DEPARTMENT OF ENERGY

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

EMLA-25-BF069-2-1

March 31, 2025

Mr. JohnDavid Nance, Hazardous Waste Bureau Chief
Designated Agency Manager
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New Mexico Environment Department
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Santa Fe, NM 87505-6313

Received
MAR 31 2025
NMED Hazardous Waste Bureau

Subject: Submittal of the 2024 Sandia Wetland Performance Report

Dear Mr. Nance:

Enclosed please find two hard copies with electronic files of the "2024 Sandia Wetland Performance Report." The U.S. Department of Energy (DOE) Environmental Management Los Alamos Field Office (EM-LA) and Newport News Nuclear BWXT-Los Alamos, LLC (N3B) have prepared this report in response to requirements set forth in the "Work Plan and Final Design for Stabilization of the Sandia Canyon Wetland." The requirement to design a Sandia wetland monitoring program was previously set forth in the New Mexico Environment Department's (NMED's) "Approval with Modification, Interim Measures Work Plan for Stabilization of the Sandia Canyon Wetland," in response to the previously submitted "Interim Measures Work Plan for Stabilization of the Sandia Canyon Wetland."

Pursuant to Section 24.D of the 2016 Compliance Order on Consent, as revised in 2024, EM-LA, N3B, and NMED held a pre-submission review meeting on December 12, 2024, to discuss changes in monitoring requirements for 2025. The enclosed report captures the changes discussed.

If you have any questions, please contact Adam Barras at (505) 257-8289 (adam.barras@em-la.doe.gov) or Cheryl Rodriguez at (505) 414-0450 (cheryl.rodriguez@em.doe.gov).

Sincerely,

Digitally signed by Brian G. Harcek
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Brian Harcek, Director
Office of Quality and Regulatory Compliance
U.S. Department of Energy
Environmental Management
Los Alamos Field Office

Enclosures: Two hard copies with electronic files (EM2025-0047)

1. 2024 Sandia Wetland Performance Report

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2024 Sandia Wetland Performance Report

EM2025-0047

2024 Sandia Wetland Performance Report

March 2025

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EXECUTIVE SUMMARY

The 2024 Sandia Wetland Performance Report is the eleventh annual performance report following the 2012–2014 baseline report, which assessed the overall condition of the wetland at the head of Sandia Canyon. Sandia wetland monitoring was conducted to evaluate the wetland's ability to mitigate the migration of contaminants of concern (i.e., chromium, polychlorinated biphenyls [PCBs], and polycyclic aromatic hydrocarbons) detected in wetland sediments due to historical releases at Los Alamos National Laboratory (LANL or the Laboratory). Key indicators of wetland conditions include the geochemistry of surface water, groundwater, and sediment, along with the physical stability of sediment and the spatial extent and health of vegetation. Wetland conditions indicate the effectiveness of the grade-control structure (GCS) in stabilizing the wetland and monitor the impacts from changes in outfall volumes discharging into the wetland. The results of monitoring conducted for surface water, alluvial groundwater, and geomorphology between January and December 2024 are presented in relation to the baseline conditions outlined in the "Sandia Wetland Performance Report, Baseline Conditions 2012–2014."

Monitoring conducted in 2024 indicates that the Sandia wetland continues to remain stable following the GCS installation, despite lower effluent volumes associated with the 2012 Sanitary Effluent Reclamation Facility (SERF) expansion project. The GCS remains effective at preventing headcutting at the downstream terminus of the wetland. Groundwater chemistry within the shallow alluvium remains in a reducing condition. Sampling of hexavalent chromium [Cr(VI)] in base flow and alluvial groundwater indicates concentrations near the method detection limit and below the applicable New Mexico water quality criteria. Water levels in the wetland have remained consistent over the past decade, with temporary seasonal drops in the easternmost transect. Despite reductions in discharge after the SERF came online in 2012, water levels remain sufficient to sustain obligate wetland vegetation. Analytical results for iron and manganese confirm that alluvial groundwater has retained strongly reducing conditions across the wells upgradient of the GCS. Chloride, considered a conservative tracer and a highly mobile nonreactive chemical species, exhibits similar trends at both upgradient and downgradient gaging stations (E121 and E123), confirming stable hydrological conditions. Stormwater data also indicate that the GCS continues to reduce contaminant mobility. Concentrations of suspended sediment and chromium in storm flow have decreased post-GCS, particularly downgradient of the wetland at gaging station E123. Historically, total PCB concentrations in base flow and storm flow decreased post-GCS installation, but since 2020, concentrations have shown greater variability, particularly at gaging stations E121 and E122, with 2024 storm flow samples confirming an upward trend both upstream and downstream of the wetland. Additionally, for the first time, per- and polyfluoroalkyl substances were analyzed at alluvial wells and gaging stations, providing baseline data for future evaluation.

Visual inspections in 2024 confirm that the wetland remains stable, with minimal geomorphic or vegetation changes. Since 2019, aerial-based survey techniques have replaced ground-based survey techniques to provide more accurate assessments of geomorphic and vegetation changes. Results from the most recent geomorphic (2021) and vegetation (2022) surveys revealed minor changes, including a slight reduction in cattails in an area affected by sediment deposition. There were also notable increases in rush and willow populations in the lower wetland near E123, likely associated with increased monsoon precipitation in 2022. The next geomorphology and vegetation surveys, planned for 2025, will provide further insights and will continue to recur on a 3-yr interval.

Surface water and alluvial groundwater analytical data collected in 2024 were compared with New Mexico surface water quality criteria (20.6.4 New Mexico Administrative Code [NMAC]) and groundwater standards (20.6.2 NMAC). Exceedances are associated with historical Laboratory releases, runoff from developed areas, naturally occurring chemicals, or the wetland's natural reducing conditions. These results provide a comprehensive assessment of the Sandia wetland's physical and chemical stability, highlighting its continued role in mitigating contaminant migration within the Sandia Canyon watershed.

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1.0 INTRODUCTION

This report evaluates the performance of the Sandia wetland for Calendar Year (CY) 2024. Section 1 describes the Sandia wetland, contaminants present in its sediments, and the monitoring goals. Section 2 outlines the monitoring methods and summarizes activities conducted in 2024. Section 3 presents the monitoring results, Section 4 discusses the 2025 Monitoring Plan, and Section 5 provides conclusions. Appendices include the following:

- Appendix A: Acronyms, a metric conversion table, and definitions of data qualifiers
- Appendix B: A summary of watershed mitigation inspections in 2024
- Appendix C: 2024 polychlorinated biphenyls investigation
- Appendix D: Analytical data for gaging stations, alluvial wells, and sediments; water level data; and 5-min stage, discharge, and precipitation data (provided on CD)

The Sandia wetland, located at the head of Sandia Canyon, has expanded from a relatively small footprint in the early 1950s to its current size due to liquid effluent releases from LANL. Effluent discharges from outfalls in Technical Area 03 (TA-03) have sustained the wetland throughout Laboratory operations. Historical releases introduced contaminants, including chromium, PCBs, and polycyclic aromatic hydrocarbons (PAHs), into wetland sediment (LANL 2009, 107453). Ensuring the stability of the wetland is essential for managing the contaminants entrained in its sediment. Information on radioactive materials and radionuclides, including sampling and analytical results, is also voluntarily provided to the New Mexico Environment Department (NMED) under U.S. Department of Energy (DOE) policy.

The performance of the wetland has been monitored and reported since the initial 2012–2014 baseline report (LANL 2014, 257590). Monitoring activities have been designed to assess the wetland's physical and chemical stability and its ability to prevent downstream migration of contaminants below the grade-control structure (GCS; Figure 1.0-1).

The "2023 Sandia Wetland Performance Report" was provided to NMED on April 30, 2024 (N3B 2024, 703211). Per- and polyfluoroalkyl substances (PFAS) monitoring was added to the 2024 monitoring plan and the "2023 Sandia Wetland Performance Report, Revision 1" was provided to NMED on June 20, 2024 (N3B 2024, 703275). NMED provided the "Approval and Comments 2023 Sandia Wetland Performance Report, Revision 1" on July 18, 2024 (NMED 2024, 703302). The "Response to the NMED's Approval and Comments" was provided on August 29, 2024 (DOE 2024, 703336), and NMED found it acceptable and confirmed they had no additional comments on October 8, 2024 (NMED 2024, 703383).

1.1 Wetland Description

The Sandia wetland is a cattail-dominated system primarily sustained by effluent from National Pollutant Discharge Elimination System ([NPDES] Permit No. NM002835)-permitted Outfalls 001 and 03A199. Between 2012 and 2016, an additional NPDES-permitted Outfall 03A027 also discharged effluent to the wetland (EPA 2014, 600257; EPA 2015, 701237). Since mid-2012, operational changes at the Sanitary Effluent Reclamation Facility (SERF) have influenced both the volume and the chemical composition of the effluent (Figures 1.1-1 and 1.1-2). The wetland initially experienced a reduction in outfall discharge (both daily and annually) from Outfalls 001 and 03A027 due to the SERF expansion and water reuse programs at the Laboratory. However, monitoring data indicate that Outfall 001 has shown a slight increase in effluent discharge since the initial decline (Figure 1.1-1b).

Under the SERF expansion project, a portion of the effluent previously released to Sandia Canyon is now rerouted to cooling towers at facilities such as the Strategic Computing Complex (SCC) and Trinity supercomputer (Figure 1.1-3). Since September 2019, a discharge temperature limit of 20°C has been imposed on Outfall 001. To ensure compliance with this limit during warmer months, some effluent is rerouted to the power plant cooling towers before being discharged (Griffin 2021, 701199). No operational changes affecting the quantity or quality of water discharged to the wetland were implemented in 2024. Descriptions of earlier SERF-related operational changes are discussed in prior Sandia Wetland Performance Reports (LANL 2015, 600399; LANL 2016, 601432; LANL 2017, 602341; LANL 2018, 603022; N3B 2019, 700415).

The 2023 discharge permit (NPDES Permit No. NM0028355) authorizes additional effluent reuse by the SCC, rerouting of cooling tower blowdown, and recycling of effluent to the SERF, all of which may impact discharge from the dominant Outfall 001. Discharge levels are recommended to be maintained at a minimum of 40,000 gallons per day (gpd) during months with high evapotranspiration rates. This minimum discharge level is considered sufficient to sustain wetland's ecological, hydrological, and geochemical functions, as outlined in the "100% Design Memorandum for Sandia Wetlands Stabilization Project" (LANL 2012, 240016).

If future reductions in effluent volume or changes in effluent chemistry adversely impact wetland conditions, or if evapotranspiration rates increase substantially, adaptive management strategies will be implemented to ensure wetland stability. These may include installing engineered controls to manage sediment and water distribution to adequately maintain wetland saturation. Currently, discharge from Outfall 001 is sufficient to support the wetland. The average daily outfall volume for 2024 is approximately 207,100 gpd, which is well above the recommended 40,000 gpd threshold. Additional inputs from snowmelt and precipitation augment discharge flows and support the wetland.

Surface water is typically confined to a discrete channel, although in some areas it spreads completely across the wetland. Surface water flows through the wetland with a relatively short residence time compared to alluvial groundwater (LANL 2009, 107453; LANL 2014, 257590). Wetland sediments are underlain by an impermeable layer of Bandelier Tuff, causing alluvial groundwater to remain perched above it. A water-balance analysis conducted in 2007 and 2008 indicated minimal infiltration of surface water (approximately 2% of the combined effluent and runoff) within the wetland (LANL 2009, 107453).

A direct-current (DC) electrical resistivity-based geophysical survey revealed that large, continuous areas of the wetland are underlain by highly resistive welded tuffs (Qbt 2 of the Tshirege Member of the Bandelier Tuff). These tuffs likely act as a significant barrier to the deep percolation of groundwater (LANL 2012, 228624). The survey also identified subvertical conductive zones penetrating the upper bedrock tuffs, which appear to correspond with mapped fault and/or fracture zones. These conductive zones may represent current or historical pathways for infiltration. However, the DC resistivity data cannot distinguish between zones containing higher water content (possibly indicating active infiltration) and clay-rich, wetted fracture fill, which could impede infiltration (LANL 2012, 228624).

A GCS was installed in the lower portion of the Sandia wetland in 2013 to arrest an active headcut that was up to 9.8 ft high. The structure was designed to maintain favorable hydrologic and geochemical conditions, while reducing or preventing the migration of contaminants (LANL 2011, 203454). The GCS was engineered with the following objectives:

- minimize erosion during large flow events
- provide an even grade to facilitate wetland expansion and enhance stabilization

- ensure sufficient imperviousness to prevent the drainage of alluvial soils and sustain a high-water table
- facilitate non-channelized flow across the wetland
- support wetland function under conditions of potentially reduced effluent discharge

The “Completion Report for Sandia Canyon Grade-Control Structure” (LANL 2013, 251743) documents that the GCS transitions the grade approximately 11 vertical ft, connecting the wetland’s elevation upgradient of the former headcut to the natural streambed just upstream of gaging station E123. To maintain the grade while minimizing the fill volume and size of the structure, the GCS design incorporates a series of three steel sheet-pile walls, with decreasing elevation drops. Downstream of the third sheet-pile wall, a cascade pool constructed of boulders and cobbles facilitates the transition to the final grade.

The design ensures a gradual, smooth, and stepped transition from the wetland above the GCS to the stream channel below, preventing erosive flows that could destabilize the downstream stream reach (LANL 2013, 251743). This configuration supports a reduction in outfall effluent discharge to the wetland without compromising its physical and geochemical functions, particularly at the eastern terminus, where the GCS exerts greater control over the wetland water levels.

To further stabilize the wetland, the area behind the GCS was backfilled, and aquatic vegetation was planted to promote wetland expansion. These measures enhance physical stability by reducing sediment and associated contaminant transport to lower sections of the canyon and by maintaining reducing conditions in sediments near the wetland terminus. These combined efforts contribute to minimizing the potential for contaminant migration (LANL 2013, 251743).

A set of as-built diagrams for the GCS is included in Appendix C of the completion report for the construction of the GCS (LANL 2013, 251743).

The installation of the GCS has successfully halted headcutting at the wetland terminus and created an impermeable barrier to subsurface flow, forcing alluvial groundwater to resurface before exiting the wetland. Given the impermeable nature of the GCS and the underlying Bandelier Tuff, the system can be conceptually described as a “bathtub”, effectively retaining water with excess flow spilling over the GCS at the wetland terminus. Annual evaluations of base flow rates support this analogy, as inflow and outflow rates are similar. However, this relationship can be disrupted during storm events due to additional flow contributions from peripheral tributaries.

As long as outfall discharge exceeds wetland evapotranspiration rates, moderate reductions in effluent volumes are unlikely to affect water levels or the saturation of wetland sediments. Conversely, significant decreases in effluent input could result in wetland dewatering. Sediments at the eastern end of the wetland typically remain saturated, with unsaturated near-surface sediments occurring along the margins and the western end of the wetland. Vegetation surveys conducted in 2019 confirmed the recovery of cattails in the western end of the wetland, an area previously dewatered following the relocation of Outfall 001 (N3B 2020, 700810). The 2022 vegetation survey observed minor shifts in vegetation but found that cattails comprised 82% of the wetland and remained the dominant species (N3B 2023, 702641).

Channel meandering and sediment redistribution have facilitated the reestablishment and expansion of cattails in this area. Effluent volumes entering the wetland have remained sufficient to sustain both the water table depth and the extent of vegetative cover. The wetland vegetation community plays a critical role in mitigating the mobilization of contaminants during storm events, both by stabilizing sediments through root binding and by physically trapping suspended particles.

1.2 Contamination in Wetland Sediment

Hexavalent chromium [Cr(VI)] was historically released in liquid effluent from the TA-03 power plant at the head of Sandia Canyon between 1956 and 1972 (LANL 2009, 107453). Cr(VI) persists in the perched intermediate-depth groundwater beneath Sandia and Mortandad Canyons at concentrations exceeding the NMED groundwater standard of 50 µg/L, within an area estimated to span approximately 1 mile in length and about a half-mile in width (LANL 2023, 702995). Additional historical discharges from a transformer storage area and a former asphalt batch plant introduced PCBs and PAHs into the wetland, where they currently remain sequestered in sediment.

The ongoing Sandia Canyon wetland performance monitoring is integral to the broader chromium remediation efforts, as the wetland sediments continue to sequester a significant portion of the original chromium inventory. A comprehensive characterization of contamination in Sandia Canyon is described in the "Investigation Report for Sandia Canyon" (hereafter, the Phase I Investigation Report [IR]) (LANL 2009, 107453) and the "Phase II Investigation Report for Sandia Canyon" (hereafter, the Phase II IR) (LANL 2012, 228624).

Detailed sediment mapping conducted during the Phase I investigations (LANL 2009, 107453) identified Canyon Reach S-2, which encompasses the Sandia wetland, as a hotspot for high concentrations and proportions of the originally released contaminant inventory. Several factors contribute to this accumulation:

- proximity to contaminant sources
- large volume of sediment deposition during the period of active contaminant releases
- high concentrations of solid organic matter within the wetland, enhancing contaminant retention
- abundant silt and clay, binding contaminants due to their small particle size and high surface area

Contaminants in the Sandia wetland commonly adsorb to inorganic and organic sediment particles or precipitate with them. Chromium is the primary inorganic contaminant of concern, with its release from the wetland potentially being triggered by oxidation-reduction (redox) changes [e.g., mobilization of Cr(VI)] or through erosion and transport of chromium-bound particles. The organic contaminants of concern, PCBs and PAHs, are predominantly transported during flood events due to their low solubility and strong affinity to bind to organic materials and sediment particles.

