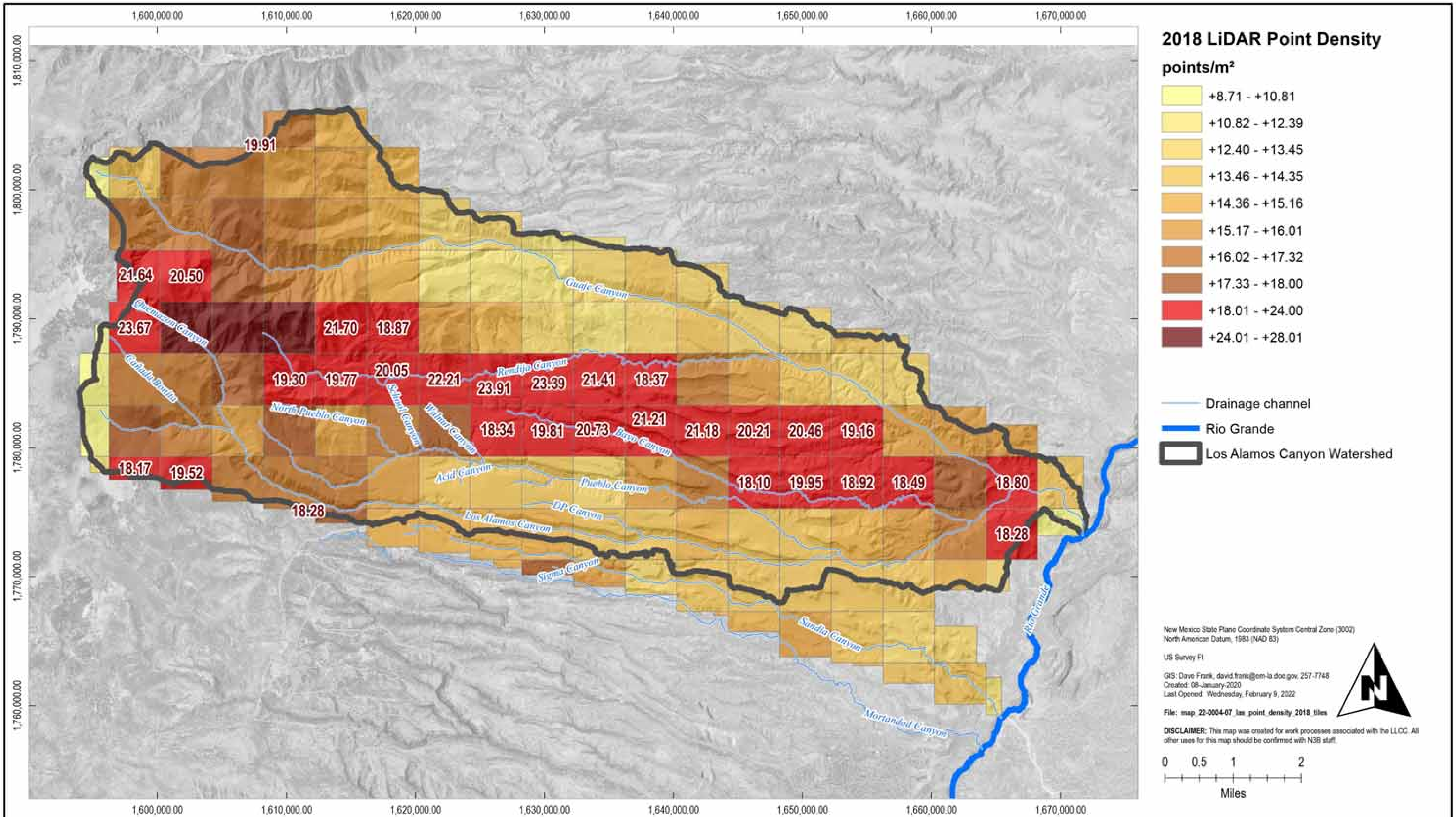


Figure B-2.1-1 2018 LiDAR point density in the Los Alamos and Pueblo Canyon watershed

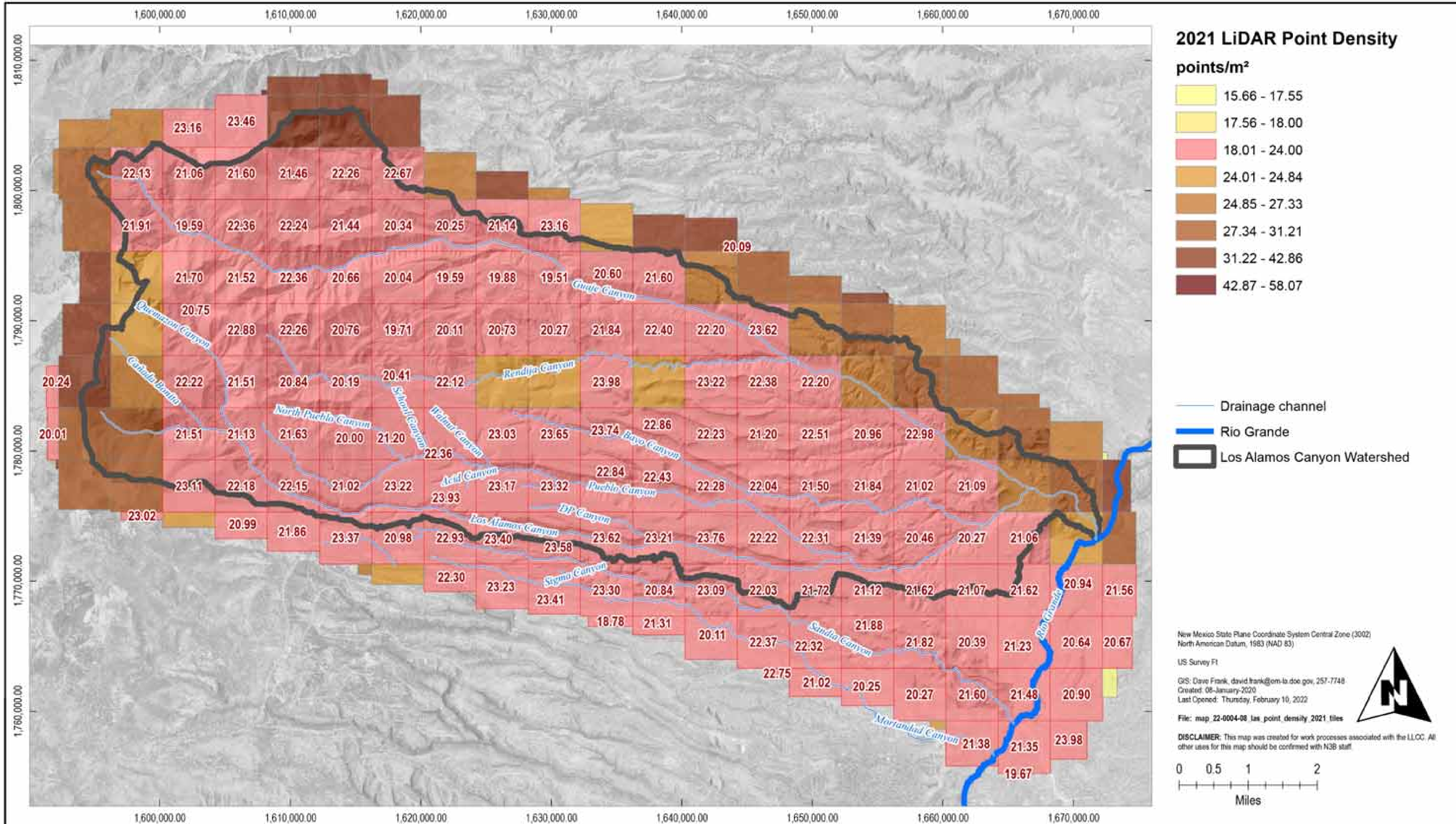


Figure B-2.1-2 2021 LiDAR point density in the Los Alamos and Pueblo Canyon watershed

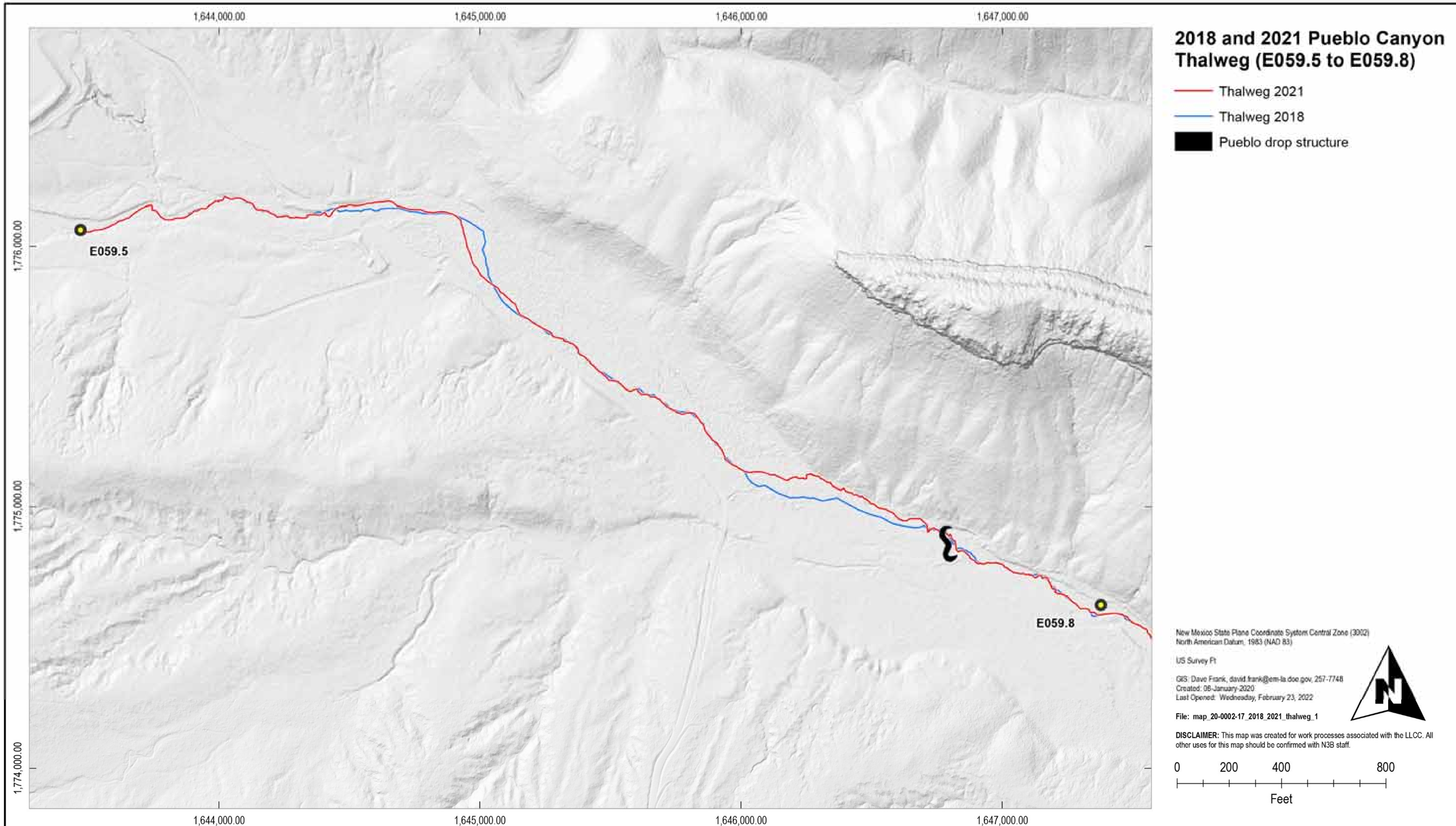


Figure B-4.1-1 2018 to 2021 aerial thalweg comparison for Pueblo Canyon (E059.5 to E059.8)

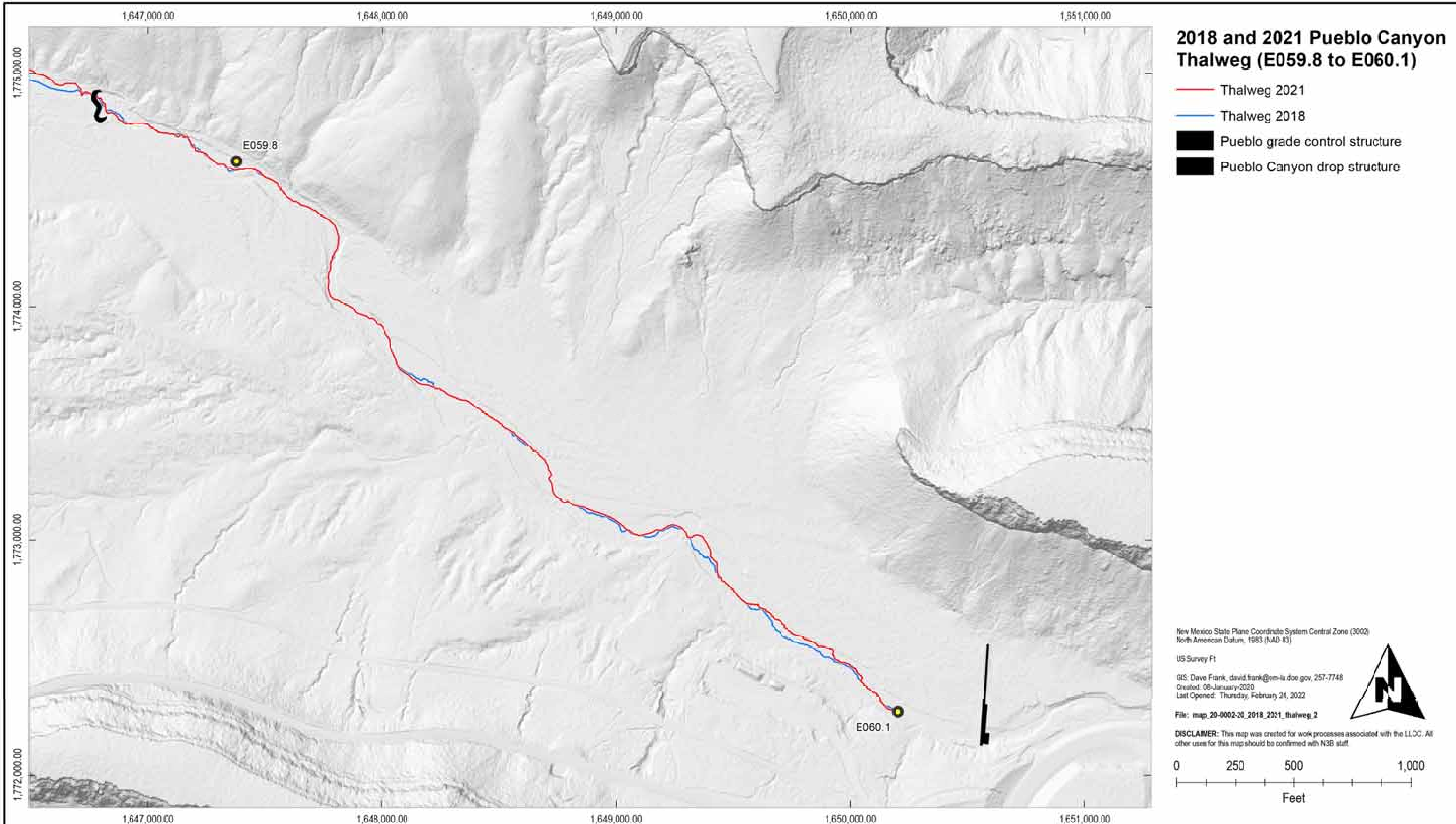


Figure B-4.1-2 2018 to 2021 aerial thalweg comparison for Pueblo Canyon (E059.8 to E060.1)