These findings underscore the role of historical activities in contributing to contaminant distribution within the wetland (LANL 2009, 107453).

The chromium contamination within the Sandia wetland soils is primarily in the form of trivalent chromium [Cr(III)], stabilized by the wetland's reducing conditions (LANL 2009, 107453). These reducing conditions are maintained by alluvial saturation and the presence of significant amounts of solid organic matter derived from wetland vegetation. High concentrations of dissolved iron and manganese in the alluvial groundwater further indicate these reducing conditions. Under aqueous conditions, the oxidation of Cr(III) to Cr(VI) primarily occurs through reactions with manganese oxides (Rai et al. 1989, 249300).

Geochemical studies presented in the Phase I IR (LANL 2009, 107453) and previous Sandia Wetland Performance Reports (N3B 2021, 701253; N3B 2022, 701996; N3B 2023, 702641; N3B 2024, 703275) indicate that the manganese dioxide (MnO_2) present in wetland sediments is insufficient to drive significant oxidation of Cr(III) to Cr(VI). Furthermore, chromium in wetland sediments is predominantly geochemically stable as Cr(III) and is unlikely to become a future source groundwater contamination, provided that saturated conditions are maintained within the wetland.

Monitoring results from the 2012–2014 baseline report (LANL 2014, 257590) as well as subsequent years' reports (LANL 2015, 600399; LANL 2016, 601432; LANL 2017, 602341; LANL 2018, 603022; N3B 2019, 700415; N3B 2020, 700810; N3B 2021, 701253; N3B 2022, 701996; N3B 2023, 702641; N3B 2024, 703275) demonstrate that the Sandia wetland system remains chemically and physically stable. Vegetation cover has remained stable or increased in various parts of the wetland, further supporting its resilience.

Most notably, stormwater monitoring at gaging station E123 has consistently shown reduced chromium concentrations, following the installation of the GCS. (See Figure 3.3-1 in Section 3.3.)

1.3 Project Goals

Newport News Nuclear BWXT-Los Alamos, LLC (N3B) prepared this document in accordance with the Compliance Order on Consent, signed June 24, 2016, and modified in September 2024. This report fulfills obligations outlined in the "Work Plan and Final Design for Stabilization of the Sandia Canyon Wetland" (LANL 2011, 207053), which requires the annual reporting of Sandia wetland monitoring data to the NMED by April 30.

The requirement to establish a Sandia wetland monitoring program was originally set forth in NMED's "Approval with Modification, Interim Measures Work Plan for Stabilization of the Sandia Canyon Wetland" (NMED 2011, 203806), which responded to the Laboratory's "Interim Measures Work Plan for Stabilization of the Sandia Canyon Wetland" (LANL 2011, 203454). The monitoring program was initially provided in the work plan and final design (LANL 2011, 207053) and has been periodically updated to incorporate new insights into the wetland system. The current monitoring plan, discussed in detail in Section 2.0, aims to detect physical and chemical changes in the Sandia wetland associated with the installation of the GCS at the wetland terminus (LANL 2013, 251743) and changes in outfall chemistry and discharge volumes related to the SERF expansion (DOE 2010, 206433).

Monitoring efforts focused on answering the following key questions:

- Are outfall volumes sufficient to sustain the wetland's hydrological balance?
- Is the physical stability of the wetland effectively maintained by the GCS?
- Does the GCS successfully attenuate storm flow and prevent the migration of contaminants?
- Is the wetland's chemical stability being preserved?

2.0 METHODS

In 2024, monitoring activities focused on surface water and alluvial groundwater to evaluate the condition of the Sandia wetland. Data were assessed against baseline conditions established in the "Sandia Wetland Performance Report, Baseline Conditions 2012–2014" (LANL 2014, 257590) and compared with previous years to identify physical and geochemical changes. The monitoring program includes the following components:

- Alluvial Wells: Measurements of water levels and water chemistry to assess the condition of alluvial groundwater in the wetland
- Gaging Stations: Surface water and stormwater data collected at two upstream gaging stations and one downstream station

- LiDAR Surveys: Airborne light detection and ranging (LiDAR) surveys conducted triennially to monitor vegetation and detect geomorphic changes
- Hyperspectral Imagery: Airborne hyperspectral imagery collected triennially to assess vegetation changes
- Post-Monsoon Walkdown: Annual inspection conducted with NMED to evaluate the wetland's condition following the monsoon season
- GCS and Log-Check Dam Inspections: Semiannual inspections and additional inspections following flow events exceeding 50-cubic feet per second (cfs) at gaging station E123 to evaluate the stability of the GCS and log check dams located in tributaries adjacent to the wetland

In the event of a large disturbance (approximately 100 cfs at gaging station E123), additional geomorphic and vegetation monitoring may be conducted. This threshold is based on historical knowledge that indicates storm events of approximately 100 cfs have the potential to cause significant erosion. If discharge at gaging station E123 meets or exceeds this value, N3B will classify it as a large storm event and may initiate an aerial-based geomorphic and vegetation survey ahead of the scheduled triennial survey.

Should a scheduled field visit reveal significant erosion or vegetation disturbance, additional aerial surveys may be conducted after the monsoon season for geomorphic assessments and during the monsoon season for vegetation evaluations. If noteworthy features are identified through aerial surveys, these features will be verified with field checks, and additional ground-based survey methods may be employed as necessary. All observations of erosion and vegetation disturbance identified during these surveys will be documented and reported in the performance report.

2.1 Changes to Monitoring in 2024

In 2024, a notable addition to the monitoring plan was the inclusion of PFAS in the analytical suite for Upper Sandia gaging stations (See Table 2.2-2 in Section 2.2.) PFAS will continue to be monitored at each location until two consecutive samples show nondetections. Additionally, starting in 2024, PCB congener monitoring was transitioned to PCB Aroclor monitoring. Apart from these updates, monitoring followed the same plan as in 2019–2023.

A detailed description of changes to monitoring that began in 2019 is included in the "2019 Sandia Wetland Performance Report" (N3B 2020, 700810). The monitoring plan for 2025 is outlined in Section 4.0.

2.2 Monitoring Conducted in 2024

Quarterly sampling of Sandia wetland surface water and annual sampling of alluvial groundwater align with the "Interim Facility-Wide Groundwater Monitoring Plan for the 2024 Monitoring Year, October 2023–September 2024, Revision 1" (N3B 2023, 702924.11) and the "Interim Facility-Wide Groundwater Monitoring Plan for the 2025 Monitoring Year, October 2024–September 2025, Revision 1" (N3B 2024, 703382).

In 2024, sampling activities included eight alluvial wells within the wetland, collocated with piezometers that were active until 2016 (Table 2.2-1). Surface water sampling was also conducted at gaging stations E121 and E122 (upstream of the wetland) and E123 (downstream of the wetland; see Figure 1.0-1.)

Alluvial groundwater analytical results were evaluated against the New Mexico Water Quality Control Commission groundwater standards outlined in 20.6.2 NMAC. Base flow and stormwater analytical results were screened against the appropriate surface water quality standards specified in 20.6.4 NMAC (see Section 3.0). All analyses were conducted off-site by contract laboratories certified under the DOE Consolidated Audit Program.

In response to an observed increasing trend in total PCB concentrations at the three Upper Sandia gaging stations, seven sediment samples, including one field duplicate, were collected in Upper Sandia Canyon in November 2024. Additional details and analytical results from these sampling efforts are presented in Appendix C.

Analytical results meet the 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 Laboratory Data”; and additional method-specific analytical data validation procedures. All associated validation procedures have been developed, where applicable, from Department of Defense/DOE Consolidated Quality Systems Manual for Environmental Laboratories, EPA National Functional Guidelines, Guidance on Environmental Data Verification and Data Validation (EPA QA/G-8), Multi-Agency Radiological Laboratory Analytical Protocols Manual , and American National Standard Verification and Validation of Radiological Data for Use in Waste Management and Environmental Remediation (ANSI/ANS 41.5).

2.2.1 Surface Water Monitoring

Surface water gaging stations E121 and E122 are in the upgradient western end of the Sandia Canyon watershed. Surface water gaging station E123 is located to the east, immediately below the GCS and the terminus of the wetland. Figure 1.0-1 shows the locations of the gaging stations and outfalls as well as the 2022 extent of the Sandia wetland. Gaging station E121 measures discharge from Outfall 001 and stormwater runoff from approximately 50 acres of TA-03. With changes at the SERF in September 2016, discharge from SCC cooling towers is primarily directed to Outfall 001, with Outfall 03A027 used only for maintenance and emergency discharge. Gaging station E122 measures discharge from Outfall 03A199 and stormwater runoff from approximately 50 acres from TA-03. Gaging station E123 measures surface water flow below the wetland, including discharge from all outfalls and stormwater runoff from approximately 185 acres, 100 acres of which are monitored by E121 and E122. Flow rates into and out of the wetland are measured at gaging stations E121, E122, and E123 during sample-triggering storm events as well as during base flow conditions. Appendix D (included on CD with this document) provides analytical data and 5-min stage, discharge, and precipitation data.

In 2024, ISCO 3700 automated samplers were programmed to collect stormwater samples in Upper Sandia when flow discharge exceeded defined thresholds above baseflow. Upward adjustments in trip levels were made following the collection of four samples to obtain additional data under a greater variety of hydrological conditions, particularly from larger, late-season storm events. At gaging station E121, samples were triggered when discharge exceeded 5 cfs above base flow. The trip level was increased to 44 cfs on July 3, 2024, following the fourth sampling event, and subsequently raised to 100 cfs on September 10, 2024, after the fifth sampling event.

At gaging station E122, the initial trip level was set to 1 cfs above base flow. On July 3, 2024, following six sampling events trip level was raised to 9.1 cfs. After the seventh sampling event on July 18, 2024, it was adjusted to 9.8 cfs and on September 10, 2024, following the eighth sampling event, it was further increased to 11.6 cfs.

At gaging station E123, sampling began with a trip level of 5 cfs above base flow. After the fourth sampling event on July 1, 2024, the trip level was increased to 32.0 cfs. Following the sixth sampling event on July 18, 2024, the trip level was raised again to 57.0 cfs.

In 2024, base flow and storm flow samples were analyzed according to the analytical suites presented in Table 2.2-2. Samplers E121 and E122 were activated on May 23, 2024, while sampler E123 was activated on May 28, 2024. Sampler shutdowns occurred on November 6, 2024, for E121 and E122 and on November 14, 2024, for E123. Stations E121 and E123 are each equipped with a Sutron 9210 data logger, a Microwave Data Systems (MDS) 4710 radio transceiver, and a Sutron Accubar bubbler. Station E122 is equipped with a Sutron 9210 data logger, a MDS 4710 radio transceiver, and a VEGA Americas VEGAPULS 61 radar sensor. Stage measurements are recorded at 5-min intervals and transmitted to a base station, where they are archived in a database.

Each of the three gaging stations is equipped with two automated ISCO samplers: one configured with a 24-bottle set for suspended sediment concentration (SSC) analyses during the storm event, and the other with a 12-bottle set for collection of chemistry samples (Table 2.2-2). Additional analytes, including dissolved organic carbon, alkalinity, pH, and gross alpha, were sampled in storm flow events for purposes not directly related to wetland performance monitoring. The 2024 sampling and preservation requirements for the surface water gaging stations are provided in Table 2.2-3. Only analytes relevant to wetland performance monitoring are presented in Table 2.2-3.

2.2.2 Alluvial System Monitoring

Monitoring of alluvial groundwater chemistry is accomplished using alluvial wells constructed with 2-in.-inside diameter polyvinyl chloride (PVC) casings and 2-in. slotted PVC casings, which act as screens surrounded by a filter pack consisting of 1/20 silica sand. The existing alluvial wells, designated with the prefix SWA, were installed between 2014 and 2016 to replace piezometers (prefix SCPZ). The alluvial wells were co-located with the previous piezometers (data from shared locations are reported alongside each other in the Section 3.4 figures). Table 2.2-1 provides a crosswalk correlating the piezometers to the alluvial wells. Since 2017, only water from the alluvial wells has been sampled.

Initially, 12 alluvial wells were installed across 4 transects that bisect the surface water channel. However, beginning in 2019, monitoring was limited to the first and fourth transects, along with wells SWA-2-4 and SWA-2-6 from the second transect, for a total of eight wells (Figure 1.0-1).

The monitored alluvial well (piezometer) transects are as follows:

- Alluvial wells SWA-1-1 (SCPZ-1), SWA-1-2 (SCPZ-2/SWA-1), and SWA-1-3 (SCPZ-3) are located on a sand-and-gravel terrace near the active channel (c1 geomorphic unit), toward the western end of the wetland. This region has experienced channel incision and dewatering relative to historical conditions. These alluvial systems are located on the c3 geomorphic unit, away from the active channel and associated inset terrace (c2a geomorphic unit), where cattail expansion has been observed since vegetation monitoring began in 2014. Well SWA-1-1 is screened near the base of alluvial fill at 15.5 ft below ground surface (bgs), while wells SWA-1-2 and SWA-1-3 have screen tops located approximately 6 and 3 ft bgs, respectively (Table 2.2-4).
- Wells SWA-2-4 (SCPZ-4) and SWA-2-6 (SCPZ-6/SWA-2) transect the widest portion of the wetland. The tops of the well screens are approximately 3 ft bgs due to the wetland water level being located near or at the wetland surface. These shallow depths are particularly responsive to water-level changes and sediment oxidation caused by decreased effluent discharge. Reduced effluent volumes may also cause lateral margins of the wetland to dewater more than the central portion, especially in the widest areas where water flux is more dispersed. Such locations may also develop preferential flow paths within the alluvium.
- The easternmost transect of wells SWA-4-10 (SCPZ-10), SWA-4-11 (SCPZ-11B), and SWA-4-12 (SCPZ-12/SWA-4) demonstrate a significant response to rewatering at the eastern terminus of the wetland following the GCS installation, with water levels consistently remaining above 7205 ft, which is sufficient to sustain obligate wetland vegetation and maintain reducing conditions within the wetland. In 2024, water levels in this transect remain at or near the surface.
- The 2024 sampling and analysis plan for the alluvial wells is provided in Table 2.2-3. Analyses were designed to evaluate redox changes associated with potential wetland dewatering. Alluvial monitoring locations were instrumented with sondes to continuously monitor water level, specific conductance, and temperature. Full analytical suites were collected at all monitoring locations in October 2024. Field parameter data for both surface water and alluvial wells are presented in Table 2.2-5.

In June 2024, all transducers within the Sandia wetland were replaced with In-Situ, Inc., Level TROLL 500 15 psi data loggers (Table 2.2-6). The Level TROLL 500 transducers are programmed to collect hourly measurements of water level, water pressure, and temperature. Factory calibration of In-Situ instruments should be performed every 12 to 18 months, or at any point when the data appears to drift significantly. Data downloads are collected biannually from the installation date. A manual water level will be completed to validate transducer calibration every 6 months. Transducers will be replaced when found outside of error tolerance or within 5 yr of original installation.

2.2.3 Geomorphic and Vegetation Monitoring

In 2019, advanced aerial survey techniques were implemented to replace the ground-based Global Positioning System (GPS) survey methods previously used. Aerial surveys encompass the entire Sandia wetland area and employ an airborne LiDAR system to acquire high-resolution elevation data and an airborne hyperspectral system to capture detailed vegetation data.

Aerial LiDAR surveys are conducted on a triennial basis to monitor geomorphological change. If a peak discharge exceeding 100 cfs is recorded at gaging station E123 during a non-survey year and is determined to have caused significant geomorphic change, an additional LiDAR survey may be conducted. LiDAR data provide high-resolution surface elevation and vegetation structure data, enabling comparisons across years to identify and quantify changes in topography and vegetation patterns. The most recent LiDAR survey was completed in October 2021, with results documented in Appendix B of the "2021 Sandia Wetland Performance Report" and "2022 Sandia Wetland Performance Report" (N3B 2022, 701996; N3B 2023, 702641).

The largest stormwater peak discharge measured at gaging station E123 was 59 cfs on September 5, 2024. As this was below the 100 cfs threshold, no additional visual inspection or LiDAR survey to assess geomorphic change was necessary.

Aerial vegetation surveys using hyperspectral imagery are also conducted on a triennial basis. Hyperspectral imagery provides high-resolution spectral data that enables the identification of individual plant species and the calculation of vegetation indices, such as the Normalized Difference Vegetation Index, that can assess plant health and vigor. Repeated acquisition of hyperspectral imagery over time supports the monitoring of temporal changes in wetland vegetation, providing insights into wetland performance and ecological trends. The most recent hyperspectral imagery was acquired in September 2022, with detailed descriptions of survey methodologies and the resulting vegetation classification provided in the "2022 Sandia Wetland Performance Report," Appendix B (N3B 2023, 702641).

Beginning in 2025, both LiDAR and hyperspectral data will be collected concurrently to provide a multi-dimensional analysis of the Sandia wetland. This integrated approach helps identify vegetation-hydrology relationships to assess overall wetland performance and guide effective management decisions.

2.2.4 GCS Monitoring

The GCS is subject to biennial inspections, as well as inspections triggered by rain events resulting in discharge exceeding 50 cfs as outlined in the "2014 Annual Monitoring Report for Sandia Canyon Wetland Grade-Control Structure" (LANL 2014, 600083). During these inspections, any evidence of erosion, instability, or structural degradation is documented, and mitigation measures are implemented as necessary to maintain the stability and functionality of the GCS. In 2024, discharge exceeded 50 cfs on June 9, July 17, August 9 and September 5. Inspections were performed following these events in addition to the biennial inspections. Photographic documentation of the GCS and associated drainage controls are presented in Appendix B.