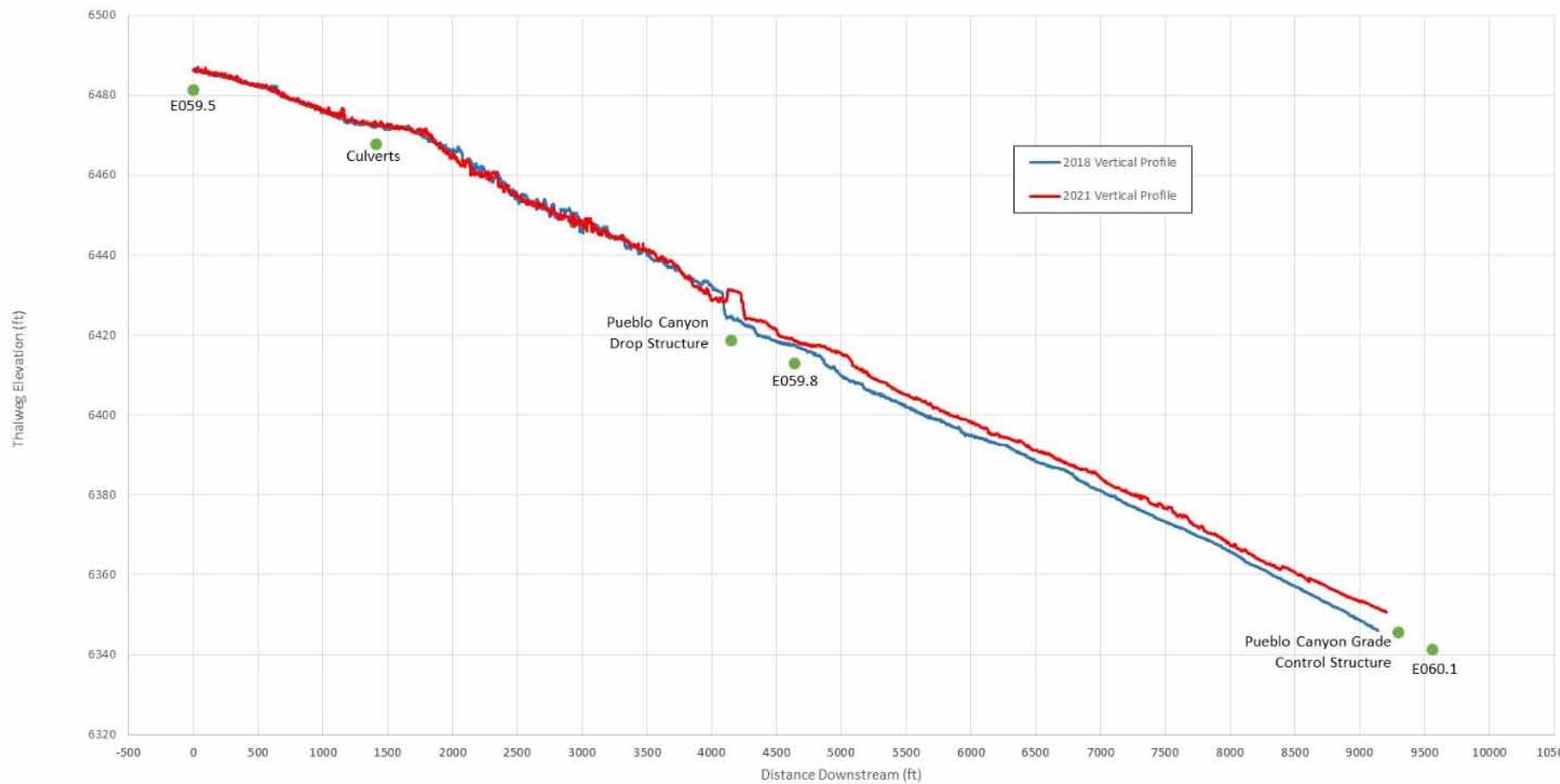


Figure B-4.1-3 2018 to 2021 aerial thalweg vertical profile comparison for Pueblo Canyon (E059.5 to E060.1)

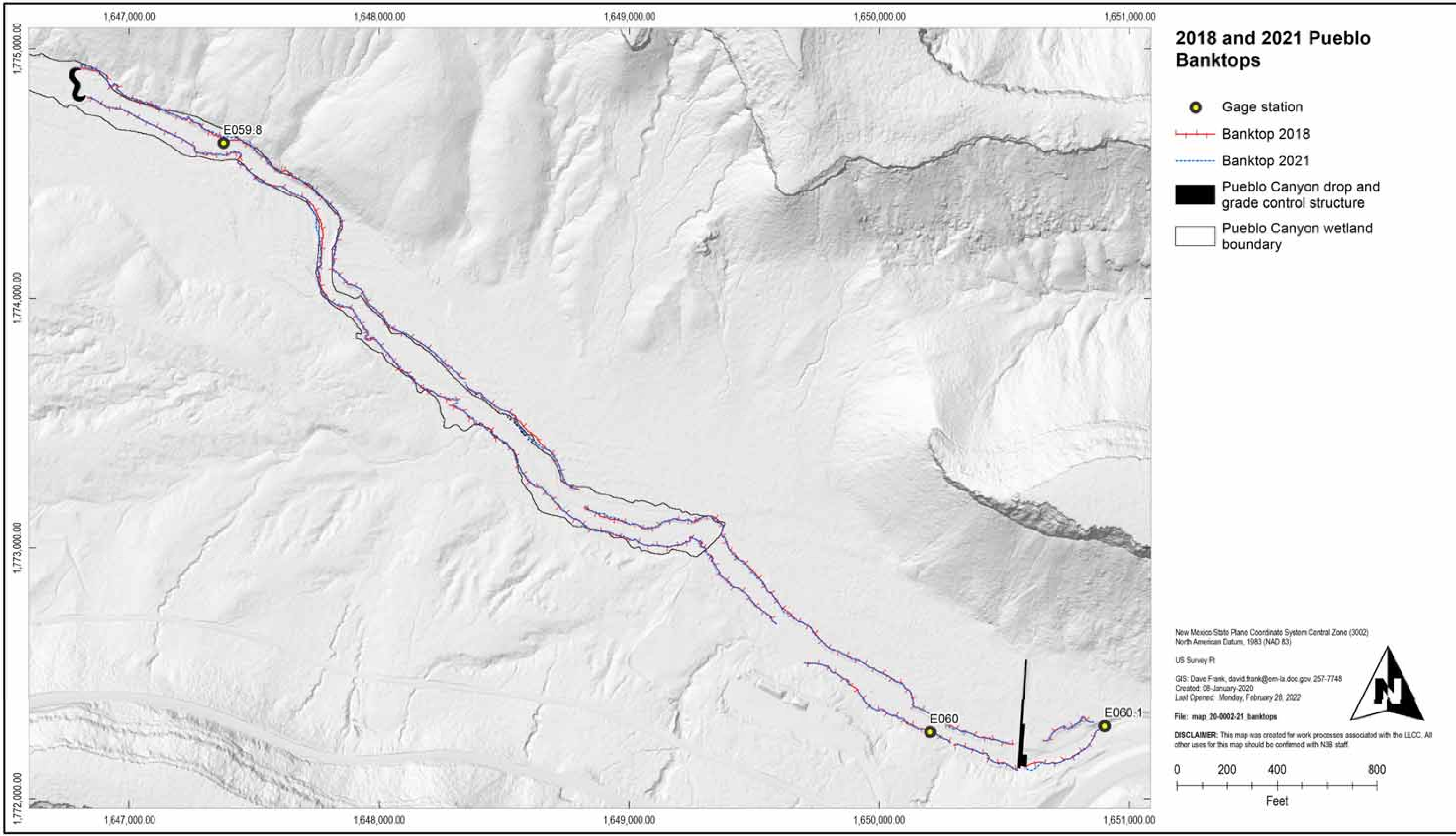


Figure B-4.1-4 2018 to 2021 channel bank comparison for Pueblo Canyon

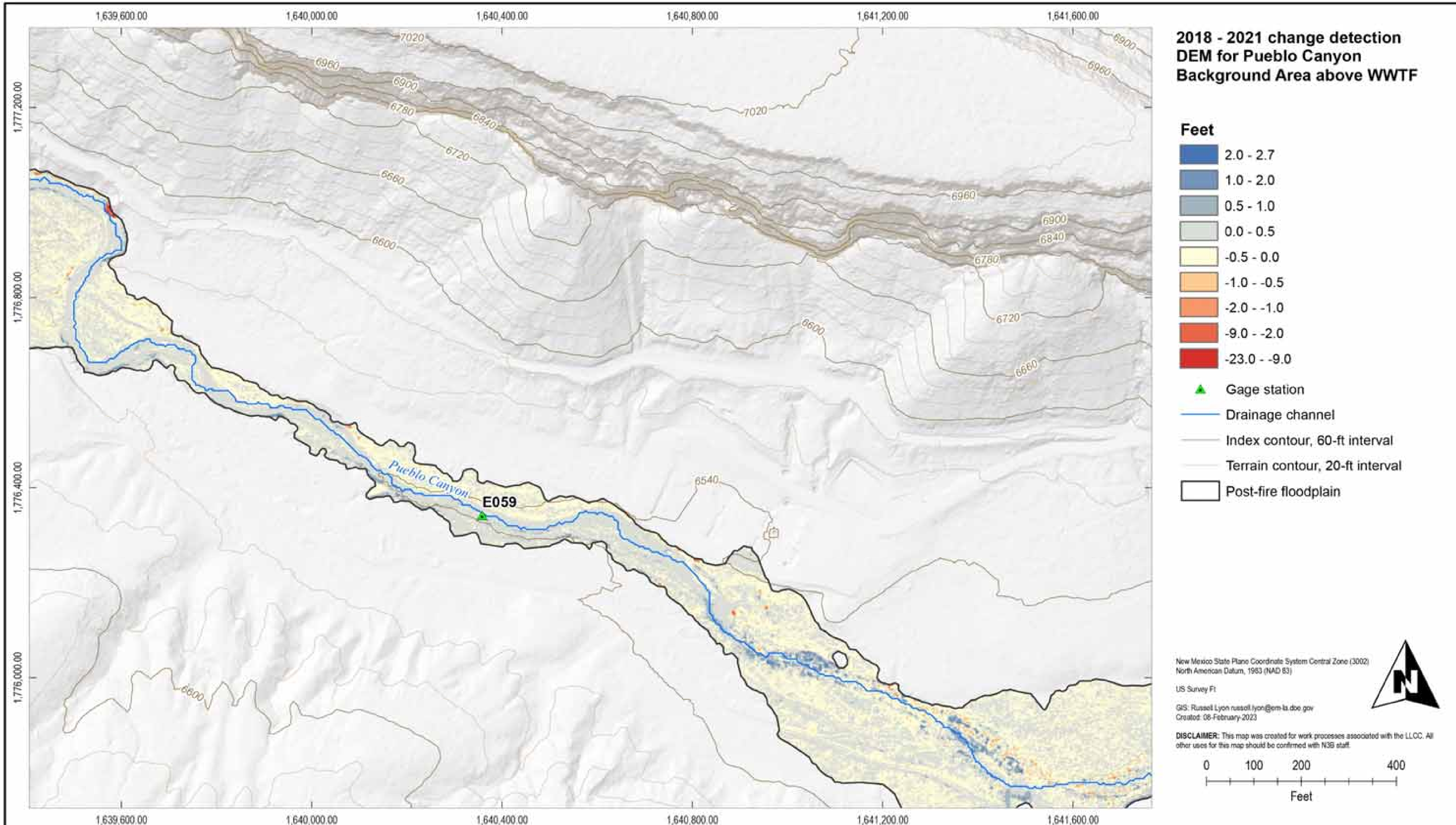


Figure B-4.2-1 2018 to 2021 DEM change detection for Pueblo Canyon background area above the WWTF

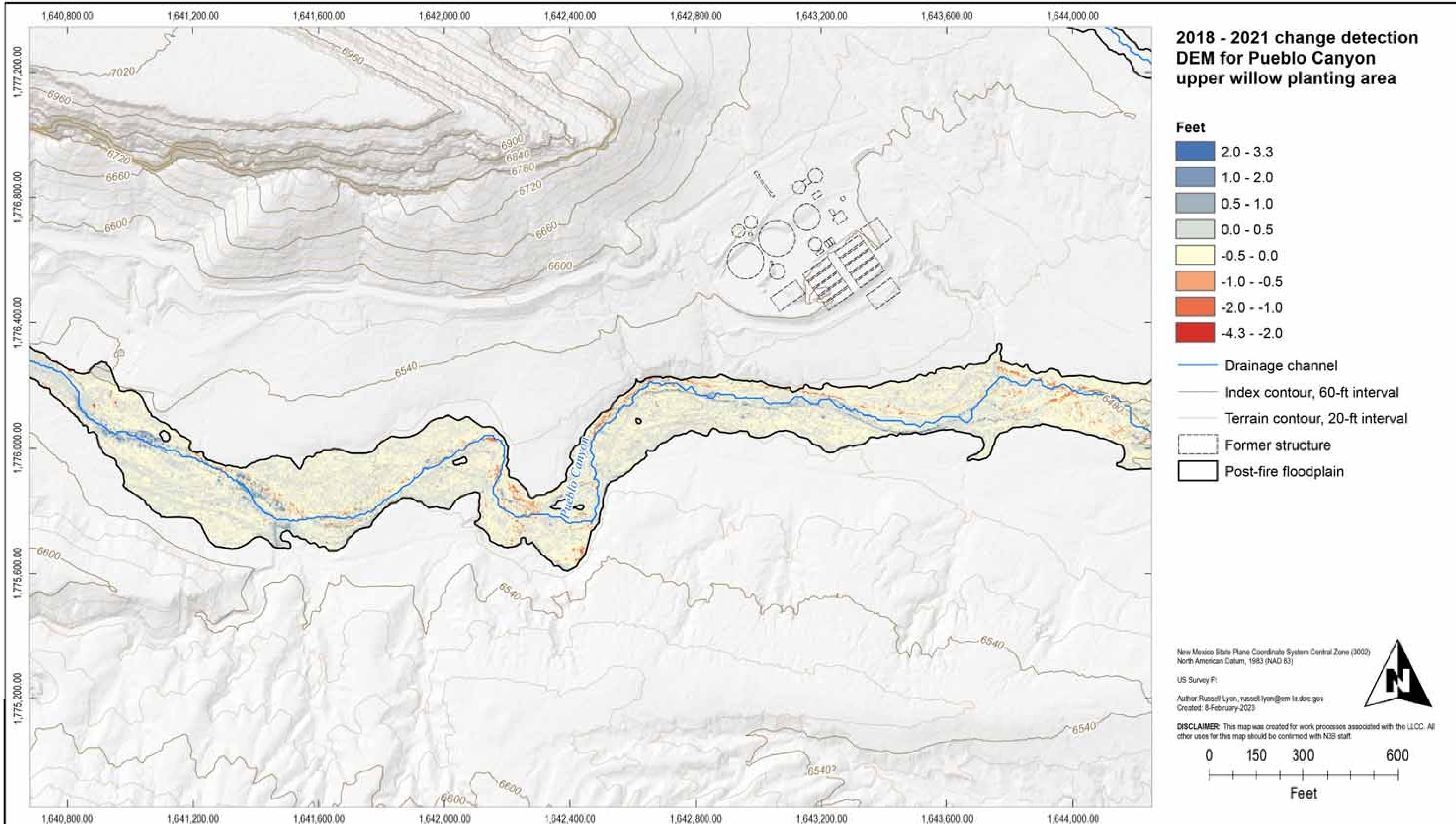


Figure B-4.3-1 **2018 to 2021 DEM change detection for Pueblo Canyon from E059.5 to WWTF near the upper willow planting area**

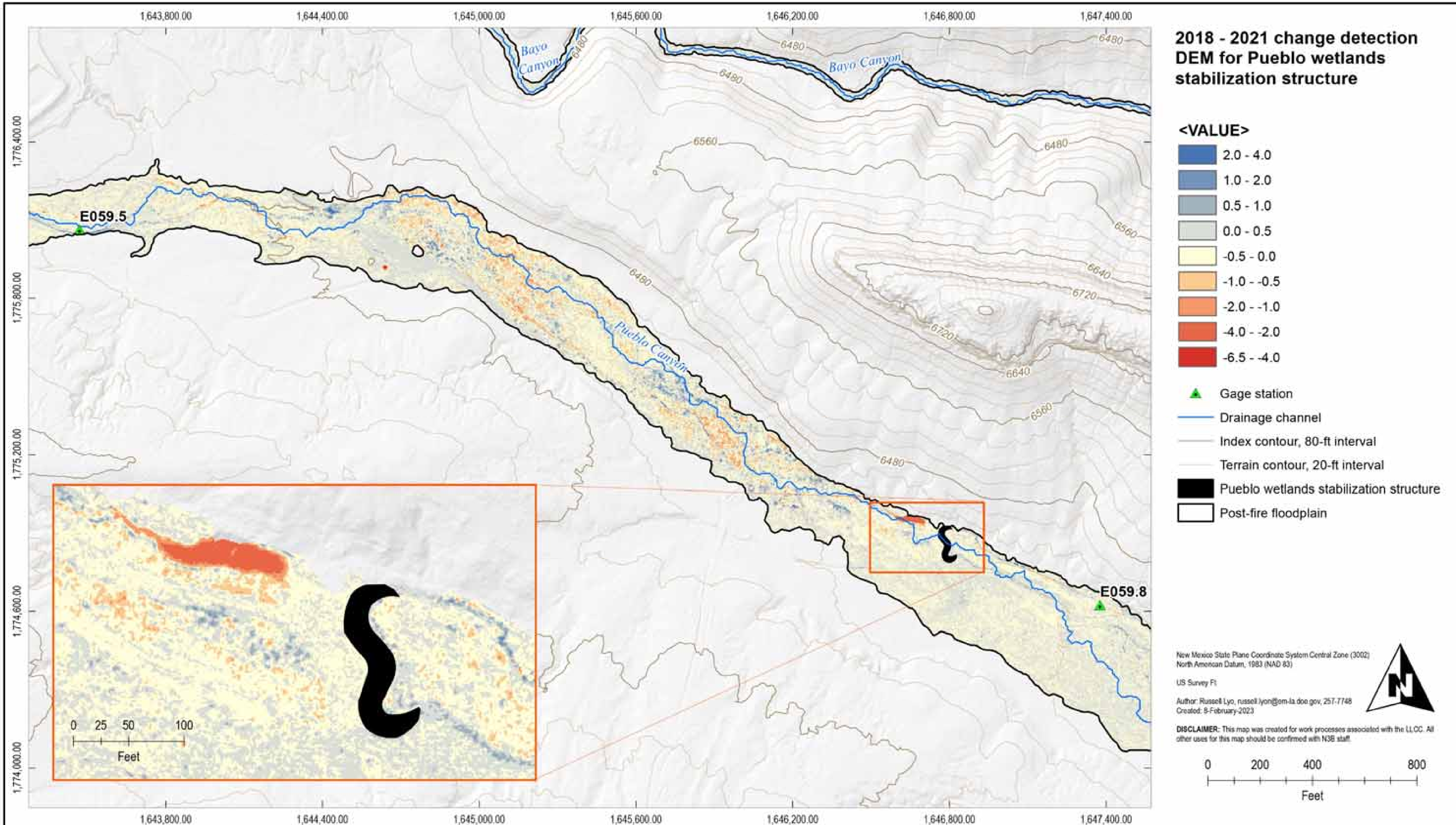


Figure B-4.4-1 2018 to 2021 LiDAR change detection in Pueblo Canyon from E059.8 to E059.5 near Pueblo Canyon drop structure

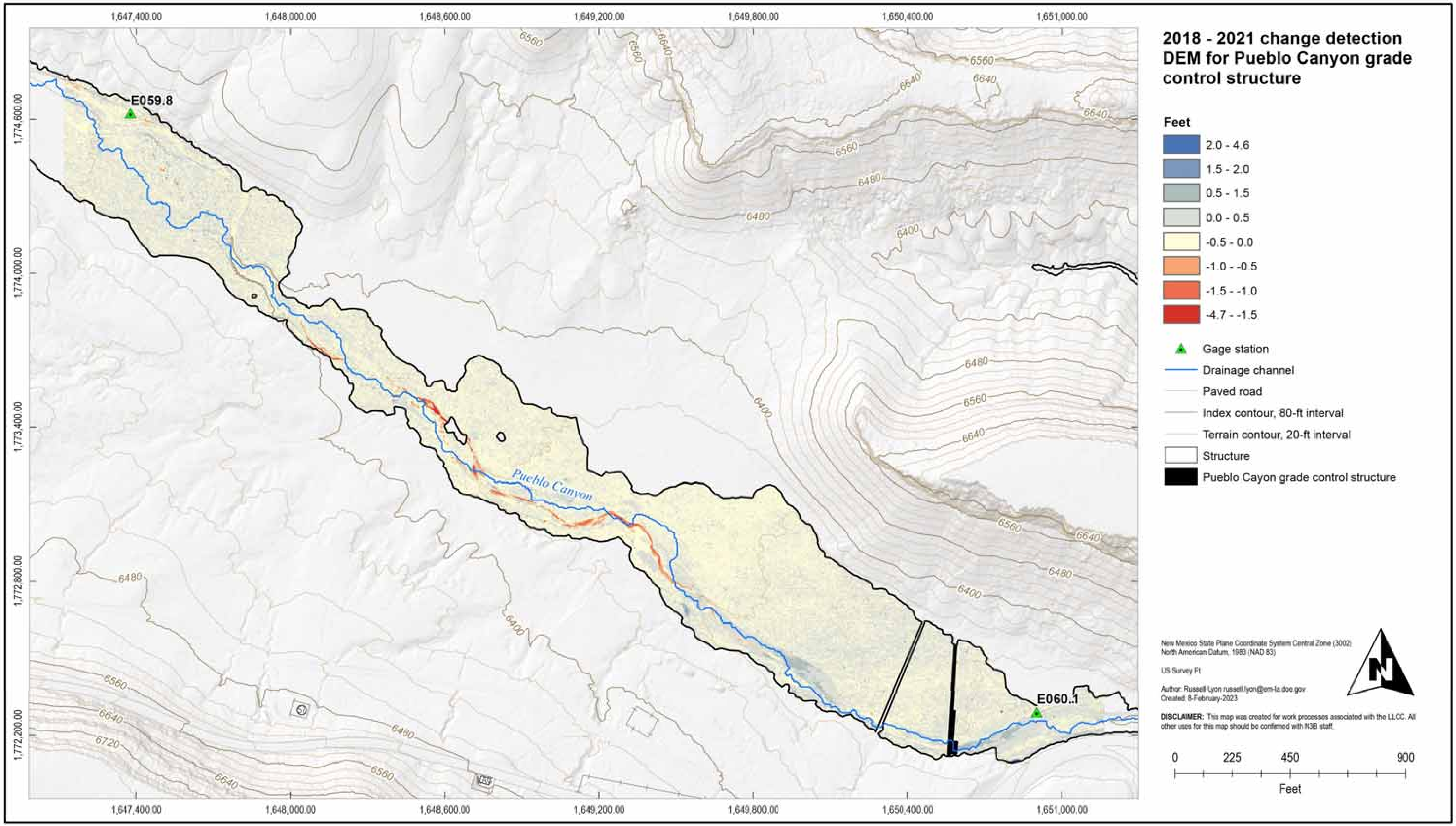


Figure B-4.5-1 **2018 to 2021 DEM change for Pueblo Canyon from E060.1 to E059.8 near the Pueblo Canyon GCS**

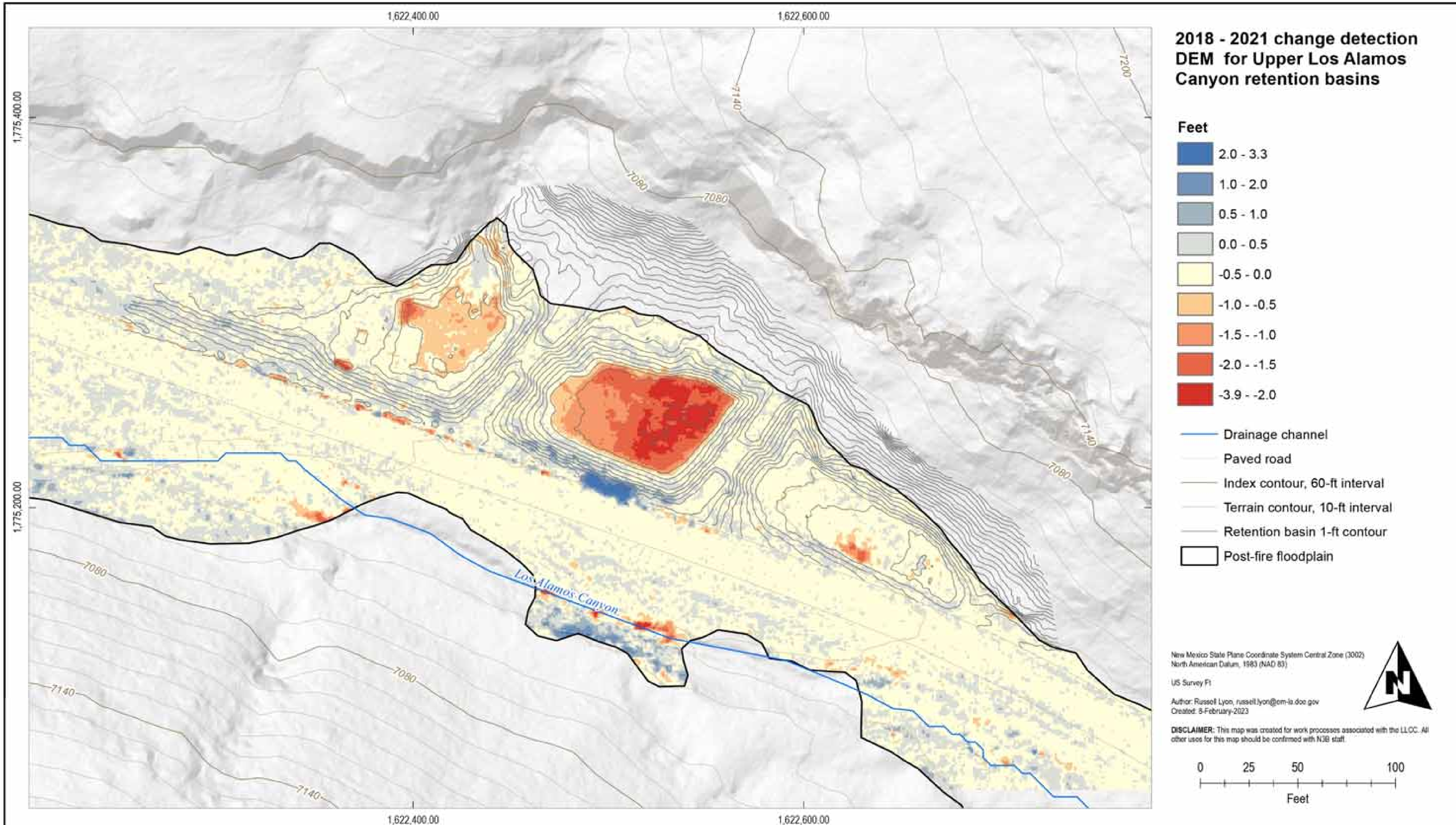


Figure B-4.6-1 2018 to 2021 LiDAR change detection in the upper Los Alamos detention basins near LA-SMA-2.1