3.0 RESULTS AND DISCUSSION

Variation in individual metrics does not inherently signify a reduction in the overall functionality of the wetland or an increased risk of contaminant release from wetland sediments. Wetland assessment requires evaluation of system performance over time, incorporating multiple lines of evidence, including geomorphic, hydrologic, and vegetation analyses, to determine its stability and functionality.

3.1 Inputs to and Hydrology of the Sandia Wetland

3.1.1 Outfalls

Outfall volumes from Outfall 001 initially decreased following the commissioning of the SERF in 2012 but have exhibited a slight increasing trend over the period of monitoring for the Sandia wetland. Historical mean daily volume of effluent per month, extending back to 2011, is presented in Figure 1.1-1(a). The mean daily outfall volume per month has shown a statistically significant upward trend since 2015 ($p = 0.04$, slope = 0.01). Although the rate of increase is modest, this consistent pattern highlights a gradual rise in discharge volumes over time, as evidenced by the trendline in Figure 1.1-1(b). Daily outfall volumes, alongside mean daily discharge, from gaging stations E121, E122, and E123 since 2011 are shown in Figure 3.1-1.

In 2024, outfall volumes exhibited a seasonal pattern, with higher volumes observed in winter months and noticeable declines in summer months. This seasonal variability aligns with historical discharge patterns, where decreases in Outfall 001 discharge can be attributed to operational factors, such as blowdown water from the SCC being rerouted to the power plant cooling towers before being discharged. This rerouting ensures compliance with the effluent discharge temperature limit of 20°C. Despite seasonal fluctuations, outfall volumes haves consistently remained well above the 40,000 gpd threshold required to sustain the wetland (Figure 3.1-1). This finding is further supported by gaging station data and alluvial water level measurements, which confirm sufficient hydrological inputs to maintain wetland functionality (Figure 3.1-2).

3.1.2 Precipitation and Gage Discharge

In 2024, annual precipitation across LANL was 15.54 in., which is slightly higher than the 1992–2023 average of 14.74 in. Monthly precipitation totals for March, June, July, October, and November exceeded the 1992–2023 averages (Figure 3.1-3). Table 3.1-1 summarizes precipitation recorded at rain gage RG121.9, peak stormwater discharge, and whether stormwater samples were collected at gaging stations E121, E122, or E123 for each storm event that met the sampling criteria in 2024.

Stormwater discharge at gaging station E121 exceeded the trip level six times in 2024, resulting in the collection of five complete samples, while one sample was missed due to unknown reasons. Discharge at E122 equaled or exceeded the trip level eight times in 2024, resulting in the collection of seven complete samples and one partial sample. Discharge at E123 exceeded the trip level eight times in 2024, and six complete samples were collected. Two samples were missed: one on July 1 because the sampler had already been triggered on a prior event, and another on September 5 because the sampler did not record two consecutive readings above the trip level. Hydrographs illustrating the sample-triggering storm events from 2024 are presented in Figure 3.1-4. The average transmission times between gaging stations were approximately 99 min from E121 to E123 and 92 min from E122 to E123 (Table 3.1-2). This observation indicates that stormwater from either E121 or E122 traversed the wetland to E123 in a similar amount of time. 2024 base flow levels at E121 were consistent with 2023 levels in the first half of the year but displayed greater variability in the second half of the year, whereas base flow levels at E122 and E123 were generally comparable to those observed in 2023 (Figure 3.1-1).

3.1.3 Alluvial Water Levels

Monitoring of alluvial well water-level data continues to provide insights on how operational effluent releases, precipitation, and snowmelt (Figure 3.1-2) influence wetland hydrology. Comparisons of water levels between 2023 and 2024 indicate overall stability, with greater fluctuations typically observed during the summer months. This seasonal variability was recorded across all wells in 2024, with SWA-2-4 and SWA-2-6 exhibiting less variance. These patterns are likely attributed to elevated evapotranspiration rates during warmer temperatures. The drop in water levels and temperatures observed across the wells in late October is attributed to the effects of well sampling.

The stability of the alluvial water levels is primarily maintained by the relatively impermeable Bandelier Tuff bedrock that underlies the wetland and the impermeable downgradient boundary created by the GCS, which effectively contains the water within the wetland. As long as water inputs exceed the evapotranspiration rate, wetland water levels and sediment saturation are expected to remain stable.

Reduced outfall discharge is anticipated to have a greater impact on the surface water balance than on alluvial groundwater levels. Water temperature measurements reveal seasonal variability, with less fluctuation observed in wells located in the channel and those with a depth greater than 10 ft (e.g., SWA-1-1; Figure 3.1-2).

3.2 Physical Stability of the Wetland

The physical stability of the wetland was evaluated using an aerial-based LiDAR survey conducted in 2021. The survey results indicated elevated surface elevations in areas with dense vegetation, as the LiDAR system was unable to fully penetrate the vegetation canopy to reach the bare earth. Subsequently, 2022 hyperspectral data were used to generate a vegetation classification, identifying cattails as the dominant species in these higher-elevation areas. The presence of cattails in these locations serves as an indicator of geomorphic stability within the wetland.

Comprehensive details and results from the 2021 geomorphic survey and the 2022 aerial-based vegetation survey are provided in Appendix B of the “2021 Sandia Wetland Performance Report” and “2022 Sandia Wetland Performance Report” (N3B 2022, 701996; N3B 2023, 702641).

Table 3.2-1 summarizes geomorphic changes associated with significant storm events in the wetland since 2014. In 2024, minor scouring was observed at and upstream of gaging station E121, minor sediment aggregation was observed within a pool located approximately 60 ft upstream of E121, and minor mobilization of woody debris was noted throughout the channel. Near the GCS, a series of log check dams designed to manage sediment migration from a side tributary into the wetland have reached their containment capacity. Alternative sediment control measures are currently under evaluation; however, there is no immediate threat to the wetland’s integrity. Photos of the log check dams are included in Appendix B for reference.

3.3 GCS Performance in Containing Contamination

Inspection results from the monitoring of the GCS, detailed in Appendix B, demonstrate that the structure remains stable and does not require any corrective or mitigation measures. As previously noted, there were four flow events exceeding 50 cfs in Upper Sandia during 2024. Biennial inspections were conducted on May 5 and October 30, 2024, with a post-monsoon walkdown of the wetland carried out in coordination with NMED on October 16, 2024. Documentation, including photographs and detailed descriptions of inspection findings, is provided in Appendix B.

In 2024, maintenance activities included the installation of two engineered caps as part of corrective actions under the Individual Permit (IP) (Table 3.3-1). The first effort involved applying shotcrete over a 2300 ft^2 area to cover solid waste management unit (SWMU) 03-056(c). The second effort involved applying shotcrete over a 600 ft^2 area to cover the site monitoring area (SMA) drainage area below area of concern (AOC) 03-014(b2).

As noted in the baseline performance report (LANL 2014, 257590), the similarity in base flow chemistry for key constituents between upgradient (E121) and downgradient (E123) locations suggests a relatively short residence time for surface water and minimal interaction or exchange with alluvial groundwater. This observation is particularly evident for chloride, nitrate plus nitrite, and silicon dioxide, which serve as indicators of water quality in outfall discharges and reflect the chemical composition of Outfall 001 (Figure 1.1-2).

Gaging station E121 functions as a monitoring point to evaluate the effect of changing input chemistry and reduced effluent volumes from Outfall 001. Improvements in water chemistry discharged from Outfall 001, associated with the SERF expansion, are evident for chloride and silicon dioxide, as inferred from post-SERF and post-GCS concentration trends at E121 (Figure 1.1-2). In contrast, nitrate plus nitrite concentrations showed a slight average increase during the post-SERF/pre-GCS period at E121, followed by a moderate average decrease during the post-GCS period at both E121 and E123 (Figure 1.1-2).

Gaging station E123, located downstream of the GCS, serves as the primary monitoring point for assessing overall wetland performance in mitigating discharges of contaminants of concern. Stormwater monitoring at E123 is critical for determining if elevated levels of sediment and associated contaminants, such as chromium, PCBs, and PAHs, are mobilized during flood events. Such mobilization may occur due to reduced contaminant contact times with sediment, diminished sorption capacity, or other changes to the chemical or physical stability within the wetland. Analytical results comparing pre- and post-GCS conditions for base flow and storm flow at the three gaging stations demonstrate the effectiveness of the GCS in minimizing the downstream migration of chromium from the wetland (Figure 3.3-1).

Median sediment concentrations, measured as SSC, in both base flow and storm flow at the three gaging stations are comparable during the post-GCS period. However, base flow sediment concentrations exhibit lower variability compared to storm flow, though there are fewer base flow data points (Figure 3.3-1). The impact of the GCS on base flow sediment cannot be quantitatively assessed, as pre-GCS sediment was measured as total suspended sediment (TSS) rather than SSC. The United States Geological Survey (USGS) has identified significant bias in the relationship between TSS and SSC, noting that SSC values tend to increase at a greater rate than their paired TSS values. Consequently, TSS and SSC methods should not be used interchangeably (Gray et al. 2000, 255422). Additionally, the USGS recommends SSC as the preferred method for monitoring sediment in natural waters (Gray et al. 2000, 255422).

Comparison of storm flow SSC measurements between upstream and downstream gaging stations suggests that the GCS effectively attenuates SSC during storm flow events, contributing to improved sediment retention within the wetland (Figure 3.3-1). This reduction is significant because several contaminants in the wetland are strongly associated with sediment particles. Thus, a reduction in SSC serves as reliable indicator for decreased contaminant transport.

Sediment volume for Upper Sandia Canyon is positively correlated with runoff volume, based on models using data from storm events recorded at the three gaging stations between 2014 and 2024 (Table 3.3-2). Figure 3.3-2 demonstrates that this relationship is moderate, with an R^2 value of 0.46.

The effectiveness of the GCS in attenuating storm flow is less clearly defined, as indicated in base flow and storm flow peak discharge data at E123 in Figure 3.3-1. The median peak discharge for base flow is lower in the post-GCS period, while the median peak discharge for storm flow is higher. It is important to note that base flow is estimated, while storm flow is defined as any discharge exceeding base flow. This classification introduces limitations in evaluating the GCS's performance in attenuating storm flow, making these methods less precise than direct measurements of SSC, PCBs, and chromium.

Beginning in 2024, PCB monitoring transitioned from congeners to Aroclors in both base flow and storm flow samples. PCB congeners were analyzed in the February and May base flow samples prior to the approval of the 2023 Sandia Wetland Performance Report, after which analyses shifted to PCB Aroclors. Results from PCB Congener monitoring through 2023 are documented in the “2023 Sandia Wetland Performance Report, Revision 1” (N3B 2024, 703275).

Prior to the GCS construction, PCB concentrations in both base flow and storm flow were higher downgradient of the wetland (at E123) compared to upgradient locations (E121 and E122). Post-GCS, PCB concentrations are more comparable in magnitude between upgradient and downgradient locations, reflecting improved attenuation within the wetland.

Base flow PCB concentrations at all three gaging stations exhibit a general decline from pre- to post-GCS, likely influenced by changes in outfall chemistry. However, PCB concentrations in base flow at E122 display greater variability compared to previous observations, with the combined contributions of E121 and E122 influencing the base flow PCB concentrations at E123.

Further analysis of the 2024 PCB Aroclor results is provided in Appendix C.

Dissolved chromium (filtered at 0.45 μm) concentrations in base flow are lower at all three gaging stations in the post-GCS period, with more notable reductions observed at E121 and E123 (Figure 3.3-1). These decreases are likely due to process improvements at the SERF. Dissolved hexavalent chromium [Cr(VI)], which is measured in base flow only, is higher at the upstream gaging stations (E121 and E122) compared to E123, reflecting the reducing conditions present within the wetland. In storm flow, dissolved chromium has remained relatively stable across all locations post-GCS. At E123, storm flow dissolved chromium concentrations remain lower in 2024 than pre-GCS levels. These findings demonstrate the continued effectiveness of the GCS in mitigating the downstream migration of chromium.

Total PAH concentrations were calculated using the 19 most prominent PAHs, with nondetections reported at half the method detection limit (MDL). Pre-GCS, PAHs were not analyzed in storm flow, and base flow results are not plotted due to insufficient data points (Figure 3.3-1). In storm flow, average total PAH concentrations are similar between upgradient and downgradient locations. In 2024, exceedances of PAH criteria were observed for benzo(a)pyrene, benzo(b)fluoranthene, bis(2-ethylhexyl)phthalate, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene in storm flow samples in Upper Sandia. Notably, no PAH exceedances were recorded in base flow samples at any of the gaging stations (Table 3.3-3 and Table 3.3-4).

3.3.1 Base Flow and Storm Flow Exceedances

Analytical results from base flow and stormwater samples collected in 2024 at gaging stations E121, E122, and E123 were screened against the applicable surface water quality criteria (SWQC) (Table 3.3-3). Surface water entering the wetland originates primarily from two sources: discharges from outfalls and stormwater runoff from the developed landscape within TA-03. These inputs influence the water-quality results at E121 and E122. Flow at E123 reflects a combination of waters from E121, E122, runoff traversing the Sandia wetland, and urban runoff from the Laboratory and Los Alamos County.

In stormwater samples from 2024, exceedances of SWQC were identified for the following constituents: aluminum, benzo(a)pyrene, benzo(b)fluoranthene, bis(2-ethylhexyl)phthalate, copper, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, iron, lead, total Aroclors, and zinc. In base flow, exceedances were limited to copper and total PCBs (Figure 3.3-3).

Likely sources of elevated PCB concentrations include construction and ongoing industrial activity in TA-03, upstream of E121, as well as a former transformer storage area (north of building 03-223) associated with SWMU 03-056(c). Investigation and remediation activities were conducted at SWMU 03-056(c) in 1994, 1995, 1996, 2000, and 2001 to address PCB contamination. The 2010 “Investigation Report for Upper Sandia Canyon Aggregate Area, Revision 1” concluded that the site met the EPA cleanup criterion for PCBs (less than 1 ppm) and recommended the site for corrective action complete without controls (LANL 2010, 110862.24).

Construction to expand Sigma Building (building 03-66) caused soil disturbance and relocation near AOC 03-052(b), a former storm drain that may have received contaminants from AOC 03-056(k), a container storage area and loading dock at building 03-66 where PCBs may have been managed and released. Previous investigations identified PCBs in shallow sediment samples collected at both AOC 03-052(b) and AOC 03-056(k) (LANL 2015, 600912).

These activities, coupled with an observed increase in PCB concentrations in stormwater samples at the three Upper Sandia gaging stations, prompted the collection of additional sediment samples in 2023 and again in 2024. The results of these sediment samples, along with measures implemented to address PCB exceedances, are discussed in Appendix C.

PFAS detections were recorded in base flow and stormflow samples from all three Upper Sandia gaging stations. Since there are no established SWQC for comparison, these detections do not qualify as exceedances. However, their presence confirms the need for continued monitoring. The PFAS results from base flow and stormflow samples are available in Appendix D (on CD included with this document).

3.4 Chemical Stability of the Wetland

The alluvial well array provides critical data on water levels and groundwater chemistry, enabling the monitoring of potential changes associated with outfall volumes, evolving geomorphology, redistribution of reducing zones, and variations in the chemistry of outfall discharges.

Key metrics for identifying detrimental impacts, as monitored in the wells, include

1) Persistent increases in contaminant concentrations [e.g., Cr(VI)] and/or shifts toward more oxidizing conditions, as indicated by changes in redox-sensitive species (e.g., dissolved iron).
2) Persistent decreases in water levels that could negatively affect obligate wetland vegetation, potentially compromising wetland function and habitat integrity.

Time-series data for selected water chemistry parameters from the alluvial sampling array are presented in Figures 3.4-1 to 3.4-4. These plots illustrate trends in water chemistry over time and are organized based on the spatial distribution of the wells within the wetland, as follows:

- Upper plots represent data from the northernmost wells in each transect, arranged from west to east.
- Middle plots correspond to data from the central wells in each transect, ordered from west to east.
- Bottom plots display data from the southernmost wells in each transect, following the same west-to-east orientation.

The alluvial sampling array consists of three transects orientated north to south and distributed along the length of the wetland. Additional surface water data from gaging station E121 (representing water entering the wetland) and gaging station E123 (representing water exiting the wetland) are included in the time-series plots, to allow comparison of input and output base flow chemistry. Differences between base flow data and alluvial groundwater data may indicate subsurface processes (e.g., reduction) and provide insights into residence times within the alluvial system. Key analytes plotted include redox-sensitive species (arsenic, iron, and manganese) and a key contaminant of concern (chromium) (Figures 3.4-1 to 3.4-4). A detailed summary of surface water base flow and alluvial well field parameters for samples collected in CY 2024 is presented in Table 2.2-5.

3.4.1 Redox-Sensitive Species

Redox-sensitive species provide critical insights into the extent of reduction occurring within the wetland sediments. Elevated concentrations of arsenic, manganese, and iron in the alluvial system compared to surface water indicate that reducing conditions are actively maintained within the sediments. These reducing conditions enhance the mobility of metals in their reduced forms and are indicative of a stable redox environment in the alluvial system.

In the surface water, concentrations of redox-sensitive species are similar between the wetland input (E121) and output (E123) gaging stations (Figures 3.4-1 through 3.4-4). This minimal change in surface water chemistry suggests that the wetland effectively contains and regulates redox processes within the subsurface without significantly altering surface water quality.

In 2024, dissolved iron concentrations in the wetland alluvial system ranged from 546 to 7160 µg/L (the NMED groundwater exceedance criterion for iron is 1000 µg/L). The highest concentrations were observed at SWA-4-12 (5510 µg/L) and SWA-2-6 (7160 µg/L) (Figure 3.4-1). Dissolved iron levels likely reflect the presence of Fe-bound or Fe-containing particulate matter. Although the measurement of speciated iron ceased midway through 2018, historical data indicate that the majority of dissolved iron is in the Fe(II) form.

At the gaging stations, the highest dissolved iron concentrations in 2024 were recorded at E121 (362 µg/L) and E123 (424 µg/L). Alluvial samples continue to have higher dissolved iron concentrations than those measured at the input and output gaging stations (Figure 3.4-1). The historically higher values for dissolved iron in the easternmost transect are believed to originate from Fe-bound particles. These values have decreased over time as the system has recovered from disturbances caused by the installation of the GCS, as suggested by trends in other constituents. In 2024, dissolved iron concentrations in the wetland alluvial system were within the previous 5-yr range of 30–24,700 µg/L.

In 2024, dissolved manganese concentrations in the wetland alluvial system ranged from 154 to 1390 µg/L (the NMED groundwater exceedance criterion for manganese is 200 µg/L). All locations, except SWA-1-2 and SWA-4-10, have manganese concentrations greater than 200 µg/L (Figure 3.4-2). Low manganese concentrations were observed at SWA-1-2 (154 µg/L), SWA-4-10 (192 µg/L), and SWA-1-3 (211 µg/L), which is consistent with their shallow completion depths in sands and gravels where manganese mobilization may be more limited.

At the gaging stations, the highest dissolved manganese concentrations in 2024 were observed at E122 (63.1 µg/L) and E123 (93.9 µg/L). Dissolved manganese concentrations in alluvial groundwater remained higher than those measured at the wetland input and output gaging stations (Figure 3.4-2). In 2024, manganese concentrations in the wetland alluvial system were within the previous 5-yr range of 2–1500 µg/L.

In 2024, dissolved arsenic concentrations in the wetland alluvial system ranged from 2 to 9.92 µg/L (the NMED groundwater exceedance criterion for arsenic is 10 µg/L). Elevated arsenic concentrations (greater than 10 µg/L) are indicative of strongly reducing conditions within the wetland sediments. The highest arsenic concentrations were observed at SWA-1-1 (6.88 µg/L) and SWA-2-6 (9.92 µg/L) (Figure 3.4-3).

At the gaging stations, the highest dissolved arsenic concentrations in 2024 were recorded at E123 (2.32 µg/L) and E122 (2.44 µg/L). Dissolved arsenic concentrations in alluvial groundwater were generally higher or comparable to those measured at the wetland input and output gaging stations (Figure 3.4-3). In 2024, arsenic concentrations in the wetland alluvial system were consistent with the previous 5-yr range of 2–13.9 µg/L.

In 2024, dissolved chromium concentrations in the wetland alluvial system ranged from 4.23 to 52.2 µg/L (the NMED groundwater exceedance criterion for chromium is 50 µg/L). Significant spatial variation in chromium was observed across the alluvial system (Figure 3.4-4). Due to the varied environmental fate and transport characteristics of the different forms of chromium, including those associated with organo-metal moieties, spatial comparisons of dissolved chromium concentrations are inherently complex. However, locations SWA-1-2, SWA-4-10, SWA-4-11, and SWA-4-12 exhibited higher concentrations compared to locations SWA-1-1, SWA-1-3, SWA-2-4, and SWA-2-6. The historically elevated concentrations in the easternmost transect (SWA-4-10, SWA-4-11, and SWA-4-12) may be attributed to disturbances associated with the construction of the GCS.

At the gaging stations the highest dissolved chromium concentrations in 2024 were observed at E121 (3.16 µg/L) and E122 (5.67 µg/L). Dissolved chromium concentrations in alluvial groundwater were generally higher or comparable to those measured at the wetland input and output gaging stations (Figure 3.4-4). In 2024, dissolved chromium concentrations in the wetland alluvial system were within the previous 5-yr range of 4.1–73.4 µg/L. The reason for elevated dissolved chromium concentrations at SWA-1-2 remains unclear.

In 2024, Cr(VI) concentrations in the wetland alluvial system ranged from 3.0 to 9.62 µg/L (there is no NMED groundwater exceedance criterion specific to Cr(VI), it is regulated under the chromium exceedance criterion of 50 µg/L). Five of the eight alluvial wells sampled for Cr(VI) in 2024 had concentrations above the detection limit of 3.0 µg/L, with the highest levels recorded at SWA-4-11 (7.38 µg/L) and SWA-4-12 (9.62 µg/L). Prior to 2017, Cr(VI) samples were generally not filtered, except for a limited number of test samples collected in 2013. Because Cr(VI) is regulated under the dissolved chromium standard, only filtered data are reported. Since 2017, a total of 155 Cr(VI) concentrations were measured in the alluvial system, with 88 recorded above or at the detection limit and 67 recorded as nondetections. The consistently low or nondetectable Cr(VI) concentrations reflect the persistent reducing conditions within the wetland. Since analysis of dissolved Cr(VI) began in 2017, no alluvial well samples have exceeded the New Mexico groundwater standards.

At the gaging stations, the highest Cr(VI) concentrations in 2024 were recorded at E121 (3.08 µg/L) and E122 (4.22 µg/L), while Cr(VI) concentrations at E123, located at the terminus of the wetland, remained consistently below the detection limit (Figure 3.3-1). Since the analysis of dissolved Cr(VI) began in 2017, no gaging station samples have exceeded the New Mexico groundwater standards.

3.4.2 Alluvial Groundwater Exceedances

Data from the alluvial system collected in 2024 were screened against the New Mexico groundwater standards (Table 3.4-1). Exceedances in alluvial groundwater were observed for chromium, iron, and manganese. Among these, iron and manganese had the highest number of exceedances, likely due to their geology-derived origins and mobilization under the reducing conditions present in the wetland.

Dissolved manganese is more persistent than iron, owing to the slower kinetics of manganese oxidation. This persistence has also been observed in surface water at E123 during past surveys. The only chromium exceedance was recorded at SWA-4-12, which has consistently exhibited elevated chromium concentrations over time (Figure 3.4-4). Measured Cr(VI) concentrations at SWA-4-12 have never exceeded the New Mexico chromium exceedance criterion of 50 µg/L.

Multiple PFAS compounds were detected at all eight alluvial wells, confirming the need for continued monitoring. The PFAS results from the alluvial well samples are available in Appendix D (on CD included with this document).

4.0 2025 MONITORING PLAN

The 2025 monitoring activities will include surface, water, alluvial groundwater, sediment, vegetation and geomorphic analyses to ensure a comprehensive understanding of the Sandia wetland's physical and chemical stability. The 2025 monitoring plan will remain consistent with the 2024 sampling requirements outlined in Table 2.2-3 and bottle configurations outlined in Table 2.2-2.

The detection of PFAS chemicals at all Upper Sandia sites in 2024 drives the continued monitoring for PFAS in 2025. If the New Mexico standards for PFAS constituents are updated, the sampling protocol will be revised to ensure compliance with the latest regulatory criteria. Analytical results will be evaluated to assess potential pathways and sources of PFAS contamination and help determine if additional control measures are warranted to prevent migration.

As part of the Annual Site Environmental Report's (ASER) sediment sampling campaign, additional sediment samples will continue to be collected in Upper Sandia Canyon in 2025 (See Appendix C for further details). This expanded sampling effort aims to refine the understanding of PCB distribution, particularly in areas that have exhibited elevated concentrations, and to assess the effectiveness of new sediment control measures that were installed in 2024. Results from these analyses will help determine if any additional actions need to be taken.

Aerial hyperspectral and LiDAR surveys scheduled for 2025 will provide detailed data on vegetation health, vegetation distribution, and geomorphic stability. The integration of vegetation and geomorphology analyses in the 2025 Sandia Wetland Performance Report will provide a comprehensive assessment of the ecological and physical conditions of the wetland.

Stormwater sampling will continue at all Upper Sandia monitoring sites, with trip levels adjusted after the fourth sampling event to capture a wider range of storm event magnitudes and hydrological conditions.

The monitoring plan remains adaptive, ensuring flexibility to respond to changing regulatory requirements and environmental conditions. Data from 2025 monitoring efforts will be evaluated against NMAC standards for surface water and groundwater quality. Findings will guide updates to control measures and inform future management decisions. Collaboration with NMED will continue to ensure alignment with environmental compliance objectives.

5.0 CONCLUSIONS

This performance period marks the eleventh year since baseline monitoring began. The data collected during this period indicate that the Sandia wetland remains stable and well-established following installation of the GCS. Comparative analysis of annual results demonstrates that the wetland continues to discharge lower concentrations of contaminants of concern in stormwater following the construction of the GCS.

Despite the overall reduction in effluent discharge volumes following the SERF becoming operational in 2012, water levels within the wetland have remained sufficiently high to sustain and support the healthy growth of obligate wetland vegetation. This vegetation plays a critical role in promoting stability and preserving reducing conditions essential for contaminant retention.

No evidence of large-scale systematic erosion has been observed within the wetland, indicating a high degree of physical stability. The GCS has effectively arrested headcutting at the terminus of the wetland. Wetland vegetation planted around the GCS has rapidly become established, and vegetation in the upper portion of the system remains stable. Stormwater data indicate that the GCS has contributed positively to mitigating contaminant transport. Concentrations of suspended sediment, PCBs, and chromium at E123 have decreased post-GCS, likely due to the cessation of headcutting and the establishment of conditions that support contaminant immobilization. PFAS were detected in alluvial well and gaging station samples and will continue to be monitored.

Ongoing monitoring will focus on assessing the performance of additional control measures implemented to address elevated PCB concentrations observed at upstream gaging stations. The triennial aerial-based geomorphic and vegetation survey scheduled for 2025 will offer a comprehensive evaluation of the wetland's physical integrity and overall stability.

The Sandia wetland continues to support water quality improvement and ecological function, demonstrating consistent stability over the monitoring period. Ongoing monitoring and adaptive management will ensure the wetland's sustained performance, regulatory compliance, and contribution to long-term environmental stewardship.

6.0 REFERENCES AND MAP DATA SOURCES

6.1 References

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

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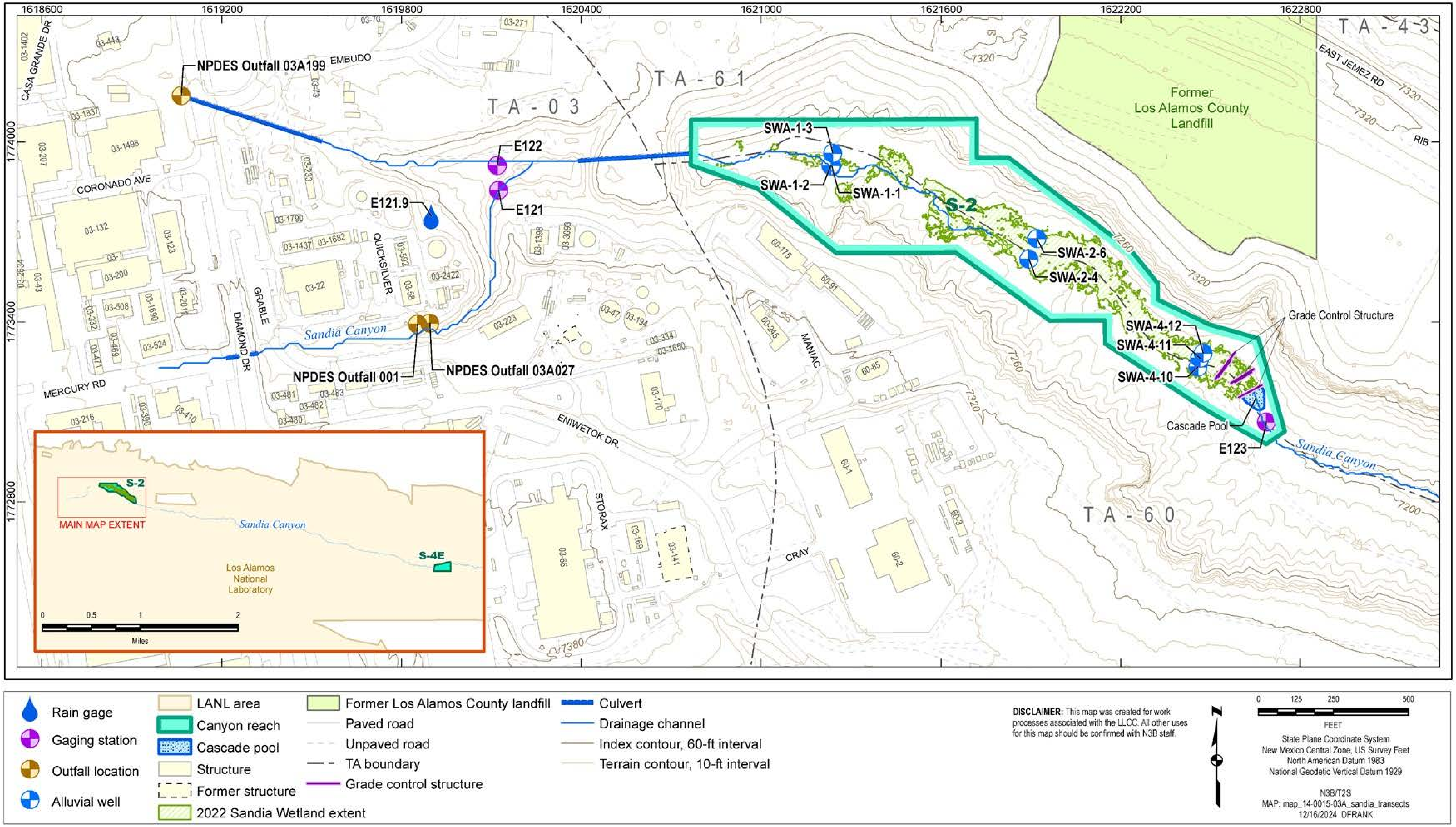
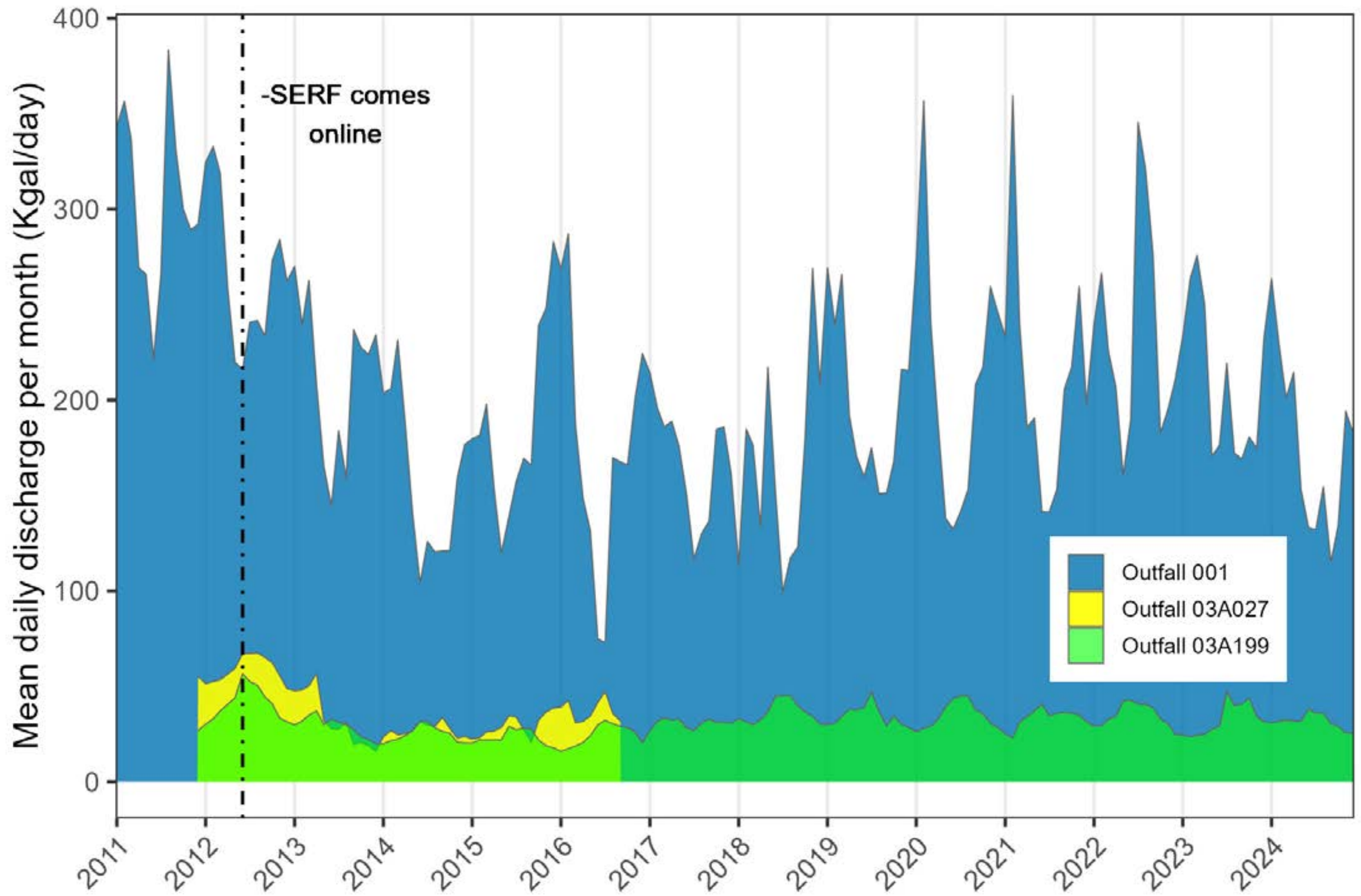
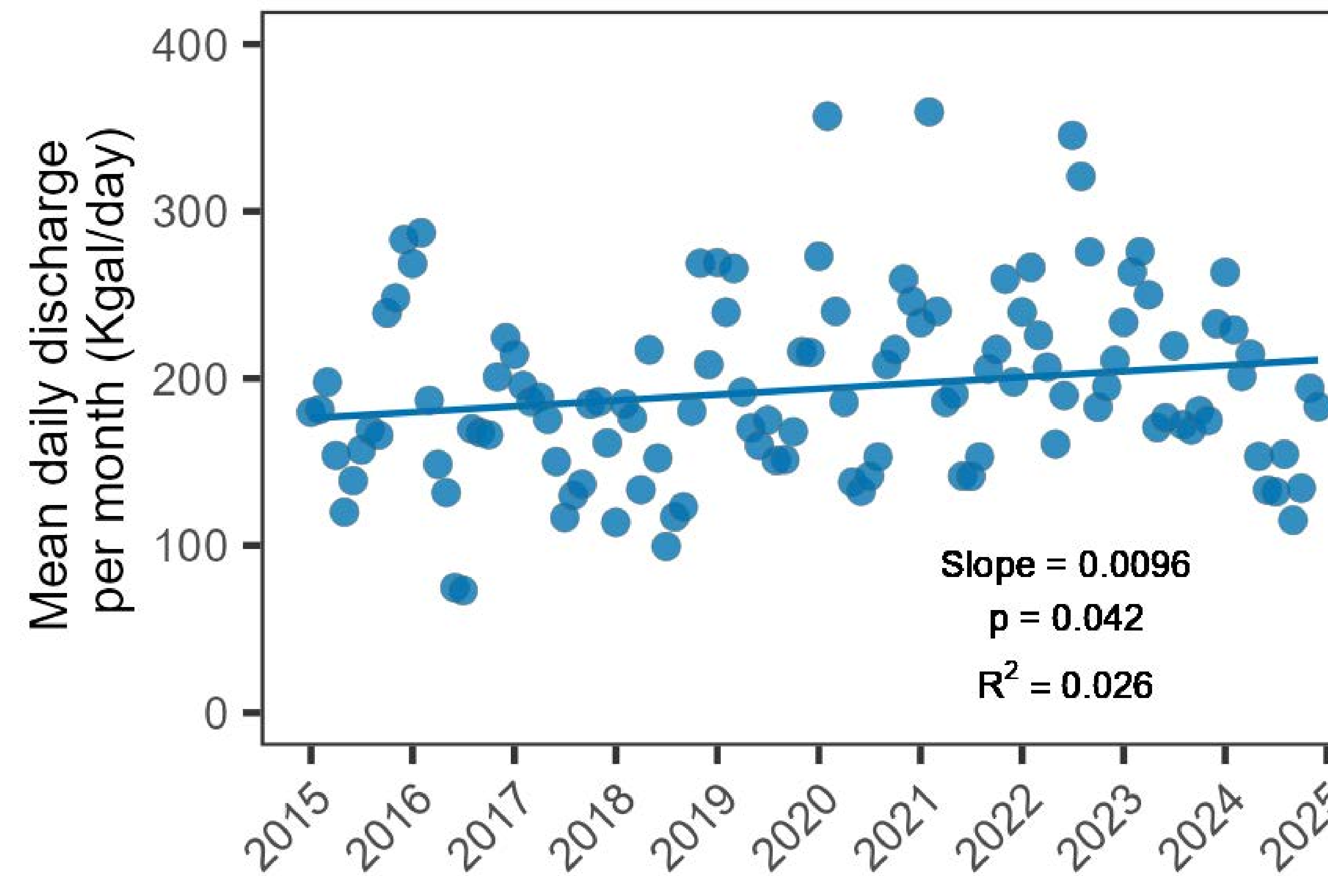