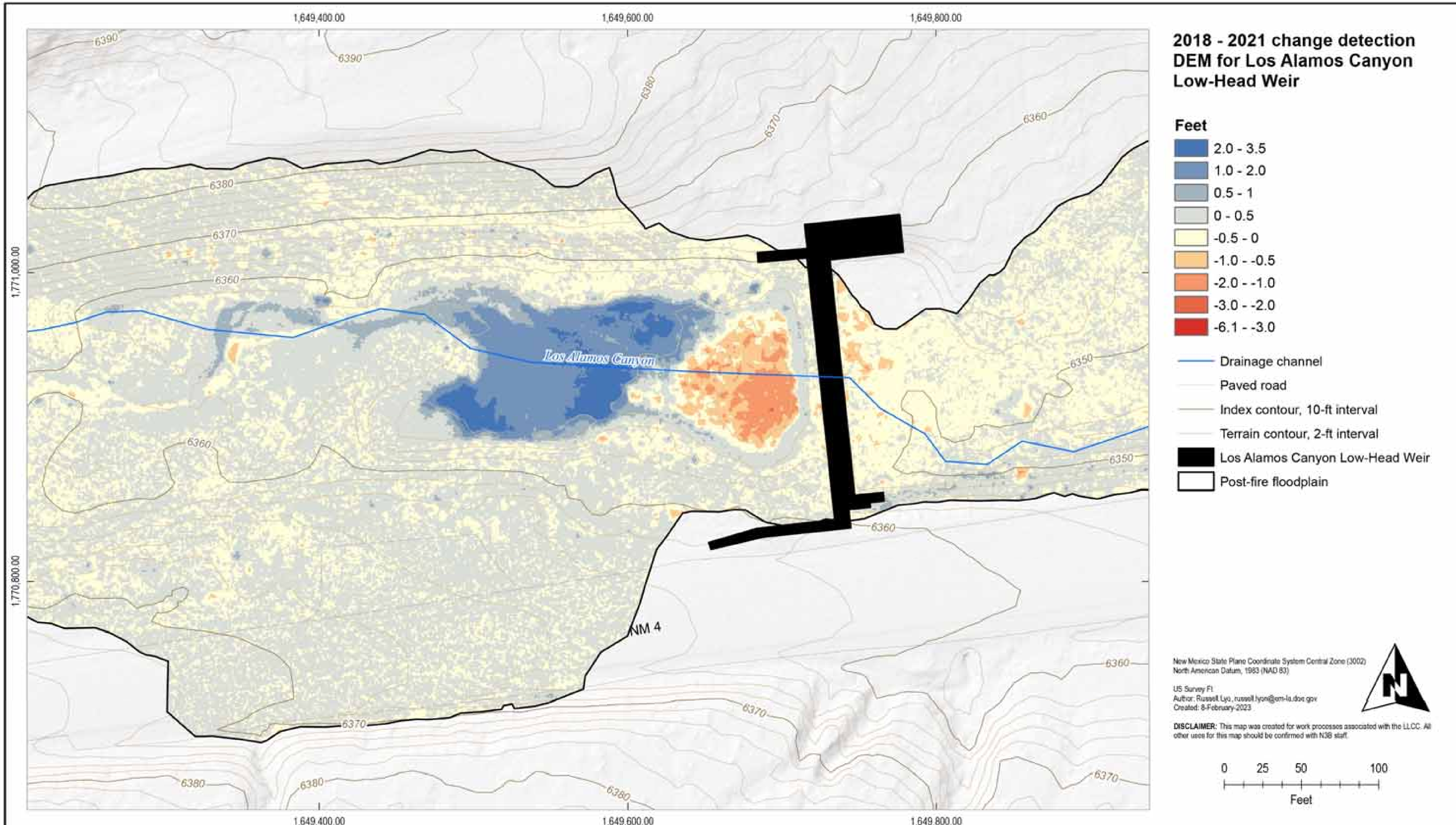


Figure B-4.7-1 2018 to 2021 LiDAR change detection near the Los Alamos Canyon low-head weir and associated sediment detention basins

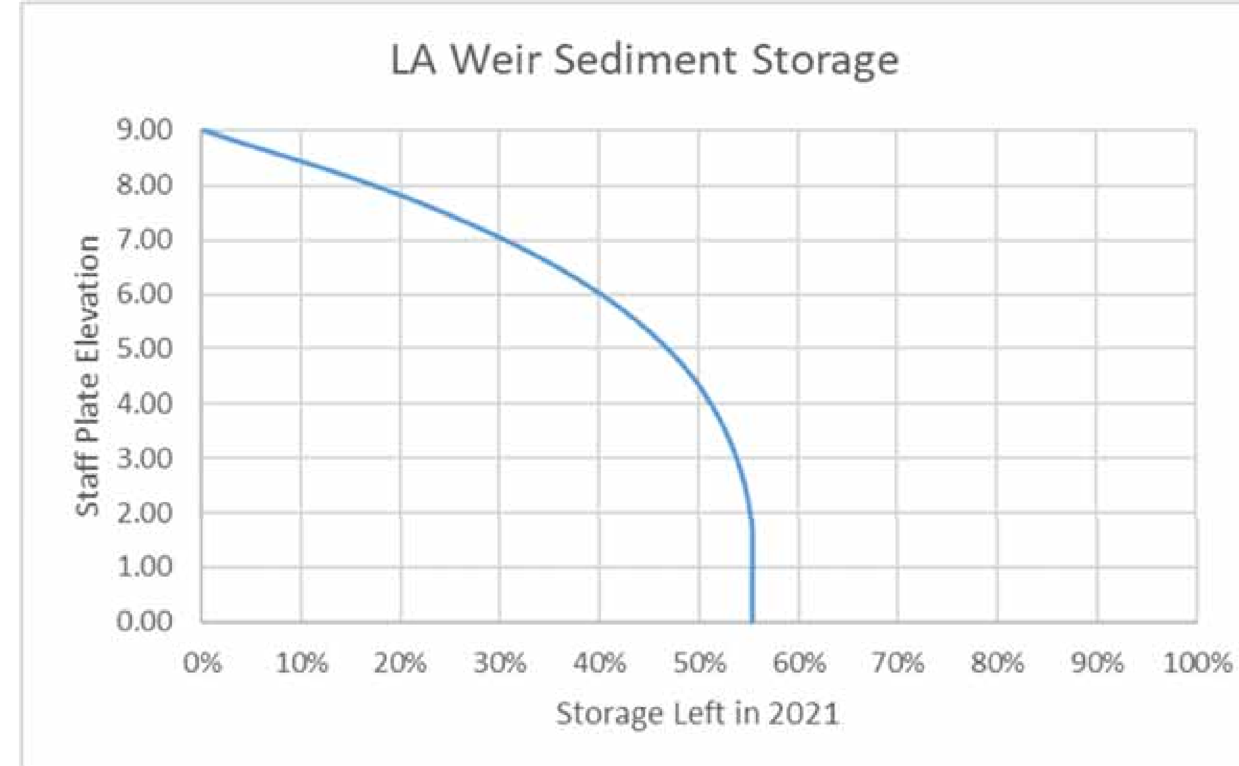


Figure B-4.7-2 Stage/storage relationship for Los Alamos low-head weir basins' percent storage remaining derived from 2021 LiDAR

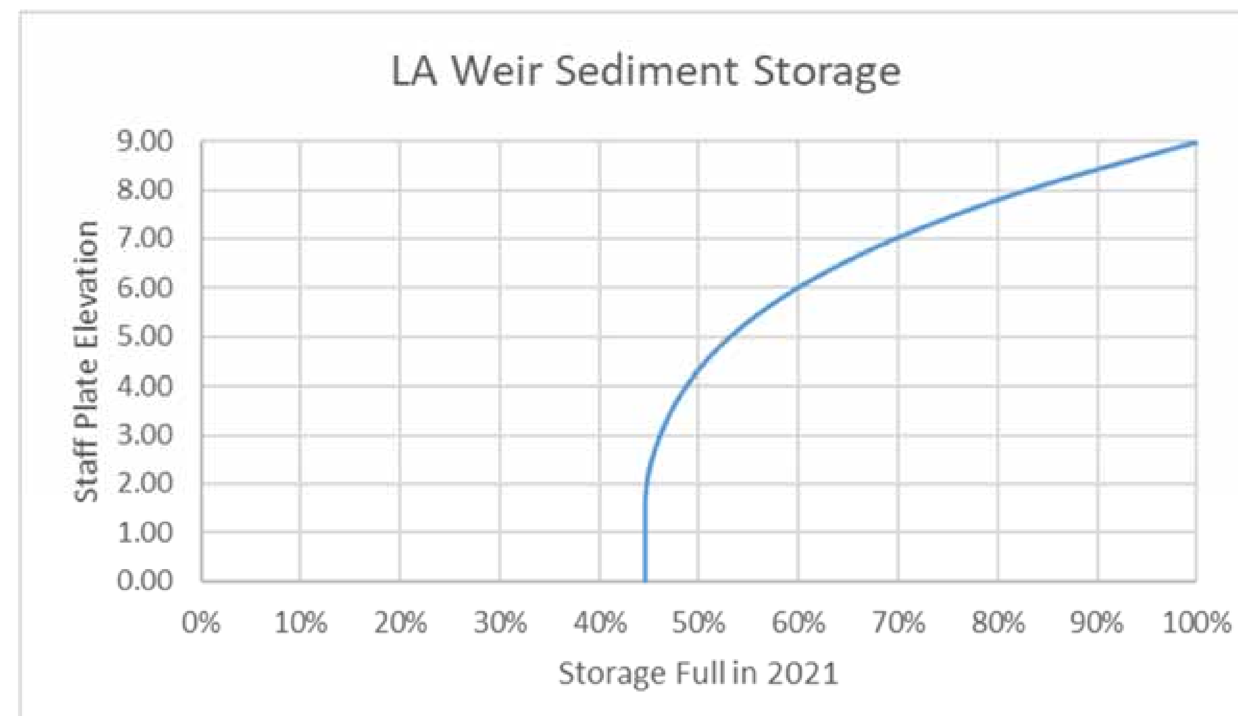


Figure B-4.7-3 Stage/storage relationship for Los Alamos Canyon low-head weir basins' percent storage capacity derived from 2021 LiDAR