Note: Reach S-2 essentially encompasses the wetland. Reach S-4E is located approximately 3.4 miles downstream of S-2.

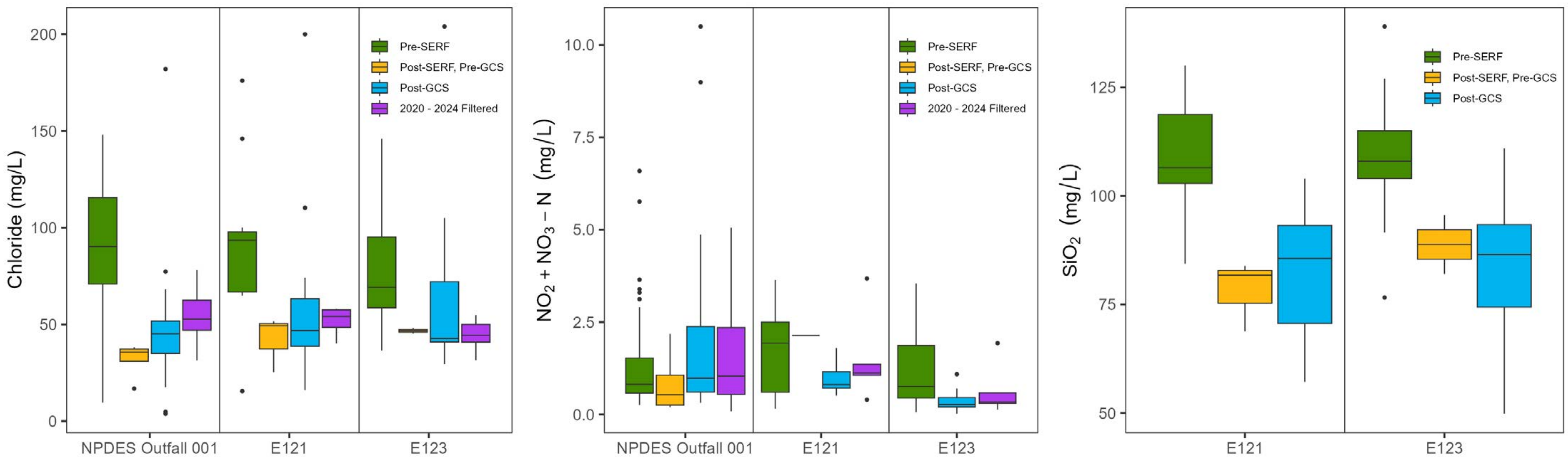
Figure 1.0-1 Locations of the Sandia GCS; NPDES outfalls; precipitation gage E121.9; alluvial wells; surface and stormwater gaging stations; former Los Alamos County landfill; surrounding technical areas; 2022 Sandia wetland extent; and reaches S-2 and S-4E.





Notes: Monthly average effluent release volumes are shown for Outfall 001 from January 2006 through December 2024 (blue); for Outfall 03A027 from January 2012 through September 2016 (yellow); and for Outfall 03A199 from January 2012 through December 2024 (green). Note that no discharges to Outfall 03A027 have occurred since September 2016. Linear regression fitted to mean daily discharge per month data. There has been a very gradual increase (0.01 kgal/day each month) in discharge since 2015 ($p = 0.036$, linear regression).

Figure 1.1-1 (a, left) Monthly average effluent release volumes (expressed as kgal/day) and (b, right) Linear regression fitted to Outfall 001 mean daily discharge per month data



Notes: The lower and upper bounds of each box correspond to the first and third quartiles, respectively, and the black line within each box represents the median. Whiskers extend to the largest or smallest value, or at most 1.5 times +/- the interquartile range (the height of the box). Values above or below the whiskers are marked as outliers (solid black points). The post-GCS period includes data from 2014 to 2019 for the chloride and nitrogen plots and 2014–2024 for the silicon dioxide plot. Note that because of differences in monitoring requirements at Outfall 001 compared with E121 and E123, concentrations before 2020 should not be compared across locations. Outfall 001 samples through 2019 were unfiltered, while data from gaging stations E121 and E123 have always been filtered. Beginning in 2020, Outfall 001 samples changed to being filtered, meaning the 2020–2024 filtered boxplots can be compared across locations.

Figure 1.1-2 Box-and-whisker plots of chloride, nitrate plus nitrite as nitrogen, and silicon dioxide concentration, all water quality indicators, before and after SERF came online and before and after the GCS was constructed, at Outfall 001 and at gaging stations E121 and E123

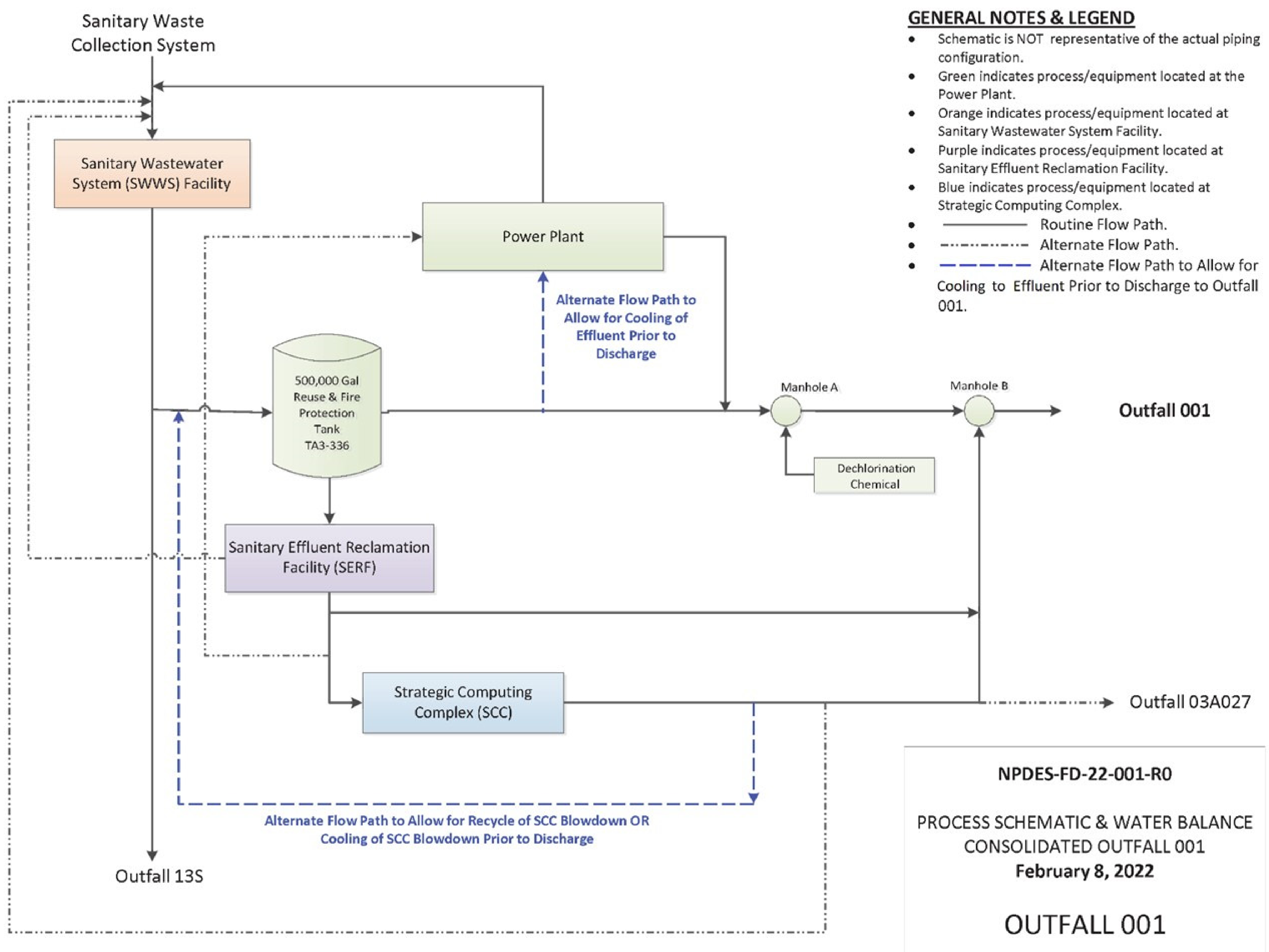
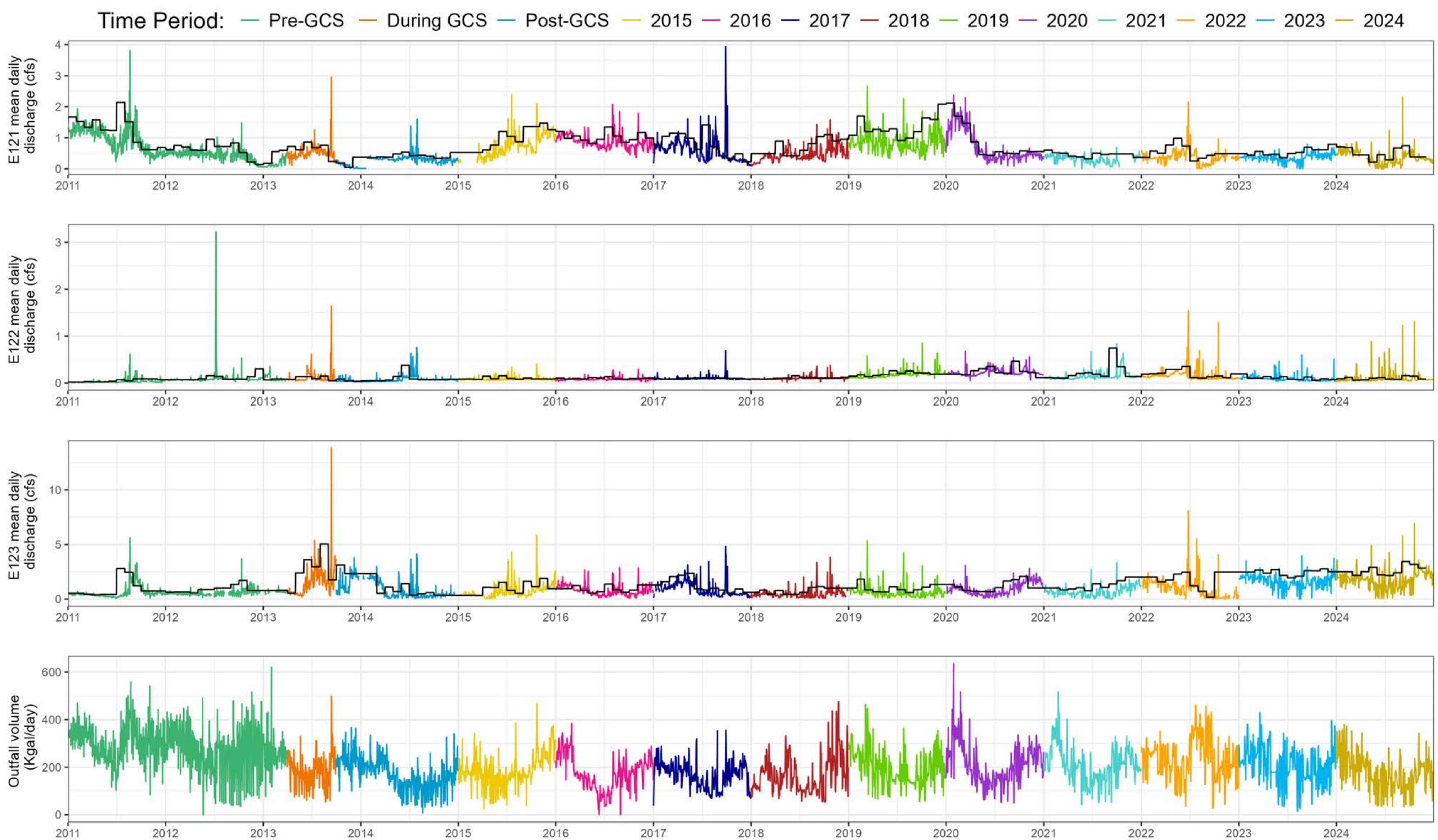


Figure 1.1-3 Process schematic for the power plant, SWWS, and SERF connections to Outfall 001 (current configuration)



Note: Black lines show approximate base flow, calculated as the monthly median daily discharge plus 1.5 times the interquartile range. Pre-GCS dates are before March 31, 2013. During GCS dates are from March 31, 2013, through September 20, 2013, and post-GCS dates are October 1, 2013, through December 31, 2014.

Figure 3.1-1 Time series plots from 2011 to 2024 showing mean daily discharge at gaging stations E121, E122, and E123 and Outfall 001

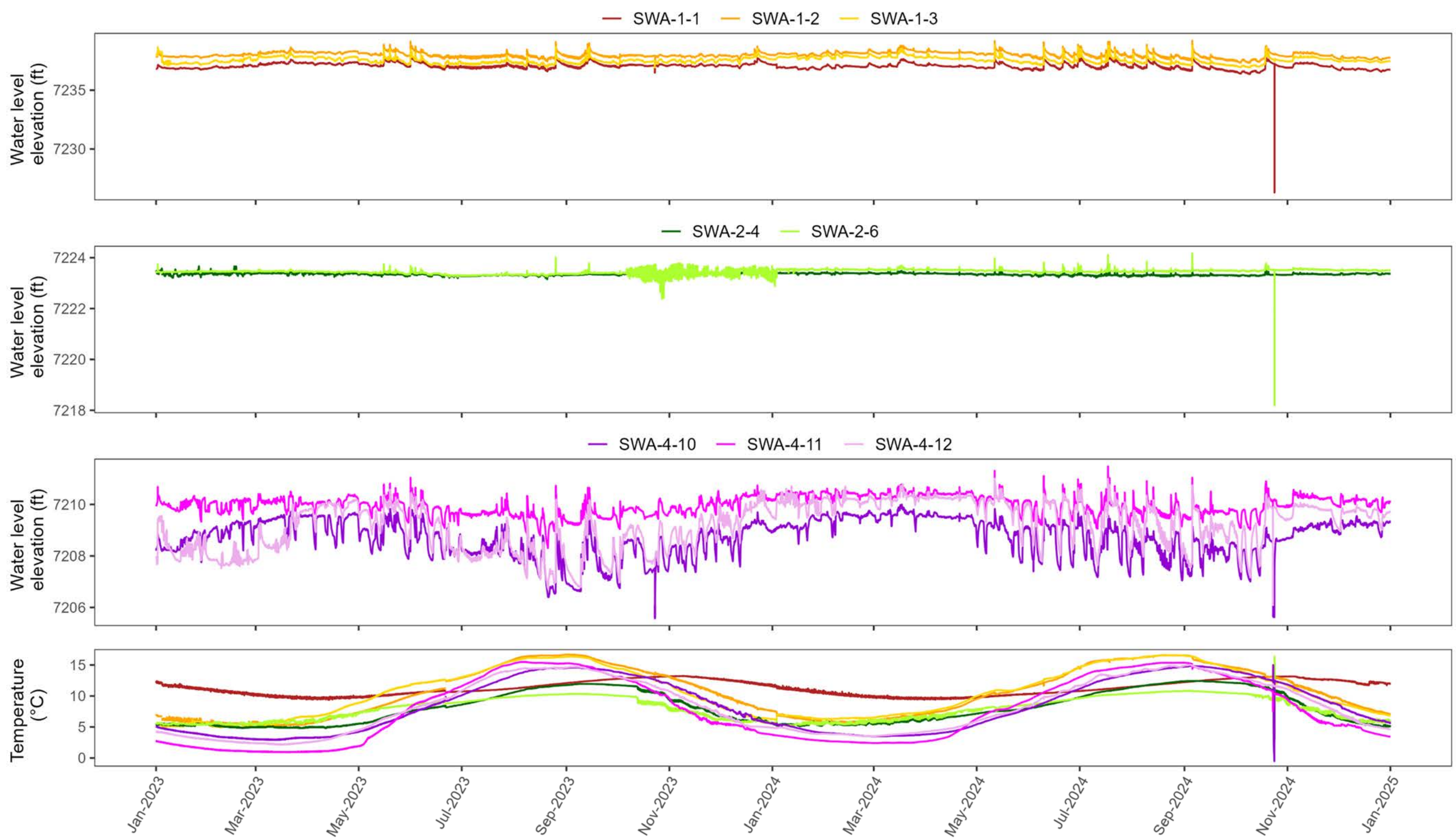


Figure 3.1-2 Alluvial water levels and alluvial water temperature in 2023 and 2024

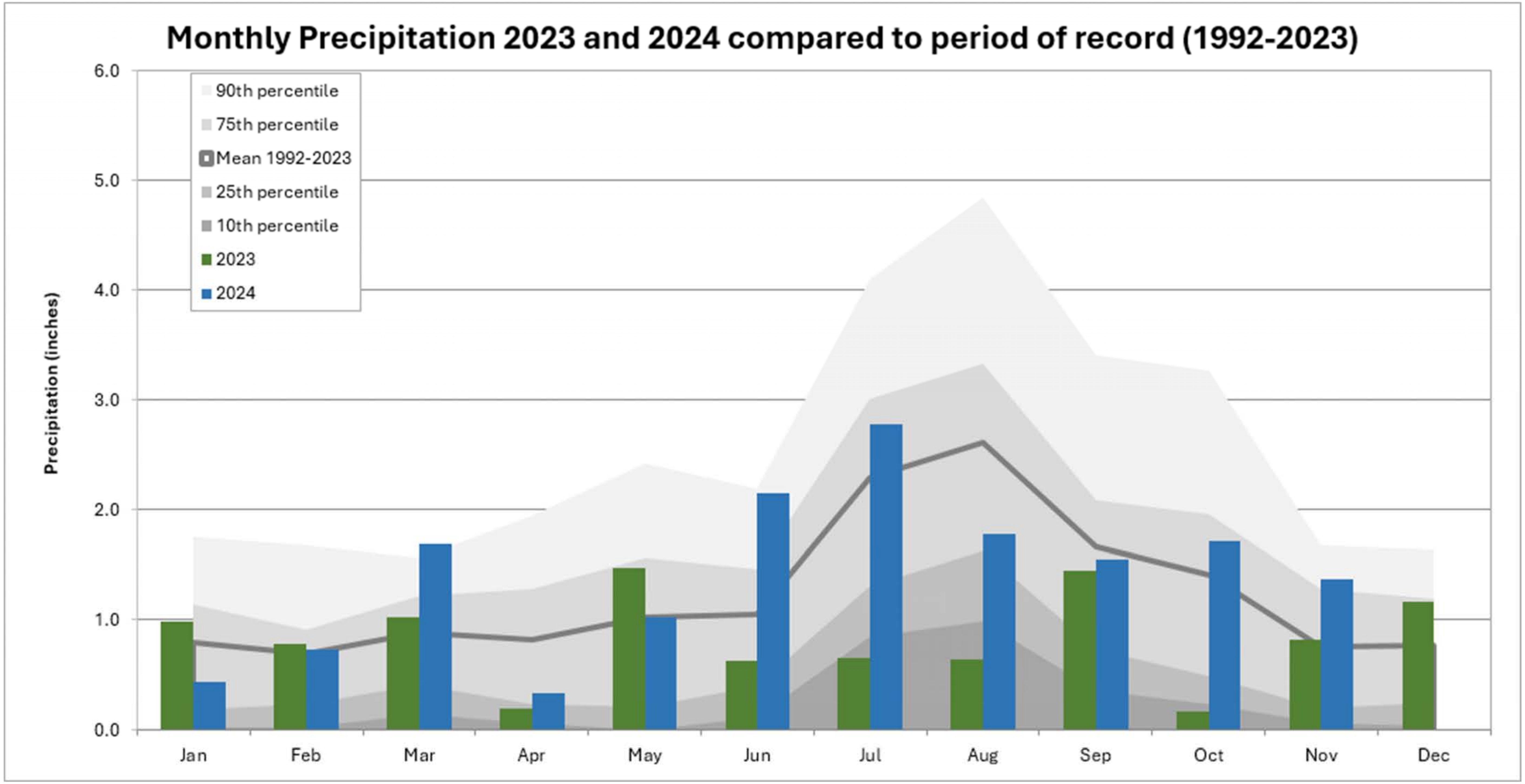


Figure 3.1-3 Total precipitation for each month in 2023 and 2024, based on meteorological tower data averaged across the Laboratory compared to 1992–2023 mean and percentiles

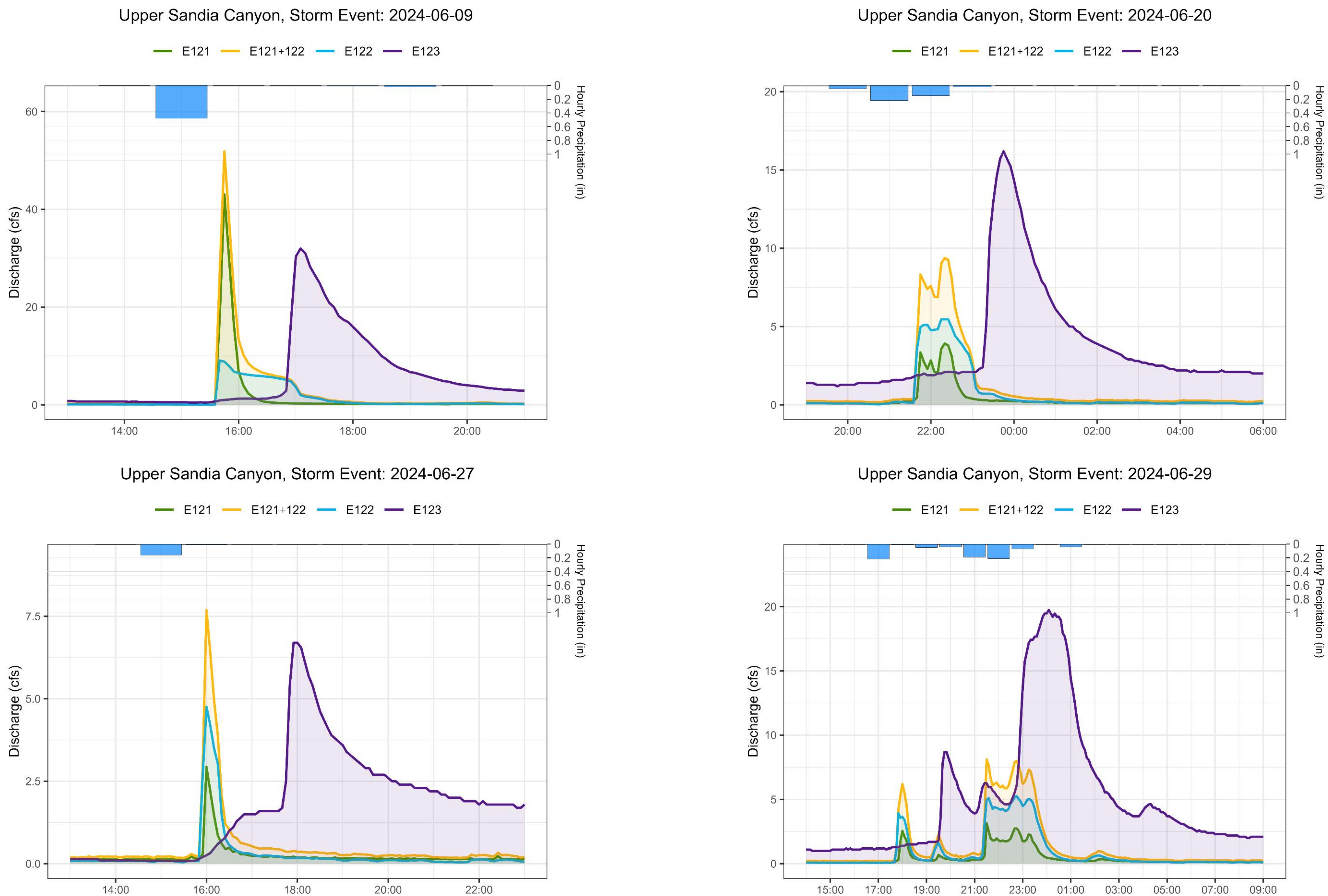


Figure 3.1-4 Hydrographs of stormwater discharge at E121, E122, and E123 during each sample-triggering storm event in 2024

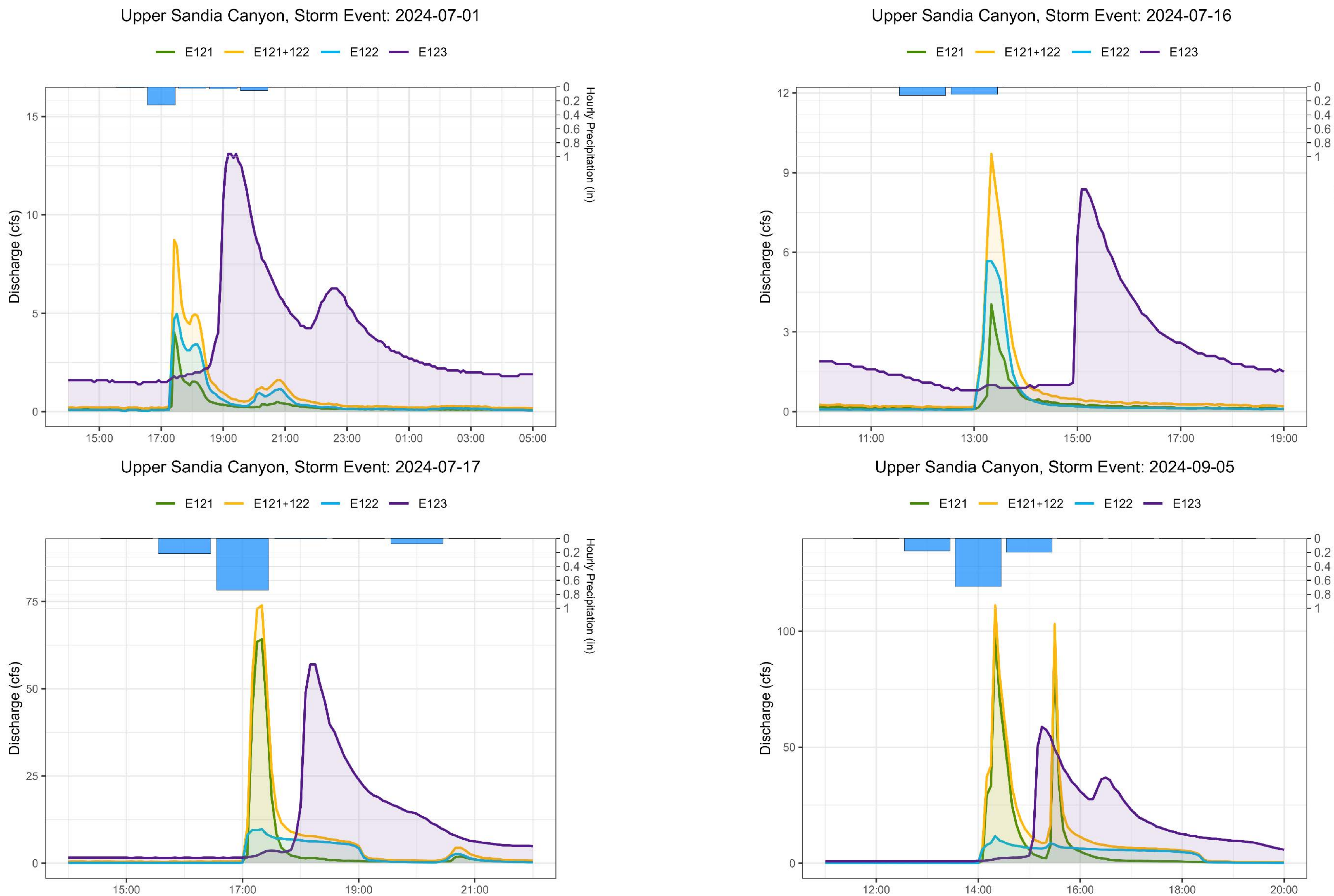
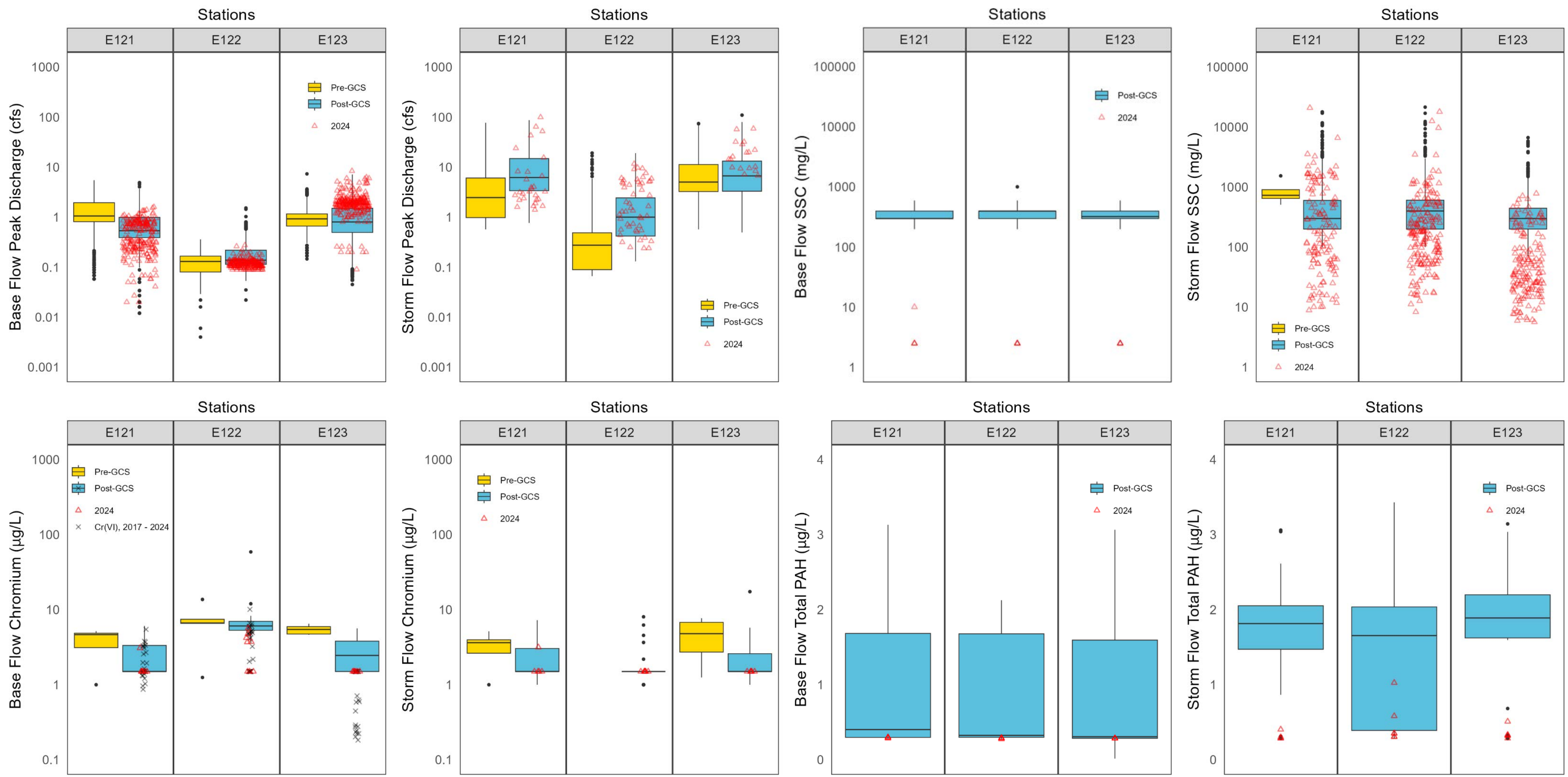


Figure 3.1-4 (continued) **Hydrographs of stormwater discharge at E121, E122, E121 plus E122, and E123 during each sample-triggering storm event in 2024**



Notes: Data for 2024 are overlaid as triangles and not included in the post-GCS boxplot. Non-detects are reported at ½ method detection limit. The lower and upper bounds of each box correspond to the first and third quartiles, respectively, and the thick black line in each box shows the median. Whiskers extend to the largest or smallest value, or at most 1.5 times +/- the interquartile range (the height of the box). Values above or below the whiskers are marked as outliers (solid black points). Before 2012, TSS was measured rather than SSC; TSS data are not shown on the SSC plots as they are not comparable metrics. There were no pre-GCS base-flow data for SSC and limited pre-GCS storm-flow data. Data for dissolved hexavalent chromium [Cr(VI)] are not included in the base flow boxplots, but are overlain as grey X's.