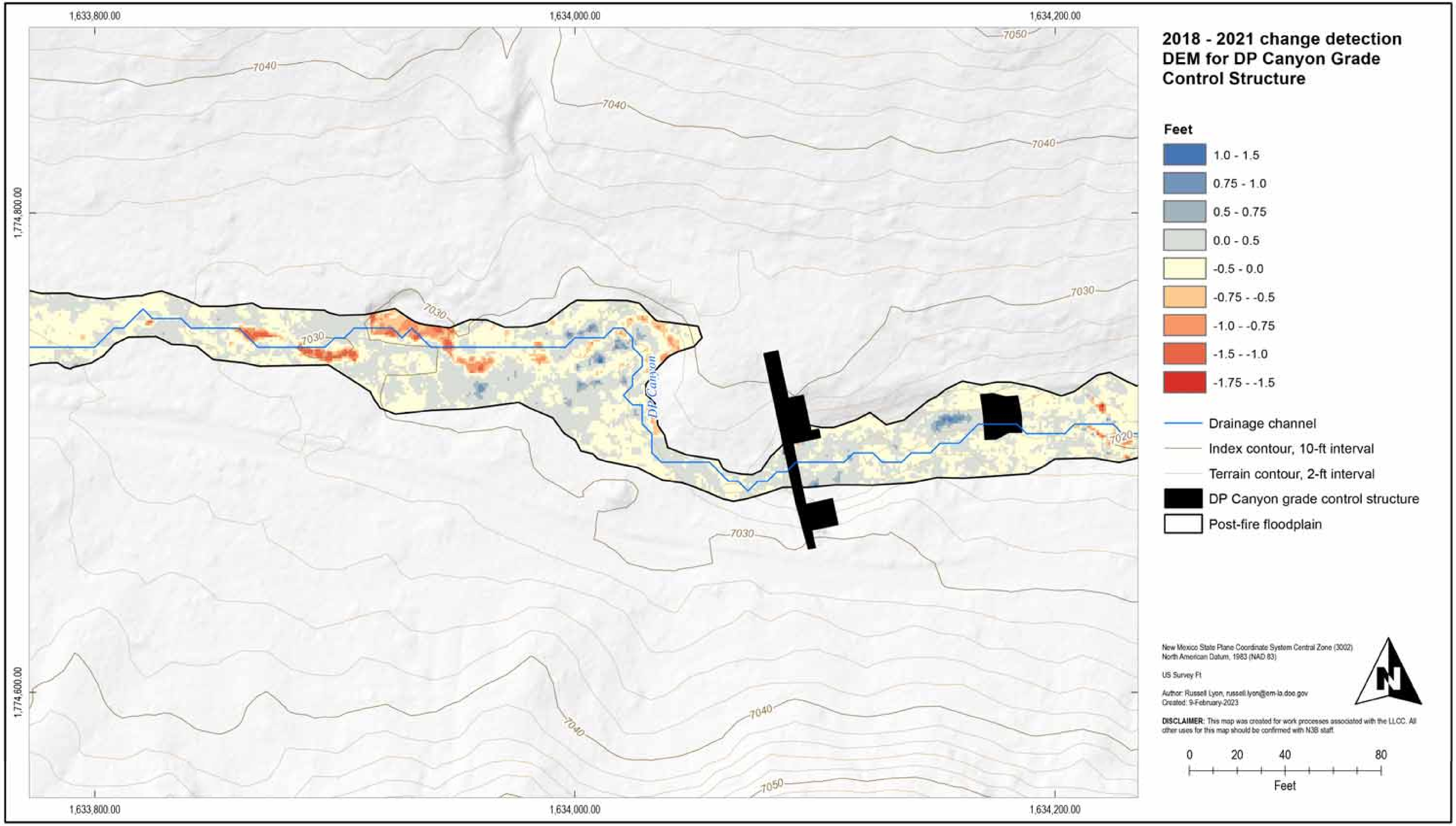


Figure B-4.8-1 2018 to 2021 DEM change near the DP Canyon GCS

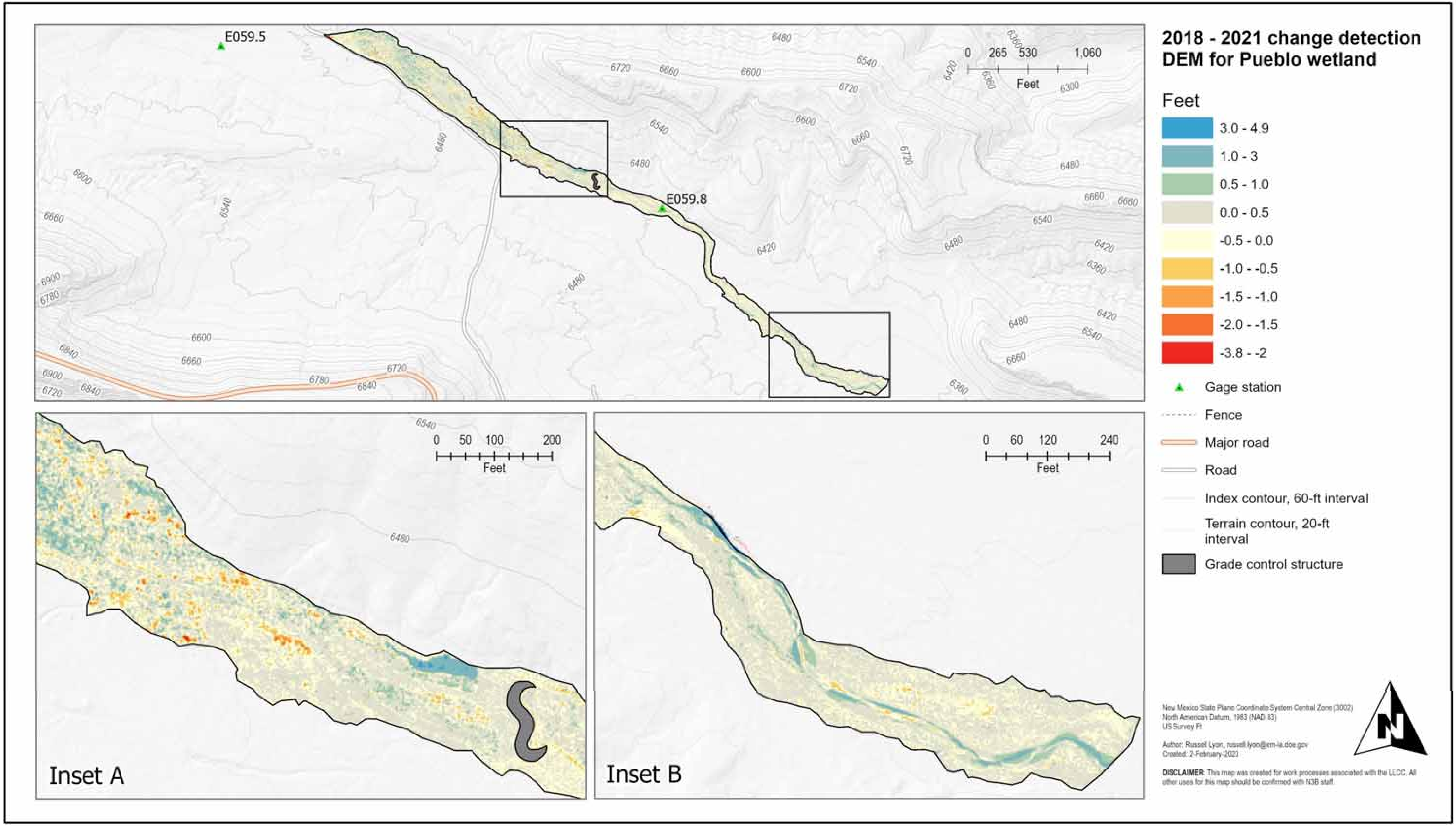


Figure B-4.9-1 **2018 to 2021 DEM change within the wetland area of interest**

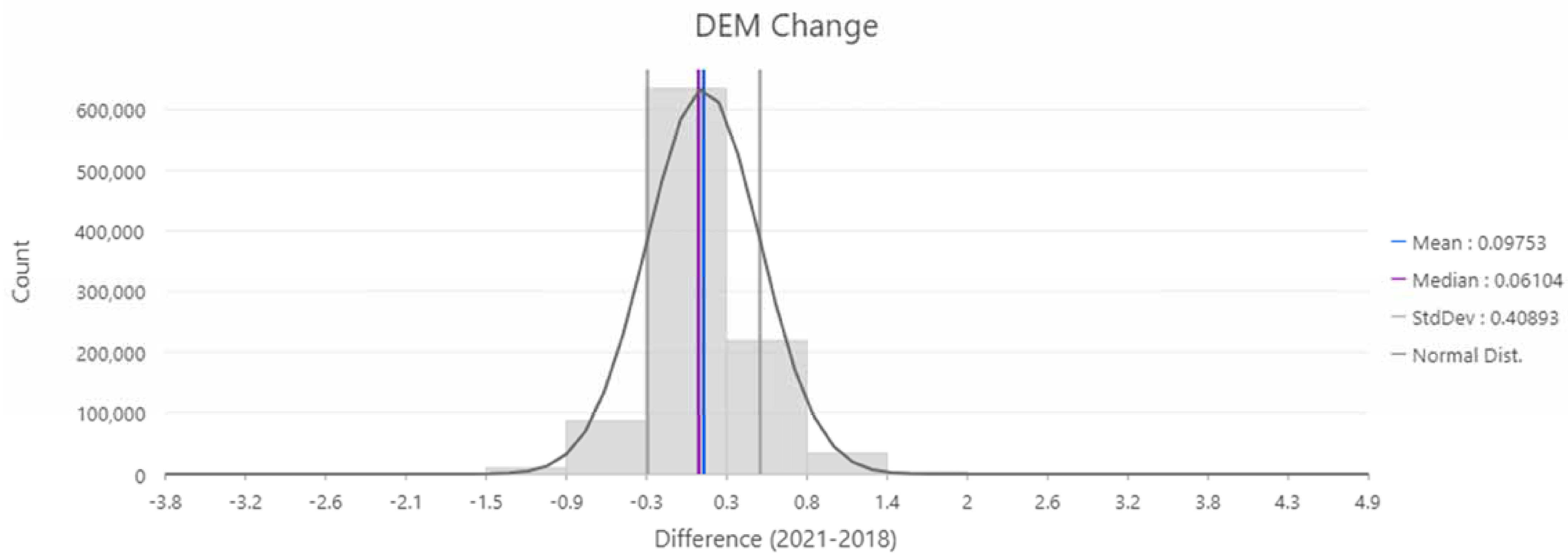


Figure B-4.9-2 Distribution of DEM differences (2021 minus 2018)

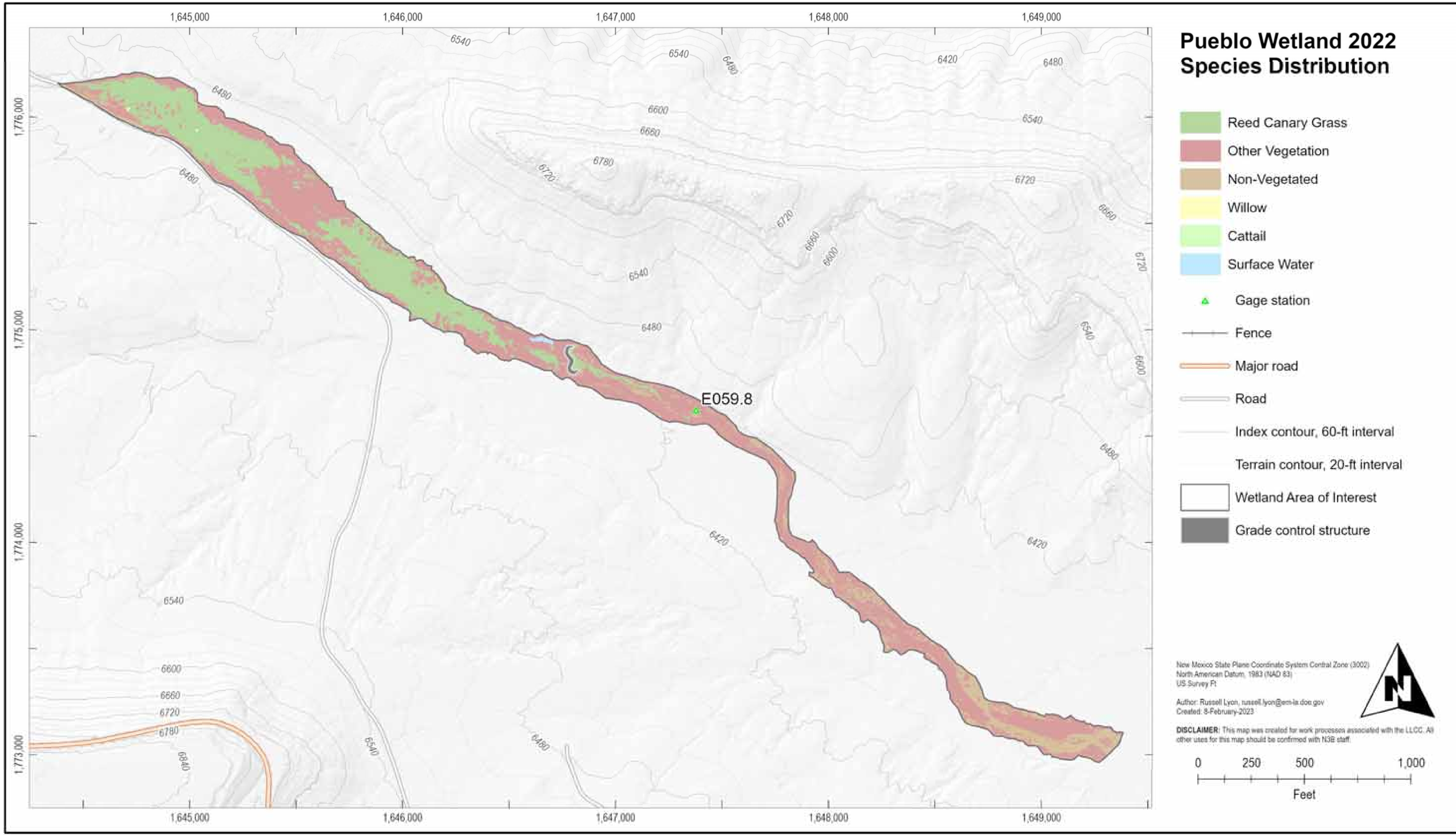


Figure B-4.10-1 2022 vegetation class species distribution

Figure B-4.10-2 **2019 to 2022 vegetation class distribution comparison**

Figure B-4.10-3 Field survey photo from February 8, 2023, shows willows (reddish stalks) grazed down to approximately 2 ft in height