Figure 3.3-1 Pre- and post-GCS box-and-whisker plots of peak discharge, SSC, dissolved chromium and Cr(VI), and PAHs for base flow and storm flow at gaging stations E121, E122, and E123

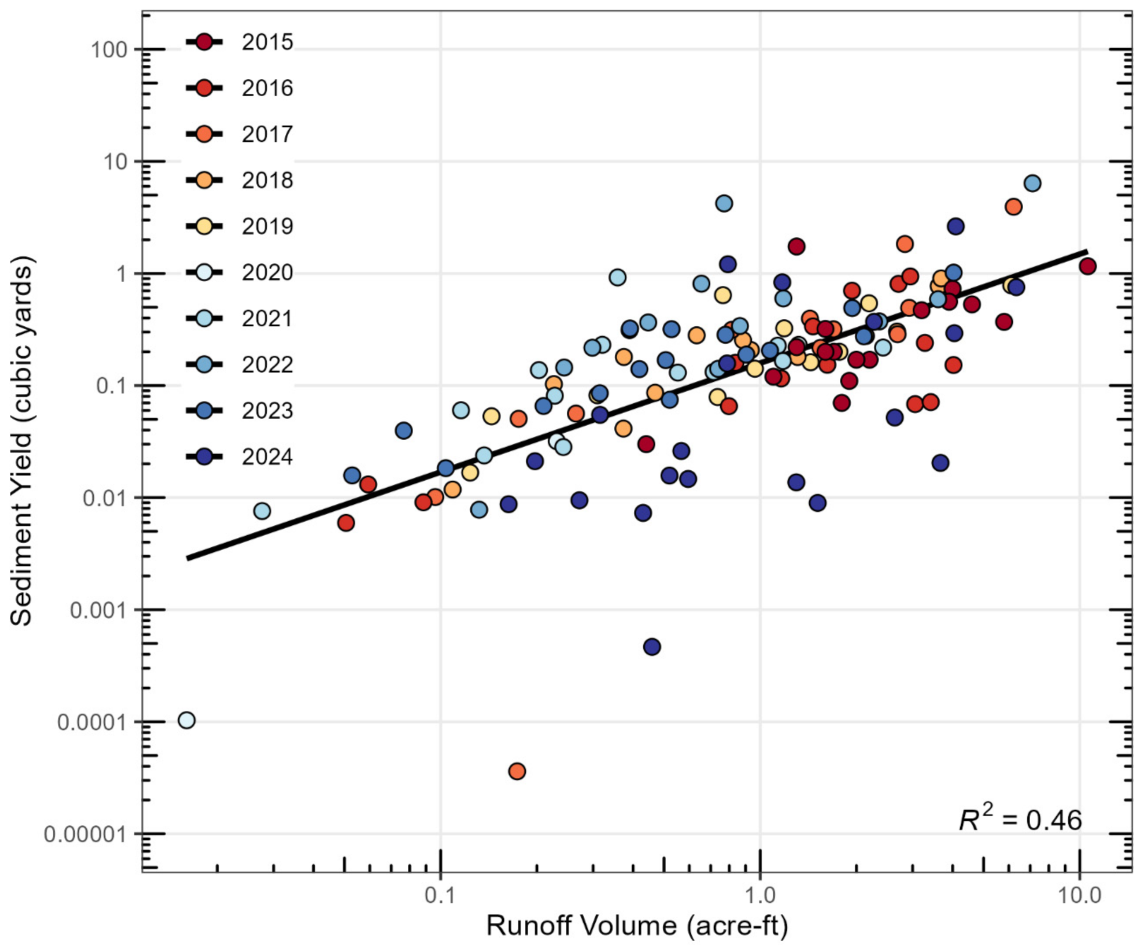


Figure 3.3-2 **Log-log plot showing the relationship between sediment volume and runoff volume from storm events from 2015 through 2024 at gaging stations E121, E122, and E123**

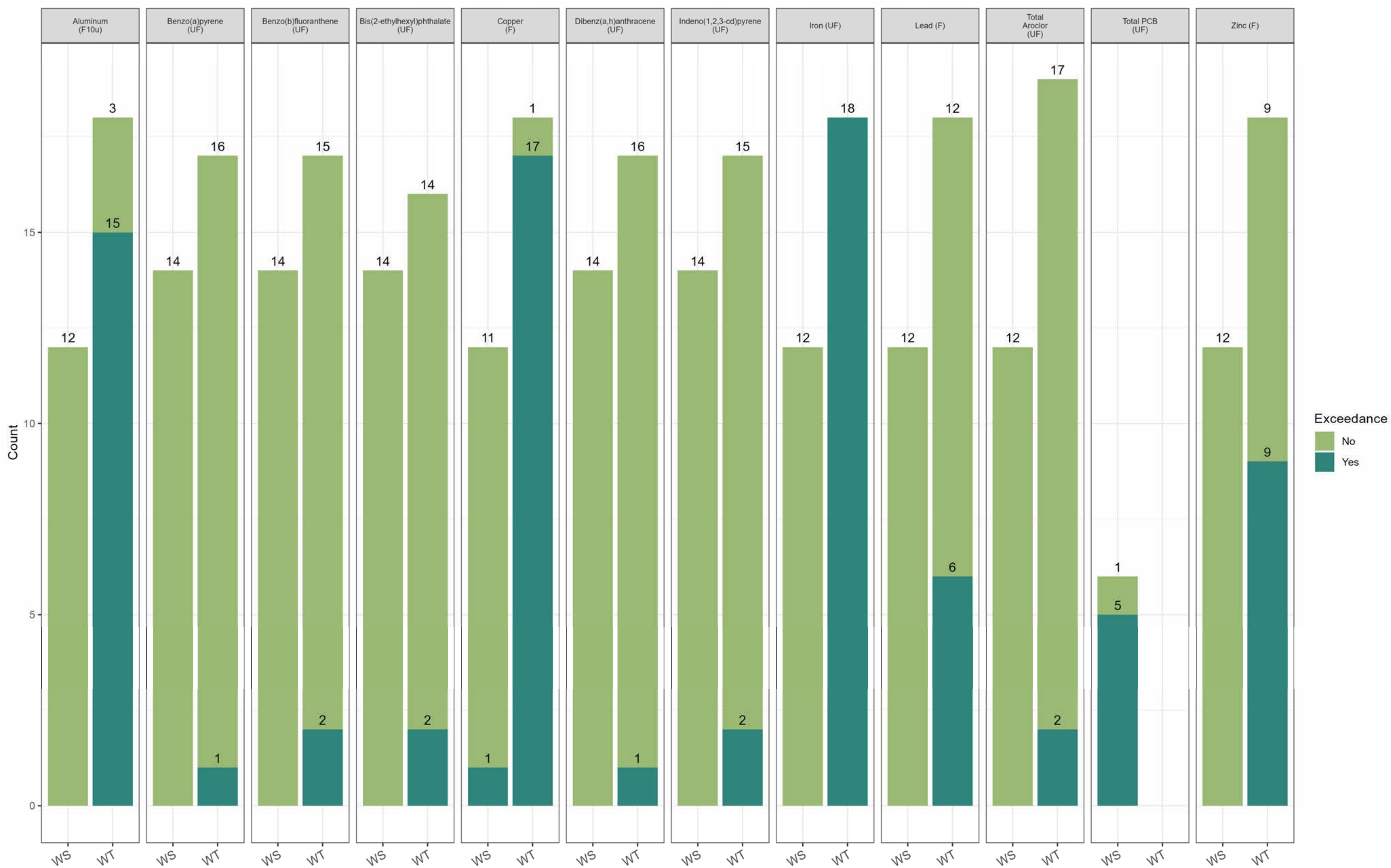
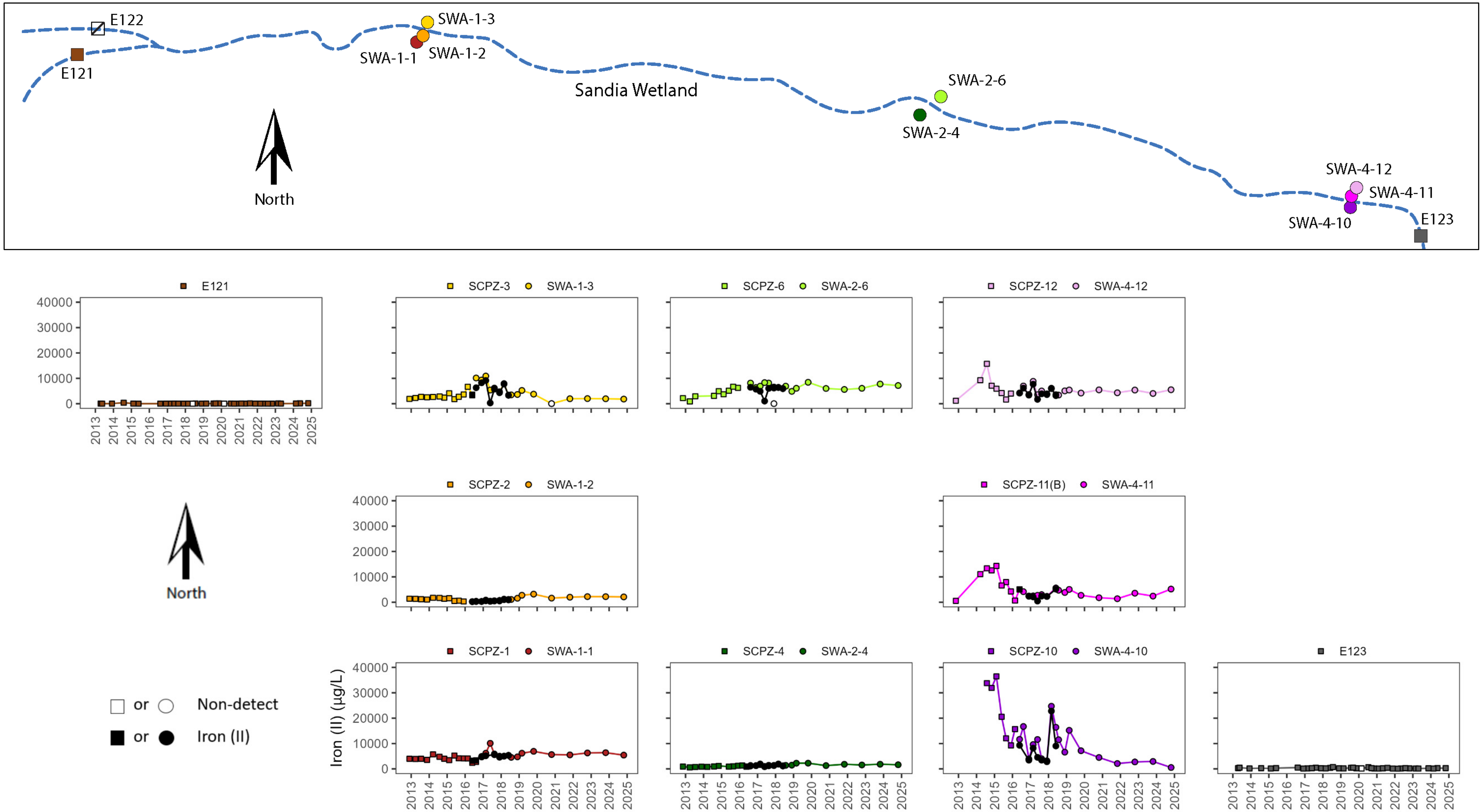
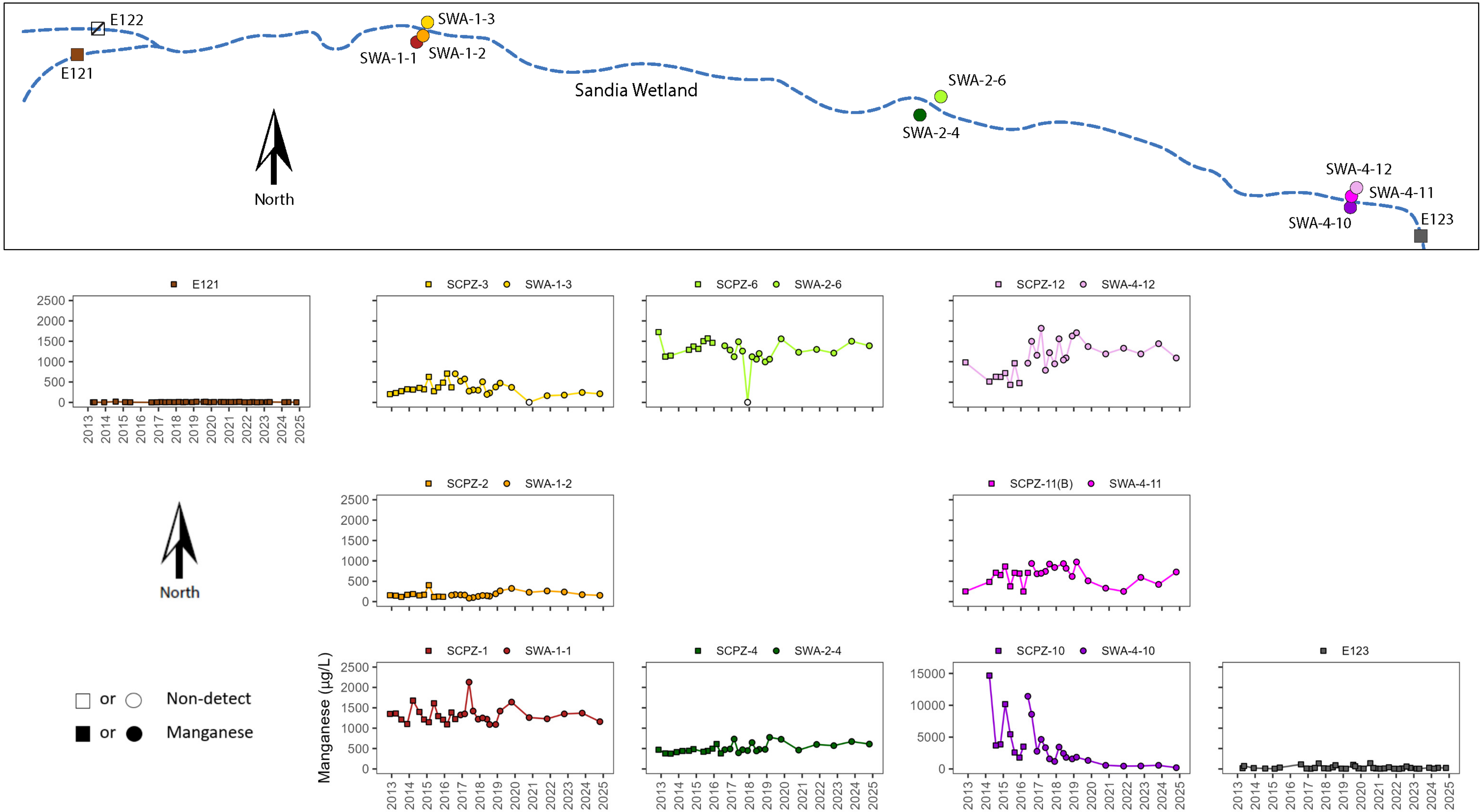


Figure 3.3-3 2024 Upper Sandia base flow (WS) and stormwater (WT) analytical exceedances summary