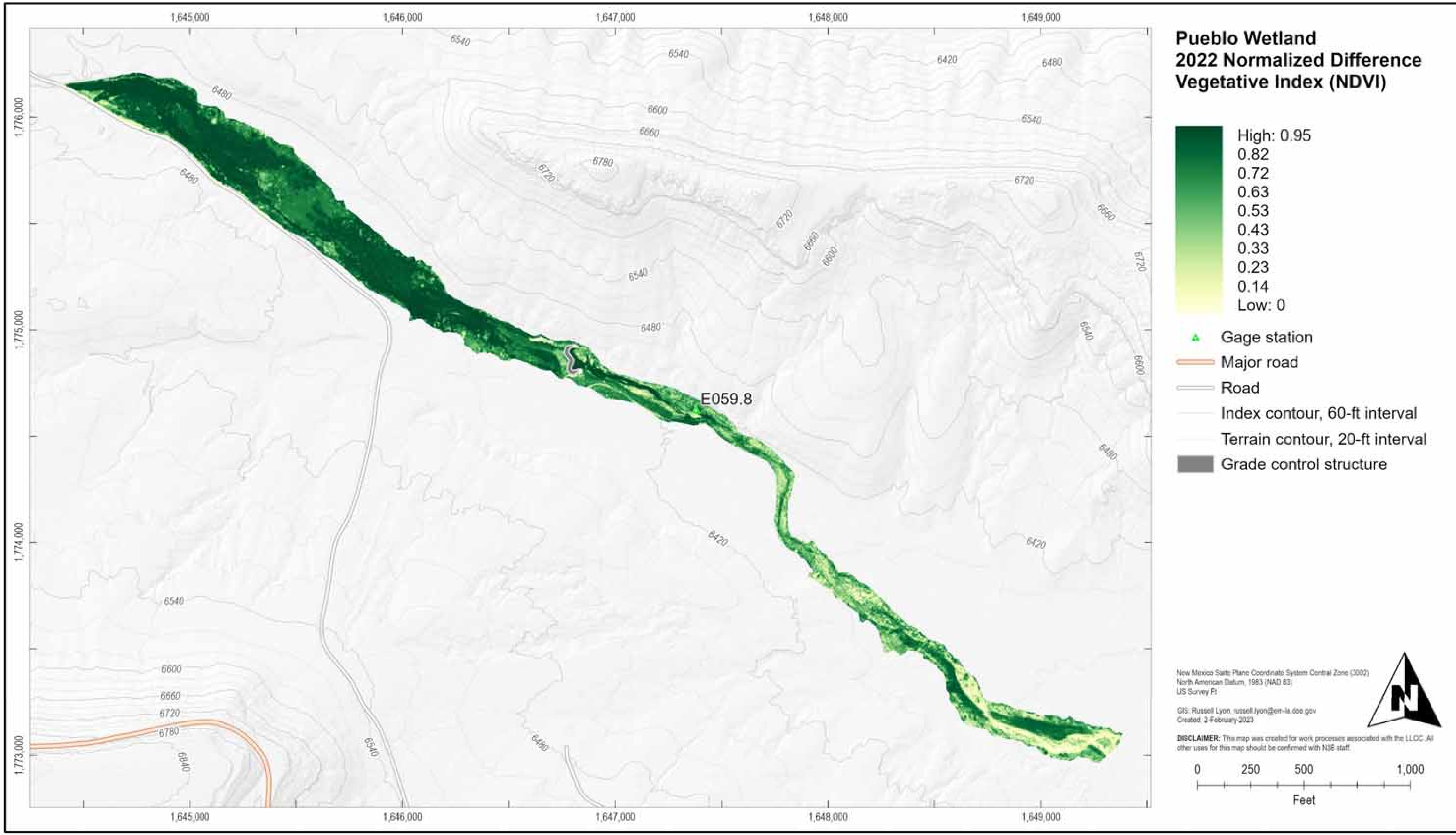


Figure B-4.10-4 2022 Normalized Difference Vegetative Index

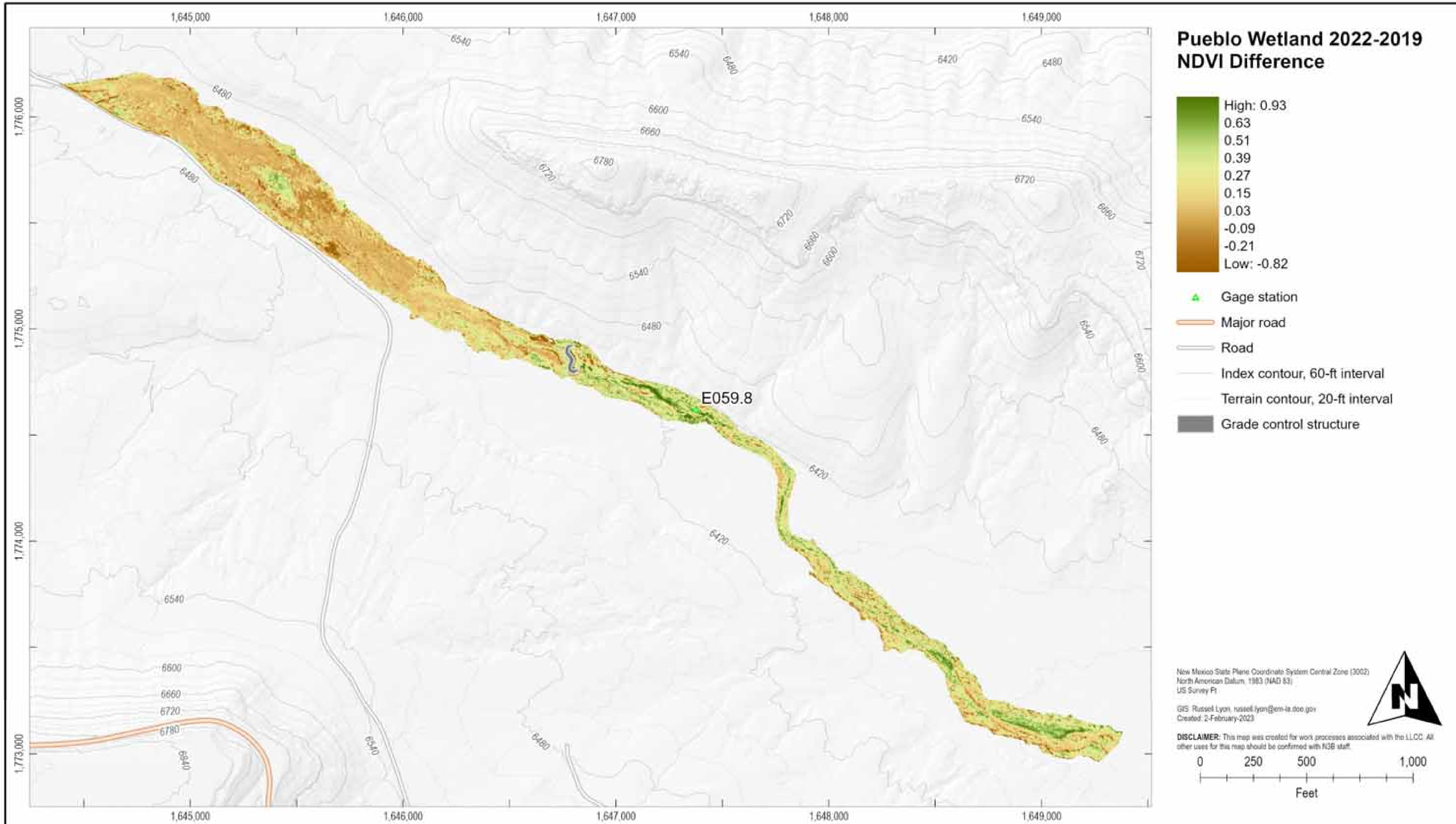


Figure B-4.10-5 2022–2019 NDVI difference

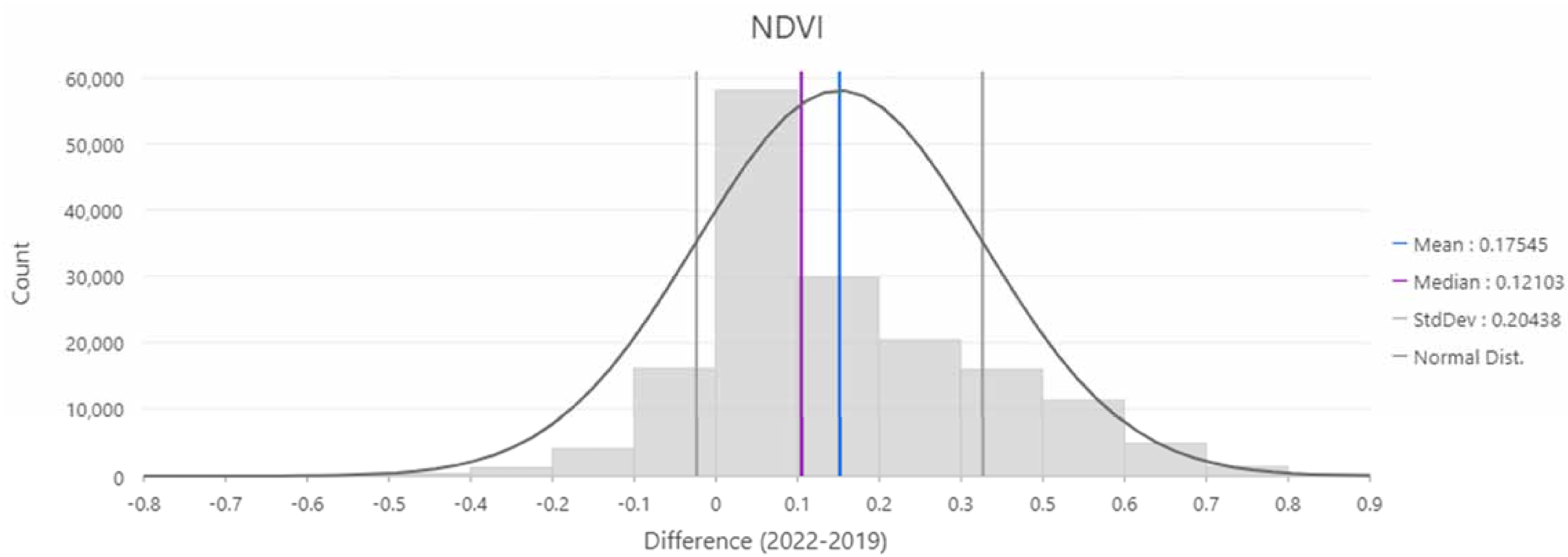


Figure B-4.10-6 Distribution of NDVI differences (2022–2019)

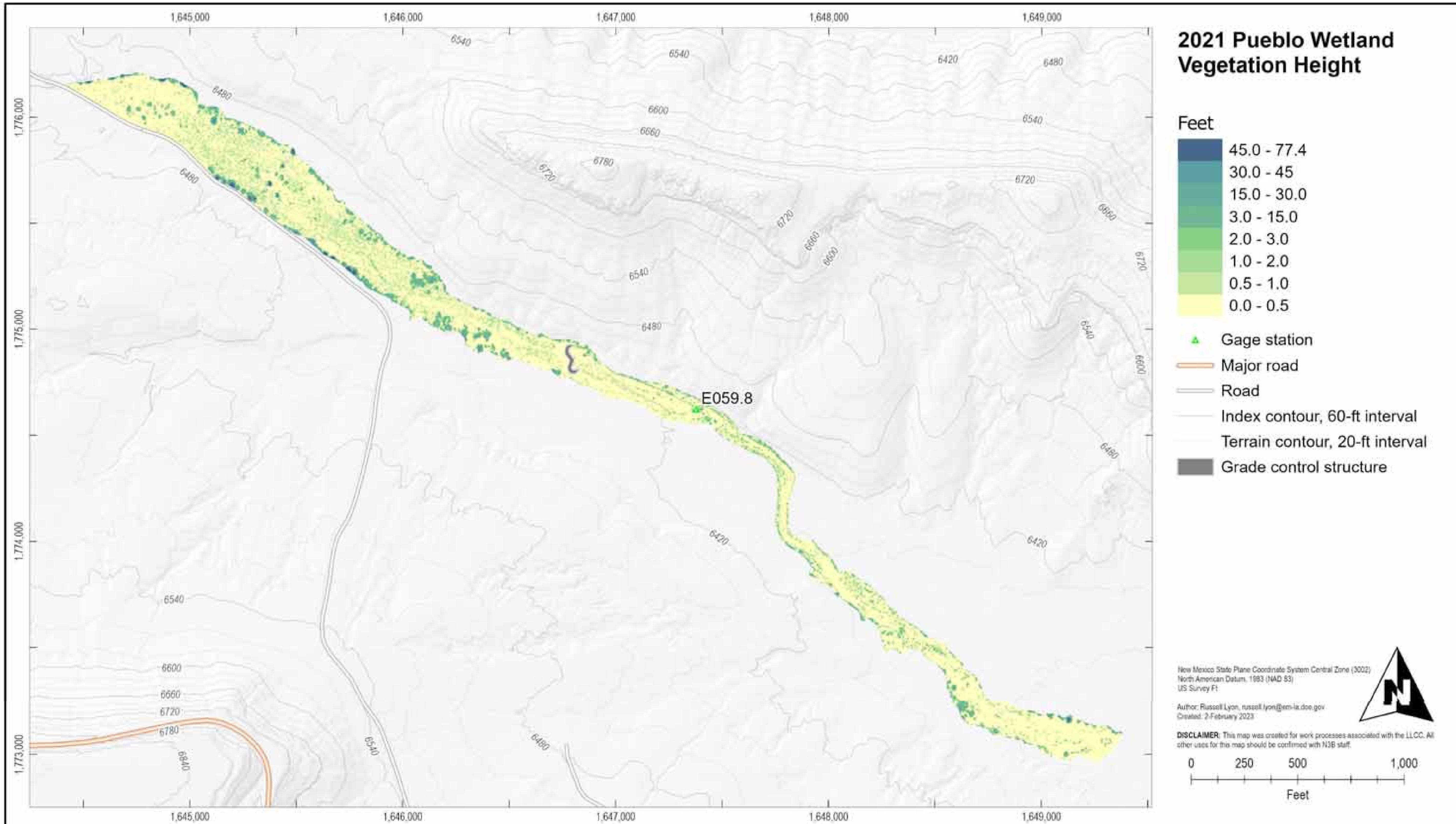


Figure B-4.10-7 **2021 vegetation height**

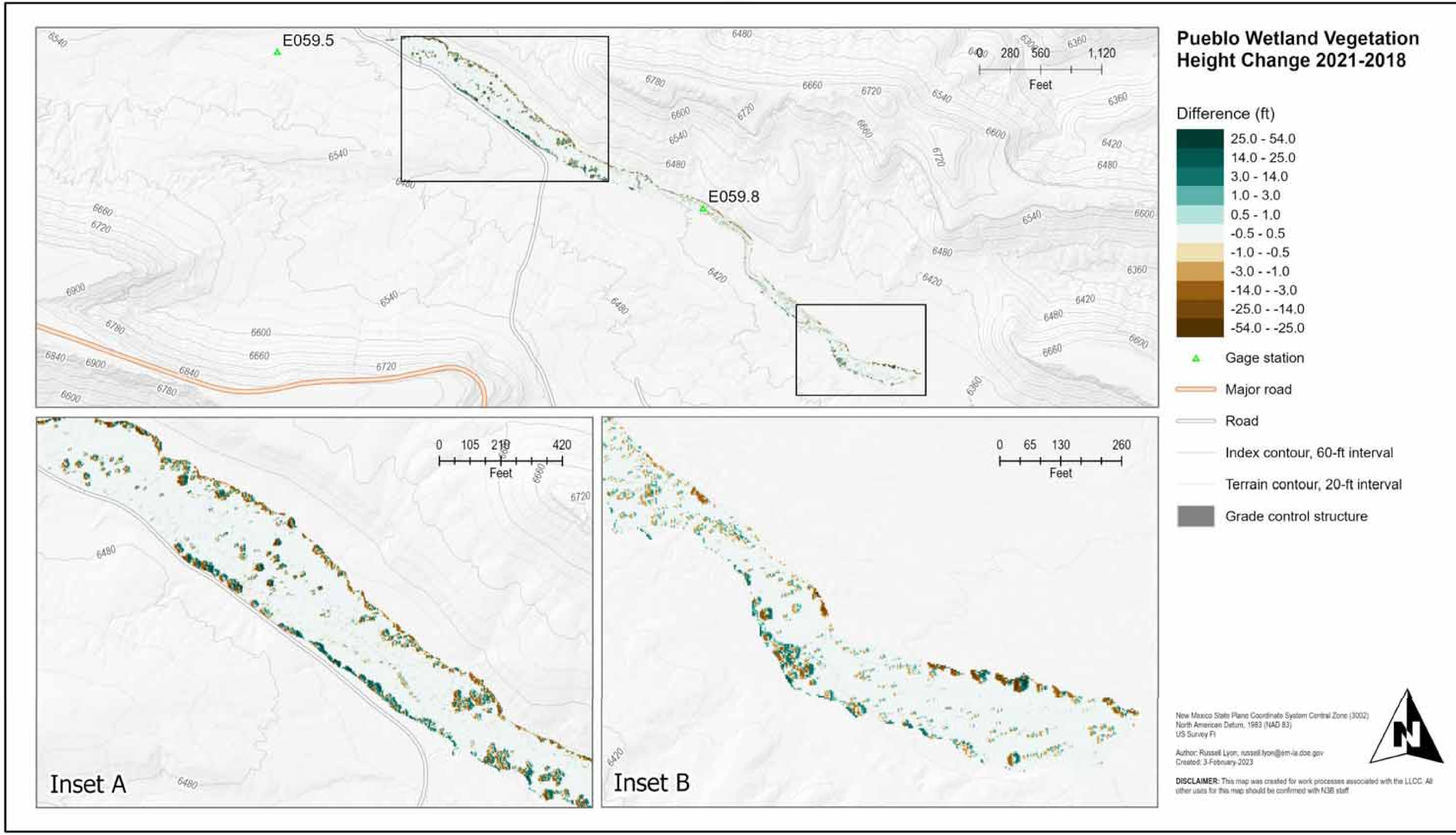


Figure B-4.10-8 2021-2018 vegetation height difference

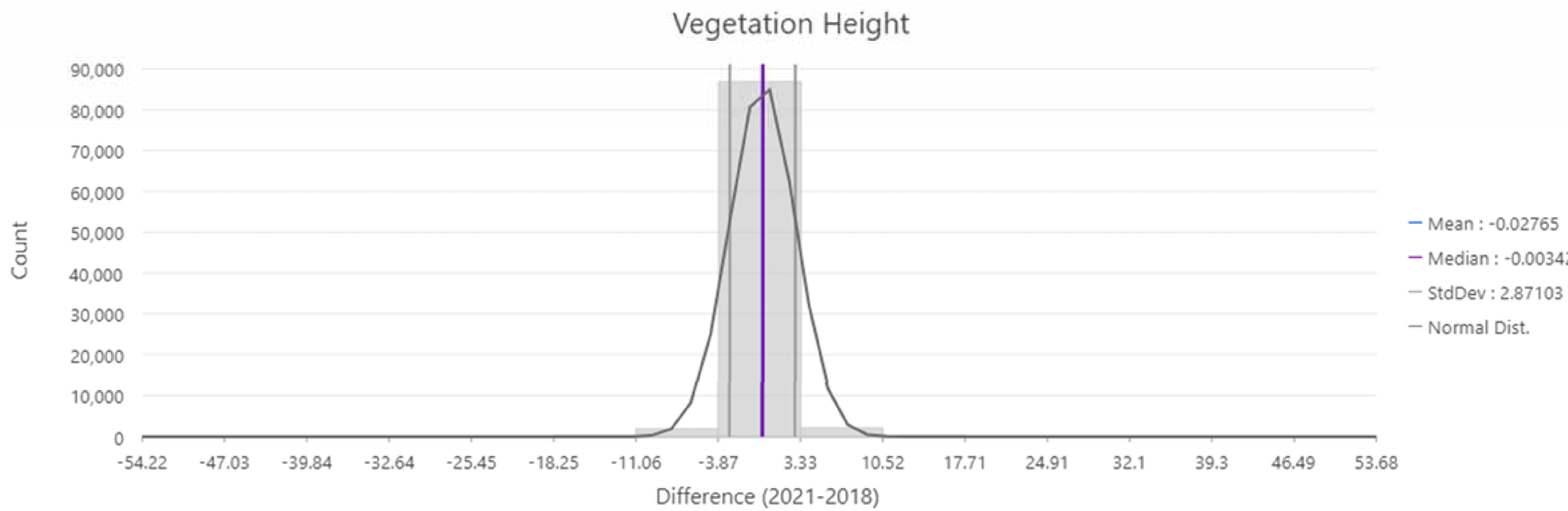


Figure B-4.10-9 Distribution of vegetation height differences (2021 minus 2018)

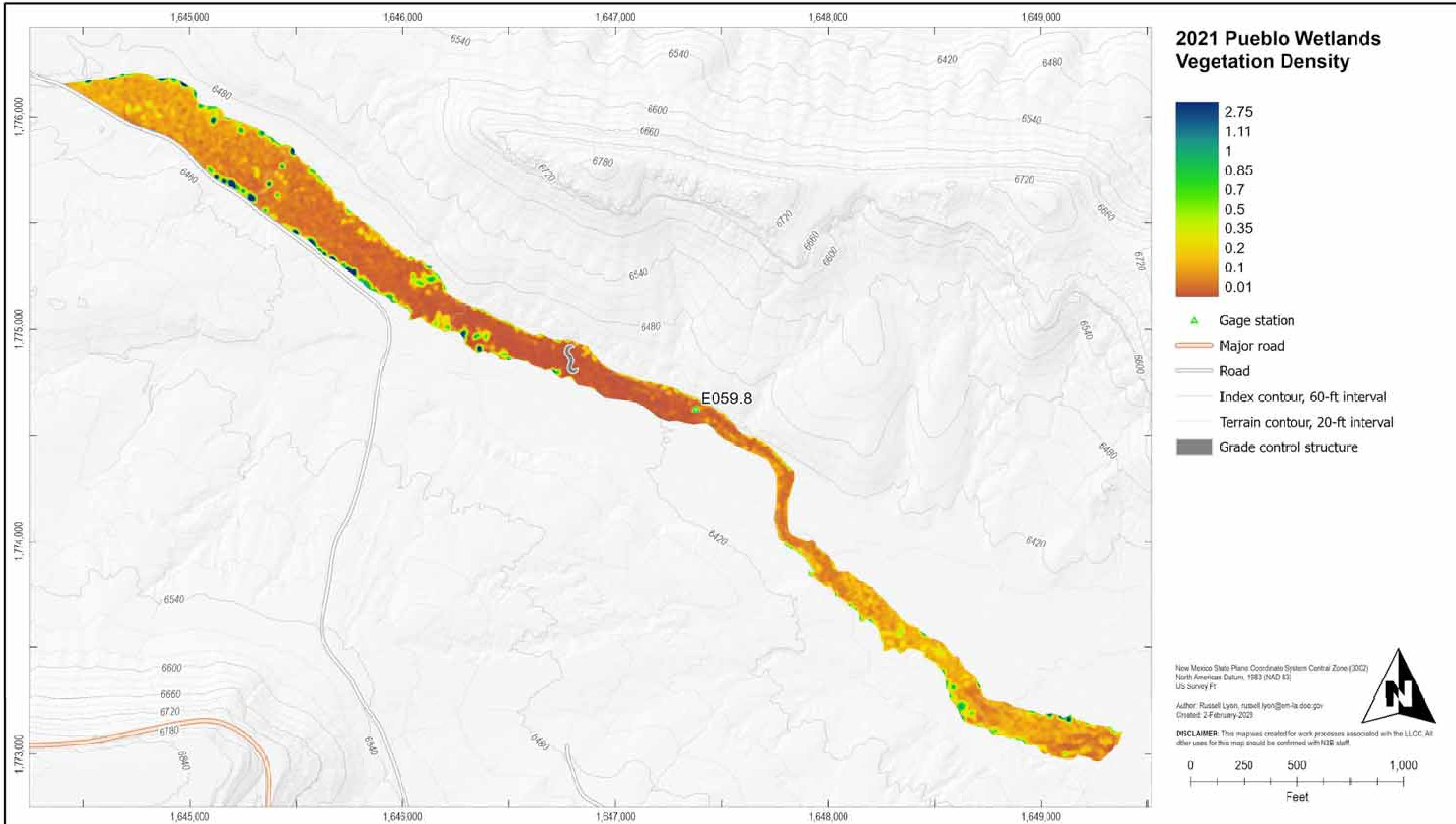


Figure B-4.10-10 2021 vegetation density

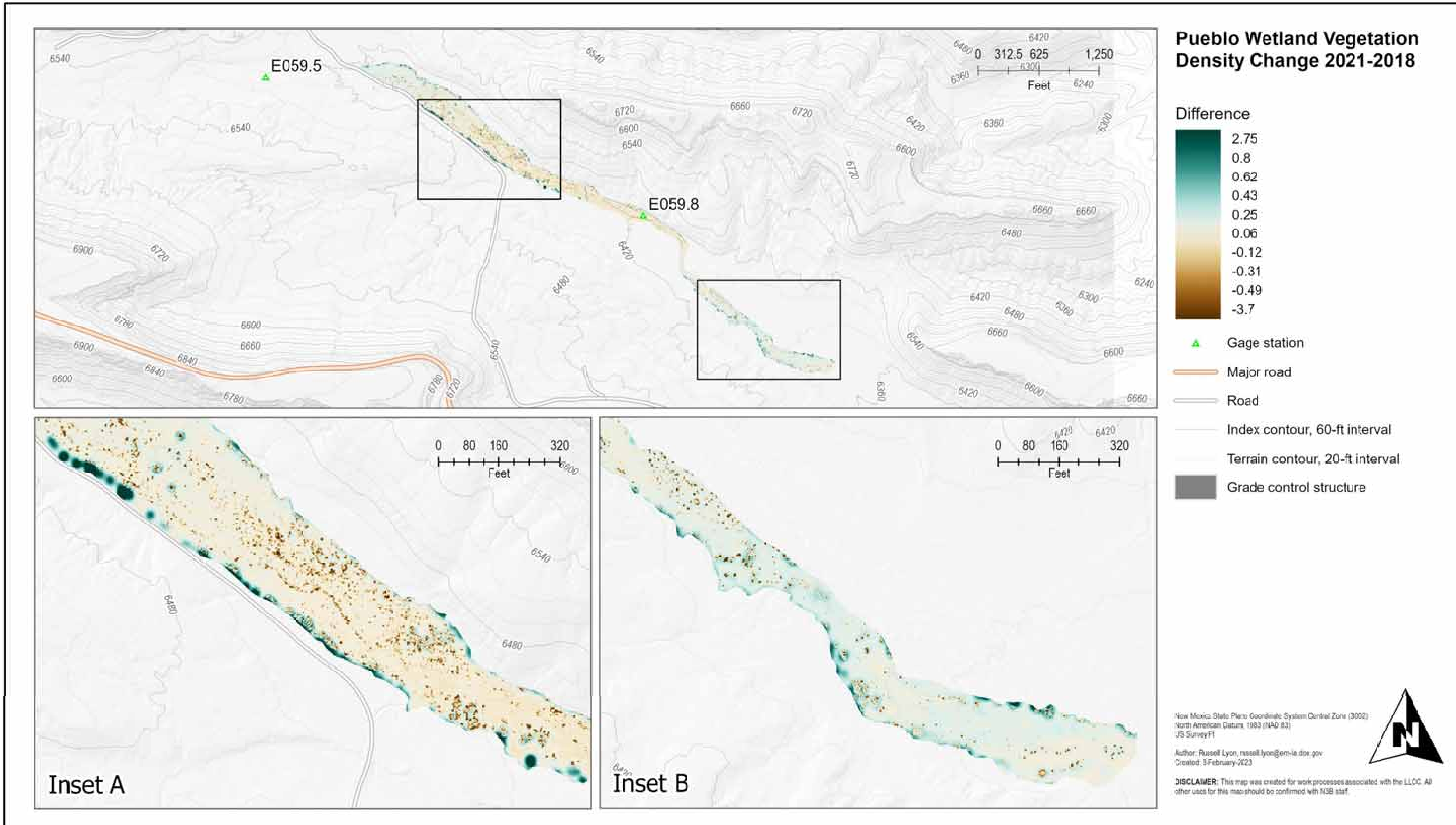


Figure B-4.10-11 2021–2018 vegetation density difference

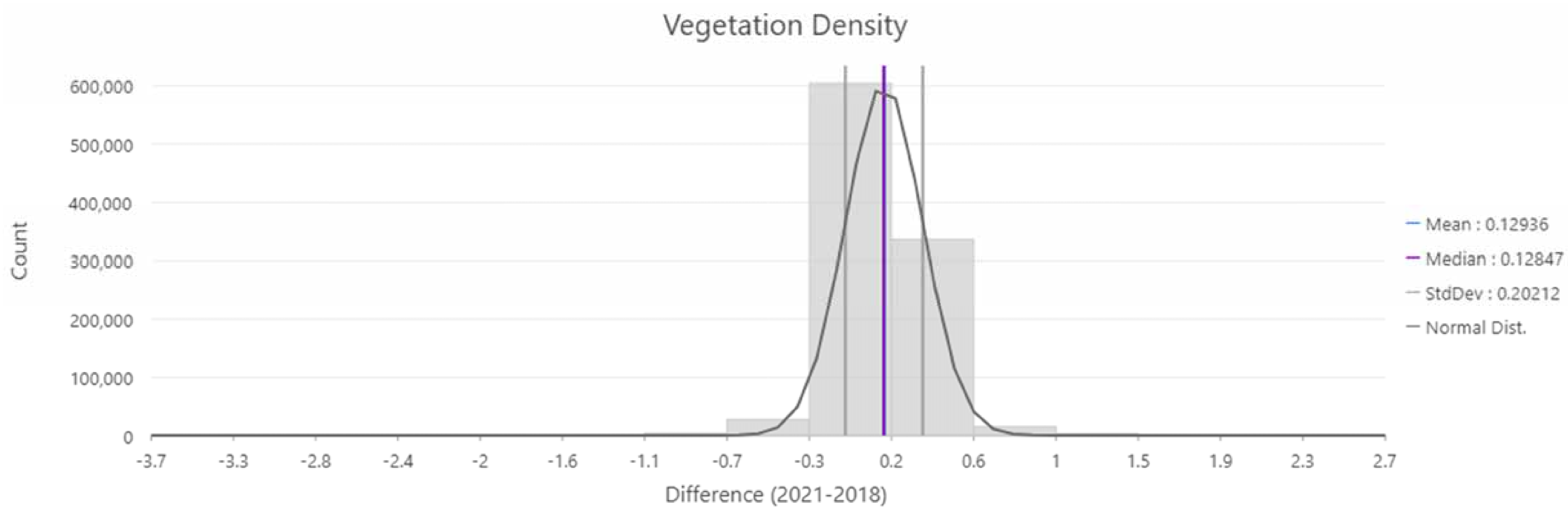


Figure B-4.10-12 Distribution of density differences (2021–2018)

Table B-3.0-1
Peak Discharge at Los Alamos/Pueblo Gaging Stations

Year	Los Alamos/Pueblo												
	DP Canyon			Los Alamos Canyon				Acid Canyon		Pueblo Canyon			
	E038	E039.1	E040	E026	E030	E042.1	E050.1	E055.5	E056	E055	E059.5	E059.8	E060.1
2012	79	97	46	130	130	290	170	0	27	13	na*	na	0
2013	330	400	830	850	450	740	740	47	820	80	na	na	1400
2014	270	320	270	54	290	210	210	16	45	70	97	na	54
2015	160	220	240	66	15	74	43	47	31	53	73	10	12
2016	130	42	75	56	9.8	63	25	35	17	18	45	6.9	3.8
2017	205	150	101	3.4	12	51	56	2.31	24	33	61	1.9	0.25
2018	115	75	78	2.2	0	10	2.3	0.92	4.6	14	0.43	0.08	1.1
2019	329	342	255	44	14	111	71	1.3	0	48	42	0	0.25
2020	38	3.25	0.06	0.52	40	0.07	0	6	0.16	0	1.2	0	0.22
2021	89	39	26	0.05	0	0.14	0.96	3.9	3.3	0	7.3	0	8.7
2022	325	304	162	0.9	0.38	48	15	17	102	97	104	3	1.3
Mean	188	181	189	110	87	145	121	16	98	39	48	3	135

* na = Not available.

Table B-4.7-1
Storage Capacity of Los Alamos Low-Head Weir
Sediment Detention Basins, Based on 2014 LiDAR

Basin	Storage (ft^3)	Storage (acre-ft)	Percent of Total Capacity
Lower Basin	276,570	6.35	95.9%
Middle Basin	4969	0.11	1.7%
Upper Basin	7016	0.16	2.4%
Total Capacity	288,555	6.62	100%

Table B-4.7-2
Stage/Storage Values for Los Alamos Canyon
Low-Head Weir Lower Sediment Detention Basin

Lower Basin Stage (ft)	Staff Plate (ft)	Storage (ft^3)	Storage (acre-ft)	% of Sediment Storage Remaining	% of Basin Capacity
6358.7	9.00	159,737	3.67	0%	100%
6357.7	8.00	110,094	2.53	17%	83%
6356.7	7.00	71,971	1.65	30%	70%
6355.7	6.00	43,986	1.01	40%	60%
6354.7	5.00	24,546	0.56	47%	53%
6353.7	4.00	11,872	0.27	51%	49%
6352.7	3.00	4371	0.10	54%	46%
6351.7	2.00	401	0.01	55%	45%
6350.7	1.00	0*	0.00	55%	45%
6349.7	0.00	0	0.00	55%	45%

* Lowest sediment level is at 1.76 ft.

Table B-4.7-3
Sediment Accumulation in Los Alamos Canyon
Low-Head Weir Sediment Detention Basins in 2014, 2018, 2021, and 2022

Year	Volume of Available Sediment Storage (ft^3)	% of Sediment Storage Remaining	% of Basin Capacity	Measurement Method
2014	288,555	100%	0%	2014 LiDAR
2018	174,488	60%	40%	2018 to 2021 LiDAR Change Detection DEM
2021	159,737	55%	45%	2021 LiDAR
2022	n/a*	55%	45%	Staff Plate Reading of 1.76

* n/a – Not applicable.

Table B-4.10-1
Individual and Total Area of Vegetation Classes from 2019 and 2022

	2022 Area (ft^2)	2022 % of Total Area	2019 Area (ft^2)	2019 % of Total Area	Change in Area (ft^2)	Change in Area (acres)	% Change
Canary Reed Grass	313,207	32%	479,229	48%	-166,022	-3.81	-35%
Willow	520	0.1%	5,613	1%	-5,093	-0.12	-91%
Cattail	32	0.003%	—*	—	32	0.001	—
Other	557,312	56%	420,777	42%	136,535	3.13	32%
Non-vegetated	119,273	12%	83,900	8%	35,373	0.81	42%
Surface water	1,964	0.2%	36	0.004%	1,928	0.04	5307%
Mixed Willow/Canary Reed Grass	—	—	4,317	0.4%	-4317	-0.10	—
Wetland Total	992,309	100	993,873	100	-1,564	-0.04	—

* — = Class was eliminated in the 2022 survey.

Table B-4.10-2
Percent Change of NDVI, Vegetation Height, and Vegetation Density by Species Class

	Average 2022 NDVI	Average 2019 NDVI	Percent Change in NDVI (from 2019 to 2022)	Average 2021 Vegetation Height (ft)	Average 2018 Vegetation Height (ft)	Percent Change in Vegetation Height (from 2018 to 2021)	Average 2021 Vegetation Density	Average 2018 Vegetation Density	Percent Change in Vegetation Density (from 2018 to 2021)
Reed Canary Grass	0.88	0.75	17%	0.51	0.97	-47%	0.13	0.54	-76%
Cattail	0.74	—*	—	0.46	—	—	0.19	—	—
Willow	0.78	0.58	34%	3.68	2.43	51%	0.34	0.65	-48%
Wetland Total	0.69	0.52	33%	1.37	1.42	-4%	0.19	0.49	-61%

* — = Class was eliminated in the 2022 survey.

Attachment B-1

Los Alamos National Laboratory
LiDAR Mapping Project 2018 Collection
(on CD included with this document)

Attachment B-2

Los Alamos National Laboratory 2019
Airborne Hyperspectral Project Report
(on CD included with this document)

Attachment B-3

Los Alamos National Laboratory
LiDAR Mapping Project
Data Delivery Report PART I
(on CD included with this document)

Attachment B-4

Project MEDLEY 2022
Los Alamos National Laboratory 2022
Airborne Hyperspectral Project
(on CD included with this document)

Appendix C

2022 Watershed Mitigation Inspections

C-1.0 INTRODUCTION

Watershed stormwater controls and grade-control structures (GCSs) are inspected biannually and after significant flow events (greater than 50 cubic feet per second) to ensure that the watershed mitigations are functioning properly and to identify needed maintenance. Examples of items evaluated during inspections include the following:

- Debris/sediment accumulation that could impede operation
- Water levels behind retention structures
- Physical damage to structure, or failure of structural components
- Undermining, piping, flanking, settling, movement, or breeching of structure
- Vegetation establishment and vegetation that may negatively impact structural components
- Rodent damage
- Vandalism
- Erosion

The photographs in this appendix depict the biannual inspections of watershed mitigations in Los Alamos and Pueblo Canyons. Each group of photographs is associated with a specific feature (e.g., standpipe or weir) that has the potential to develop issues. Photographs of features were taken to mirror previous inspection photographs as closely as possible. Pre-monsoon spring inspections were conducted in May 2022, and post-monsoon fall inspections were completed in October 2022. Table C-1.0-1 lists the maintenance dates (recommended and completed).

Table C-1.0-1
Los Alamos and Pueblo Watershed Controls Maintenance

Maintenance	Date Recommended	Date Completed
C-2.0 DP Canyon Grade Control Structure		
Repair holes in gabion	n/a	5/5/2022
Trash pickup	n/a	10/26/2022
C-3.0 Upper Los Alamos Canyon Sediment Detention Ponds		
Removed vegetation from basin spillways	5/23/2022	10/26/2022
Remove fallen tree from pipe support beam	5/23/2022	8/4/2022
Trash and debris pickup	10/26/2021	5/23/2022
C-4.0 Los Alamos Canyon Weir		
Repair holes in gabion	n/a	5/18/2022
Trash pickup	n/a	10/28/2022
C-5.0 Pueblo Canyon Grade Control Structure		
Remove vegetation from spillway	5/23/2022	10/25/2022
Repair broken wire in gabion baskets	10/14/2021	5/23/2022
C-6.0 Pueblo Wetland Stabilization Structure		
Recommend removal of old silt fence	5/23/2022	pending

*n/a = Not applicable.

C-2.0 DP CANYON GRADE CONTROL STRUCTURE

C-2.1 Embankments

Photo C-2.1-1 May 2022—South embankment, upstream of GCS, looking west/upstream

Photo C-2.1-2 October 2022—South embankment, upstream of GCS, looking west/upstream

C-2.2 Overflow Weir Structure

Photo C-2.2-1 May 2022—Upstream face of GCS, looking northeast

Photo C-2.2-2 October 2022—Upstream face of GCS, looking northeast

Photo C-2.2-3 May 2022—Crest of GCS, looking north

Photo C-2.2-4 October 2022—Crest of GCS, looking north

C-2.3 Standpipe

Photo C-2.3-1 May 2022—Standpipe. Sediment level is approximately 1 ft below wood stop board. No significant change since last inspection. Continue to monitor.

Photo C-2.3-2 October 2022—Standpipe. Sediment level is approximately 1 ft below wood stop board. No significant change since last inspection. Continue to monitor.

C-2.4 Spillway

Photo C-2.4-1 May 2022—GCS spillway and flow-way, looking south

Photo C-2.4-2 October 2022—GCS spillway and flow-way, looking south

C-2.5 Outlet

Photo C-2.5-1 May 2022—Outlet. Pond level was above the bottom of the culvert invert at time of inspection.

Photo C-2.5-2 October 2022—Outlet. Pond level was above the bottom of the culvert invert at time of inspection.

C-3.0 UPPER LOS ALAMOS CANYON SEDIMENT DETENTION PONDS

C-3.1 Basin Embankment and Ponds

Photo C-3.1-1 May 2022—Lower basin, looking east

Photo C-3.1-2 October 2022—Lower basin, looking east

Photo C-3.1-3 May 2022—Upper basin, looking southwest at gabion overflow structure

Photo C-3.1-4 October 2022—Upper basin, looking west at gabion overflow structure

C-3.2 Basin Spillways

Photo C-3.2-1 May 2022—Lower basin spillway, looking north

Photo C-3.2-2 October 2022—Lower basin spillway, looking north. Vegetation was removed from spillway during inspection.

Photo C-3.2-3 May 2022—Upper basin spillway, looking north

Photo C-3.2-4 October 2022—Upper basin spillway, looking north. Vegetation was removed from spillway during inspection.

C-3.3 Wetland and Culvert

Photo C-3.3-1 May 2022—Wetland, looking west

Photo C-3.3-2 October 2022—Wetland, looking west

Photo C-3.3-3 May 2022—Wetland culvert outlet

Photo C-3.3-4 October 2022—Wetland culvert outlet

C-3.4 Upstream Pipeline and Appurtenances

Photo C-3.4-1 May 2022—Pipeline headwall

Photo C-3.4-2 October 2022—Pipeline headwall

Photo C-3.4-3 May 2022—Pipeline supports

Photo C-3.4-4 October 2022—Pipeline supports. Downed tree was removed from support beam.

Photo C-3.4-5 May 2022—Pipeline cleanout

Photo C-3.4-6 October 2022— Pipeline cleanout and local observer

Photo C-3.4-7 May 2022—Pipeline vacuum breaker

Photo C-3.4-8 October 2022—Pipeline vacuum breaker

Photo C-3.4-9 May 2022—Pipeline bridge structure

Photo C-3.4-10 October 2022—Pipeline bridge structure

Photo C-3.4-11 May 2022—Pipeline outlet, energy dissipater, and gabion overflow structure

Photo C-3.4-12 October 2022—Pipeline outlet, energy dissipater, and gabion overflow structure

Photo C-3.4-13 May 2022—Pipeline energy dissipater

Photo C-3.4-14 October 2022—Pipeline energy dissipater

Photo C-3.4-15 May 2022—Discharge culvert inlets and trash racks

Photo C-3.4-16 October 2022—Discharge culvert inlets and trash racks

Photo C-3.4-17 May 2022—Discharge culvert outlets and bank protection

Photo C-3.4-18 October 2022—Discharge culvert outlets and bank protection

C-4.0 LOS ALAMOS CANYON LOW-HEAD WEIR AND ASSOCIATED DETENTION BASINS

C-4.1 Embankments

Photo C-4.1-1 May 2022—Upstream southern embankment, looking west/upstream

Photo C-4.1-2 October 2022—Upstream southern embankment, looking west/upstream

**Photo C-4.1-3	May 2022—Downstream southern embankment and abutment, looking southeast/downstream**

**Photo C-4.1-4	October 2022—Downstream southern embankment and abutment, looking southeast/downstream**

Photo C-4.1-5 May 2022—Downstream northern embankment, looking northeast/downstream. Sediment deposited from runoff coming from dirt roads upgradient of the embankment. No action recommended.

Photo C-4.1-6 October 2022—Downstream northern embankment, looking northeast/downstream. Sediment deposited from runoff coming from dirt roads upgradient of the embankment. No action recommended.

C-4.2 Sediment Detention Basins

Photo C-4.2-1 May 2022—Upper basin, looking southwest/upstream. Upper basin has no remaining sediment capacity.

Photo C-4.2-2 October 2022—Upper basin, looking southwest/upstream. Upper basin has no remaining sediment capacity.

Photo C-4.2-3 May 2022—Middle basin, looking southwest. Middle basin has no remaining sediment capacity.

Photo C-4.2-4 October 2022—Middle basin, looking southwest. Middle basin has no remaining sediment capacity.

Photo C-4.2-5 May 2022—Lower basin, looking east/downstream. The lower basin has significant capacity remaining.

Photo C-4.2-6 October 2022—Lower basin, looking east/downstream. The lower basin has significant capacity remaining.

C-4.3 Overflow Weir Structure

Photo C-4.3-1 May 2022—Upstream face of weir, looking south

Photo C-4.3-2 October 2022—Upstream face of weir, looking south

Photo C-4.3-3 May 2022—Weir crest, looking north

Photo C-4.3-4 October 2022—Weir crest, looking north

Photo C-4.3-5 May 2022—Downstream face of weir, looking south

Photo C-4.3-6 October 2022—Downstream face of weir, looking south

C-4.4 Standpipe

Photo C-4.4-1 May 2022—Standpipe. Debris is at staff plate height 5.1 ft and sediment is at 4.8 ft. No significant change since last inspection.

Photo C-4.4-2 October 2022—Standpipe. Debris is at staff plate height 5.4 ft and sediment is at 4.9 ft. No significant change since last inspection.

C-4.5 Weir Outlet

Photo C-4.5-1 May 2022—Weir outlet

Photo C-4.5-2 October 2022—Weir outlet. Approximately 4 ft of culvert is undercut; continue monitoring.

C-4.6 Borrow Pit

Photo C-4.6-1 May 2022—Borrow pit, looking east

Photo C-4.6-2 October 2022—Borrow pit, looking east

C-4.7 Maintenance

Photo C-4.7-1 October 2022—Hole in gabion

Photo C-4.7-1 October 2022—Hole repaired in gabion

C-5.0 PUEBLO CANYON GRADE CONTROL STRUCTURE

C-5.1 Embankments

Photo C-5.1-1 May 2022—South bank abutment, looking south

Photo C-5.1-2 October 2022—South bank abutment, looking south

Photo C-5.1-3 May 2022—North bank abutment, looking south

Photo C-5.1-4 October 2022—North bank abutment, looking south

Photo C-5.1-5 May 2022—Downstream south embankment, looking southwest/upstream

Photo C-5.1-6 October 2022—Downstream south embankment, looking southwest/upstream

Photo C-5.1-7 May 2022—Downstream north embankment, looking northwest

Photo C-5.1-8 October 2022—Downstream north embankment, looking northwest

C-5.2 Overflow Weir Structure and Spillway

Photo C-5.2-1 May 2022—Weir crest and flow-ways, looking south

Photo C-5.2-2 October 2022—Weir crest and flow-ways, looking south

Photo C-5.2-3 May 2022—Weir crest and north flow-way, looking north

Photo C-5.2-4 October 2022—Weir crest and north flow-way, looking north

Photo C-5.2-5 May 2022—Downstream face of weir, looking northwest/upstream

Photo C-5.2-6 October 2022—Downstream face of weir, looking northwest/upstream. Vegetation was removed from spillway after photo was taken.

C-5.3 Outlet

Photo C-5.3-1 May 2022—Outlet culvert standpipe. Outlet is approximately two-thirds below grade and remains functional.

Photo C-5.3-2 October 2022—Outlet culvert standpipe. Outlet is approximately two-thirds below grade and remains functional.

Photo C-5.3-3 October 2022—Outlet is approximately two-thirds below grade and remains functional.

Photo C-5.3-4 October 2022—Outlet is approximately two-thirds below grade and remains functional.

C-5.4 Spurs

Photo C-5.4-1 May 2022—Redi-rock spurs, looking west/upstream

Photo C-5.4-2 October 2022—Redi-rock spurs, looking west/upstream

C-5.5 Maintenance

Photo C-5.5-1 May 2022—Repaired flow-way gabion basket seam

Photo C-5.5-2 May 2022—Repaired flow-way gabion basket

C-6.0 PUEBLO WETLAND STABILIZATION STRUCTURE

C-6.1 Wetland Stabilization Structures

Photo C-6.1-1 May 2022—Redi-Rock block structure, looking west/upstream

Photo C-6.1-2 October 2022—Redi-Rock block structure, looking west/upstream

Photo C-6.1-3 May 2022—Redi-Rock block structure, looking southeast/downstream

Photo C-6.1-4 October 2022—Redi-Rock block structure, looking southeast. Note flow over crest.

C-6.2 Banks

Photo C-6.2-1 May 2022—Downstream north bank abutment, looking north

Photo C-6.2-2 October 2022—Downstream north bank abutment, looking north

Photo C-6.2-3 May 2022—Downstream south bank abutment, looking south

Photo C-6.2-4 October 2022—Downstream south bank abutment, looking south

C-6.3 Upstream Area

Photo C-6.3-1 May 2022—Upstream wetland, looking west/upstream

Photo C-6.3-2 October 2022—Upstream wetland, looking west/upstream

Photo C-6.3-3 May 2022—Upstream ponded area, looking west/upstream

Photo C-6.3-4 October 2022—Upstream ponded area, looking west/upstream

Appendix D

Stormwater and Sediment Analytical Data
and Instantaneous (5-min) Gaging Station Stage and
Discharge Data for the Los Alamos/Pueblo Watershed
(on CD included with this document)