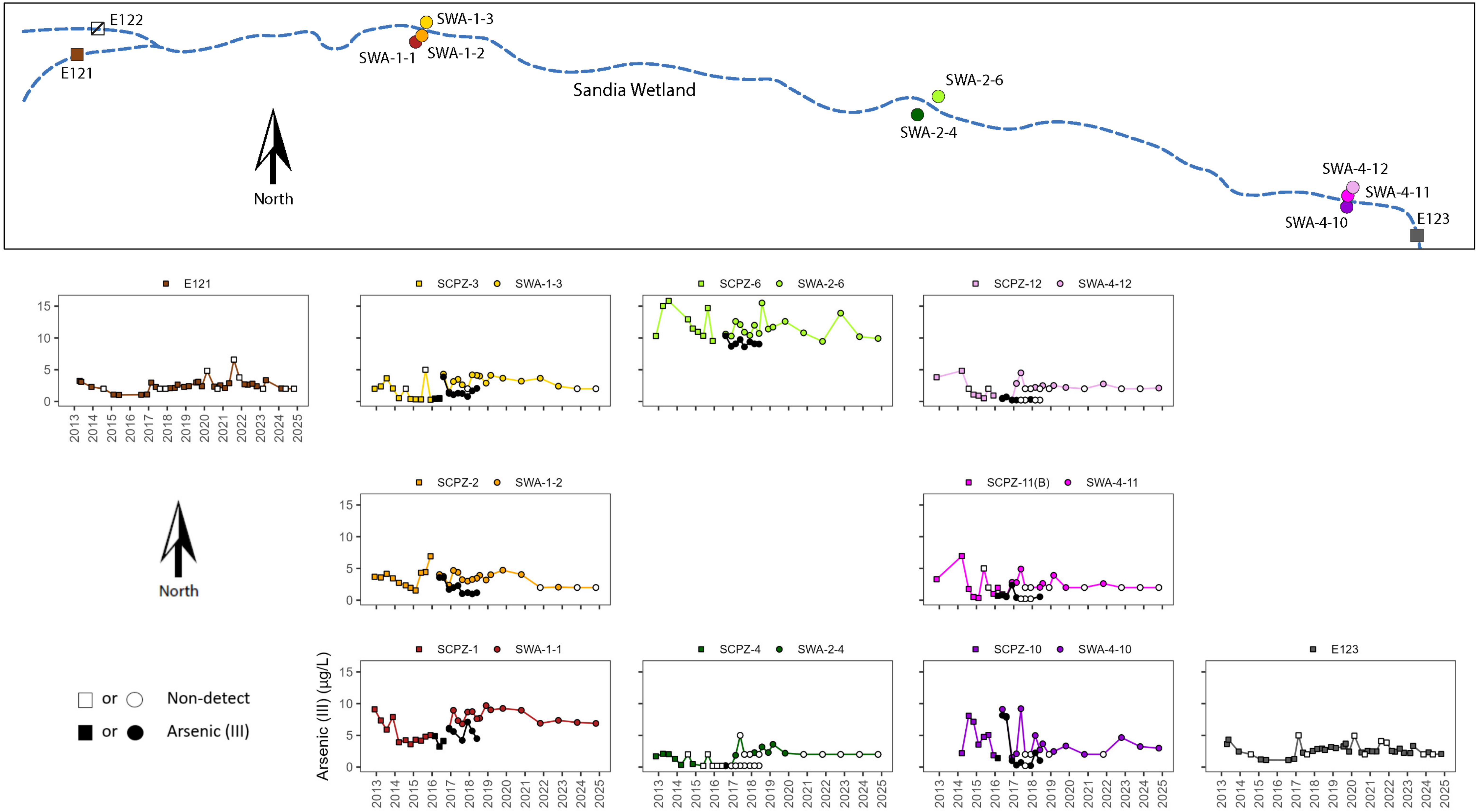
Notes: Surface water stations include E121, E122 (plot not shown), and E123. Piezometers are labeled with the prefix SCPZ (square symbols) and were replaced by alluvial wells that are labeled with the prefix SWA (circle symbols). The plots are arranged in three transects from west to east. Data are plotted for the full period of wetland monitoring. Nondetections are plotted as the MDL with open symbols. Dissolved iron is represented with colored symbols and Fe(II) with black symbols. Monitoring at piezometers SWA-2-5, SWA-3-7, SWA-3-8, and SWA-3-9 was discontinued in 2019; data can be found in previous years' reports. The map above is not to scale but shows approximate sampling locations in relation to the approximate thalweg (blue dashed line).

Figure 3.4-1 Iron concentrations in Sandia wetland surface water and alluvial system



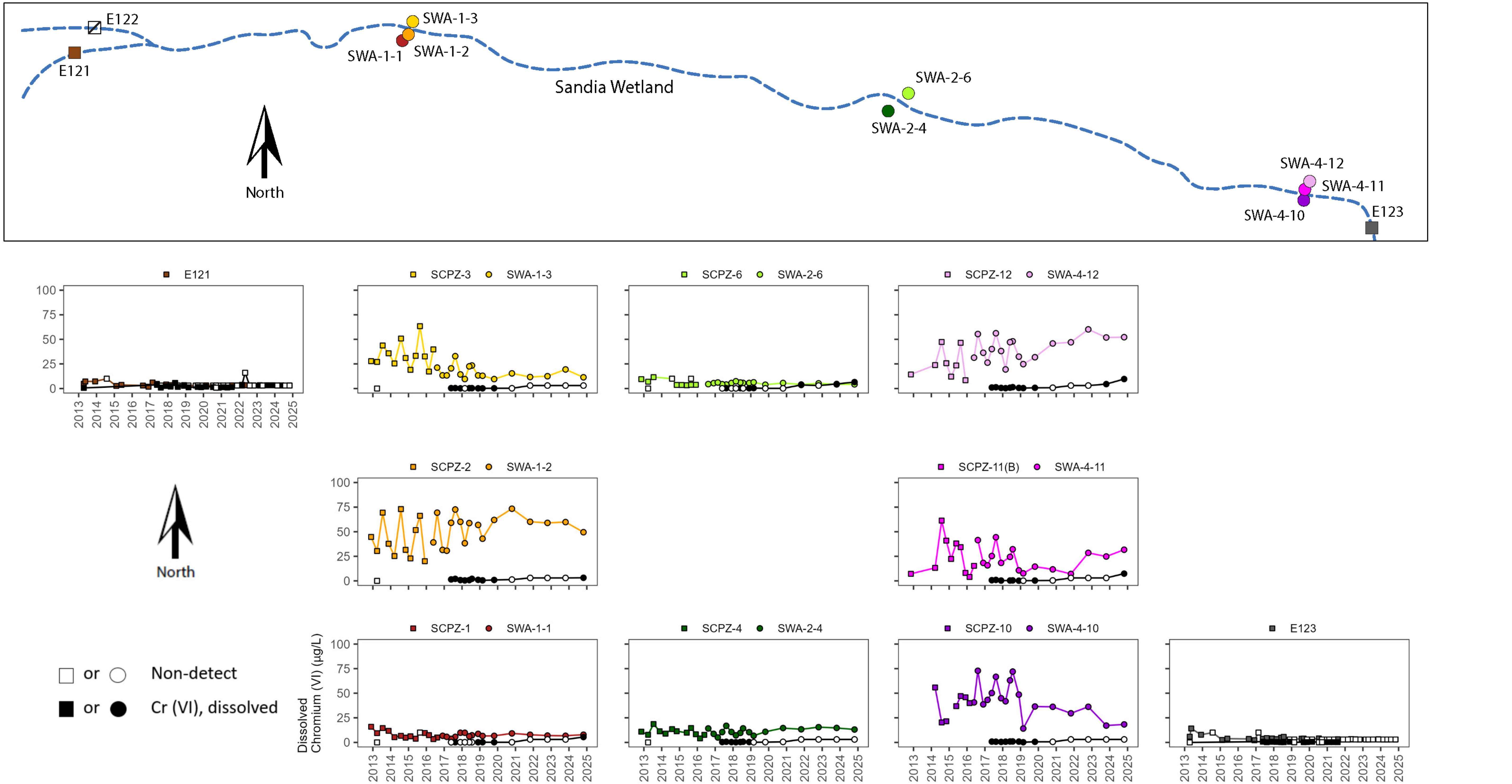
Notes: Surface water stations include E121, E122 (plot not shown), and E123. Piezometers are labeled with the prefix SCPZ (square symbols) and were replaced by alluvial wells that are labeled with the prefix SWA (circle symbols). The plots are arranged in three transects from west to east. Data are plotted for the full period of wetland monitoring. Nondetections are plotted as the MDL with open symbols. Monitoring at piezometers SWA-2-5, SWA-3-7, SWA-3-8, and SWA-3-9 was discontinued in 2019; data can be found in previous years' reports. The map above is not to scale but shows approximate sampling locations in relation to the approximate thalweg (blue dashed line).

Figure 3.4-2 Manganese concentrations in Sandia wetland surface water and alluvial system



Notes Surface water stations include E121, E122 (plot not shown), and E123. Piezometers are labeled with the prefix SCPZ (square symbols) and were replaced by alluvial wells that are labeled with the prefix SWA (circle symbols). The plots are arranged in three transects from west to east. Data are plotted for the full period of wetland monitoring. Nondetections are plotted as the MDL with open symbols. Dissolved arsenic is represented with colored symbols and As(III) with black symbols. Monitoring at piezometers SWA-2-5, SWA-3-7, SWA-3-8, and SWA-3-9 was discontinued in 2019; data can be found in previous years' reports. The map above is not to scale but shows approximate sampling locations in relation to the approximate thalweg (blue dashed line).

Figure 3.4-3 Arsenic concentrations in Sandia wetland surface water and alluvial system



Notes: Surface water stations include E121, E122 (plot not shown), and E123. Piezometers are labeled with the prefix SCPZ (square symbols) and were replaced by alluvial wells that are labeled with the prefix SWA (circle symbols). The plots are arranged in three transects from west to east. Data are plotted for the full period of wetland monitoring. Nondetections are plotted as the MDL with open symbols. Dissolved chromium is represented with colored symbols and Cr(VI) with black symbols. Monitoring at piezometers SWA-2-5, SWA-3-7, SWA-3-8, and SWA-3-9 was discontinued in 2019; data can be found in previous years' reports. The map above is not to scale but shows approximate sampling locations in relation to the approximate thalweg (blue dashed line).

Figure 3.4-4 Chromium concentrations in Sandia wetland surface water and alluvial system

Table 2.2-1
Schema Crosswalk: Past Piezometers and Current Alluvial Wells

Piezometer	To Alluvial Well	Date of Alluvial Well Installation
SCPZ-1	SWA-1-1	8/19/2016
SCPZ-2	SWA-1/SWA-1-2*	12/18/2014
SCPZ-3	SWA-1-3	7/21/2016
SCPZ-4	SWA-2-4	7/20/2016
SCPZ-6	SWA-2 / SWA-2-6*	12/16/2014
SCPZ-10	SWA-4-10	4/27/2016
SCPZ-11B	SWA-4-11	7/19/2016
SCPZ-12	SWA-4 / SWA-4-12*	12/15/2014

* SWA-1, SWA-2, and SWA-4 were pilot wells installed in December 2016; SWA-1-2, SWA-2-6, and SWA-4-12 are the same wells relabeled in 2015.

Table 2.2-2
ISCO Bottle Configurations and Analytical Suites for the 2024 and 2025 Stormwater Sampling Plan for E121, E122, and E123

Sample Bottle (1 L)	E121, E122, and E123			
	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[a]	Trigger	SSC
2	Max+12	PCB Aroclors (UF[b]) Part 1[c]	Trigger+2	SSC
3	Max+14	PFAS	Trigger+4	SSC
4	Max+16	PCB Aroclors (UF) Part 2	Trigger+6	SSC
5	Max+18	DOC[d] (F[e]), alkalinity + pH (UF)	Trigger+8	SSC
6	Max+20	TAL[f] metals + boron + uranium + hardness (F/UF)+ total recoverable aluminum (F10u[g])	Trigger+10	SSC
7	Max+22	PAH (UF)	Trigger+12	SSC
8	Max+24	SVOC[h] (UF)	Trigger+14	SSC
9	Max+26	Gross alpha (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[i]	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

Table 2.2-2 (continued)

Sample Bottle (1 L)	E121, E122, and E123			
	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
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

Notes E121 = Sandia right fork at power plant, E122 = Sandia left fork at asphalt plant or south fork of Sandia at E122, and E123 = Sandia below wetland. The 12-bottle ISCO begins collection 10 min after the peak discharge (i.e., “Peak+10”) and the 24-bottle ISCO begins collection as soon as water is detected by the liquid level actuator (i.e., “Trigger”). Red text indicates glass bottles, the rest of the bottles are poly.

[a] SSC = Suspended sediment concentration.

[b] UF = Unfiltered.

[c] Part 1 and Part 2 bottles are submitted as a single sample.

[d] DOC = Dissolved organic carbon.

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

[f] TAL = 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 calcium and magnesium, components of the TAL list.

[g] F10u = Filtered through a 10-µm membrane.

[h] SVOC = Semivolatile organic compounds.

[I] n/a = Not applicable.

Table 2.2-3
2024 Sampling and Preservation Requirements for Sandia Wetland

Analytical Suite	Analytical Method	Sample Type[a]	Frequency	Filtered[b]	Preservation	Field Storage	Holding Time	Ideal Volume	Minimum Volume	Comment
Alluvial Wells[c]										
Cr(VI) speciation	SW-846:7196A	W	Annually	F	NH4OH/(NH4)2SO4 (liquid) buffer (1 mL to 100 mL of sample) to pH 9.3–9.7; ice	<4°C	28 days	125 mL	125 mL	—[d]
TAL[e] metals	SW-846:6010D and SW-846:6020B SW-846:7470A (Hg)	W	Annually	F	Nitric acid; ice	<4°C	6 months 28 days for Hg	1 L	300 mL	—
PFAS	EPA:1633_PFAS_40a	W	Annually	UF	Ice	<4°C	28 days	0.75 L	0.75 L	Three 250 mL poly
Surface Water Base Flow at Gages E121, E122, and E123										
PAH congeners	EPA:625.1_GC/MS_SIM[f]	WS	Quarterly	UF	Ice	<4°C	7 days	3 L	1 L	Amber glass with Teflon lid
PCB Aroclors[g]	SW-846:8082	WS	Quarterly	UF	Ice	<4°C	1 yr	3 L	1L	Amber glass with Teflon lid
PFAS	EPA:1633_PFAS_40a	WS	Quarterly	UF	Ice	<4°C	28 days	0.75 L	0.75 L	Three 250 mL poly
SVOC[h]	EPA:625.1	WS	Quarterly	UF	Ice	<4°C	7 days	3 L	1 L	Amber glass with Teflon lid
TAL metals + total recoverable aluminum	SW-846:6010D and SW-846:6020B SW-846:7470A (Hg)	WS	Quarterly	F, UF, F10	Nitric acid; ice	<4°C	6 months 28 days for Hg	1 L	300 mL	—
Cr(VI) speciation	SW-846:7196A	WS	Quarterly	F	$NH_4OH/(NH_4)_2SO_4$ (liquid) buffer (1 mL to 100 mL of sample) to pH 9.3–9.7; ice	<4°C	28 days	125 mL	125 mL	—
SSC	ASTM:D3977-97	WS	Quarterly	UF	Ice	No requirement	n/a[i]	1 L	1 L	—
Surface Water Storm Flow at Gages E121, E122, and E123										
PAH congeners	EPA:625.1 GC/MS_SIM	WT	>5 cfs[j]	UF	Ice	<4°C	7 days	3 L	1 L	Amber glass with Teflon lid
PCB Aroclors	SW-846:8082	WT	> 5 cfs	UF	Ice	<4°C	1 yr	3 L	1L	Amber glass with Teflon lid
PFAS	EPA:1633_PFAS_40a	WT	> 5 cfs	UF	IC	<4°C	28 days	0.75 L	0.75 L	Three 250 mL poly
SVOC	EPA:625.1	WT	> 5 cfs	UF	Ice	<4°C	7 days	3 L	1 L	Amber glass with Teflon lid
TAL metals + total recoverable aluminum	EPA:200.7 and EPA:200.8 EPA:245.2 (Hg)	WT	> 5 cfs	F, UF, F10	Nitric acid; ice	<4°C	6 months 28 days for Hg	1 L	300 mL	—
SSC	ASTM:D3977-97	WT	> 5 cfs	UF	Ice	No requirement	n/a	1 L	1 L	—

[a] W = Alluvial groundwater samples; WS = base-flow water samples; WT = storm-flow water samples.
[b] F = Filtered using a 0.45-µm filter; UF = unfiltered; F10 = filtered using a 10-µm filter (for total recoverable aluminum only).
[c] Alluvial wells will be reduced to transect 1 (SWA-1-1, SWA-1-2, SWA-1-3), transect 4 (SWA-4-10, SWA-4-11, SWA-4-12), and wells SWA-2-4 and SWA-2-6.
[d] — = None.
[e] TAL = Target analyte list.
[f] GC/MS-SIM = Gas chromatography/mass spectrometry-selective ion monitoring.
[g] PCB congeners were also sampled in Q1 and Q2 using analytical method EPA:1668.
[h] SVOC = Semivolatile organic compound.
[i] n/a = not applicable.
[j] > 5 cfs= Greater than 5 cfs above base flow for E121 and E123 and greater than 1 cfs above base flow for E122; up to four samples.

Table 2.2-4
Completion Data for Alluvial Piezometers and Collocated Alluvial Wells

Piezometers									
	SCPZ-1	**SCPZ-2**	**SCPZ-3**	**SCPZ-4**	**SCPZ-6**	**SCPZ-10**	**SCPZ-11(A)**	**SCPZ-11(B)**	**SCPZ-12**
Total length (ft)	20.5	11.4	8.3	8.3	8.3	8.3	8.3	8.3	8.3
Stick up (ft)	4.36	3.26	3.19	3.16	3.18	4.01	3.8	4.48	3.77
Top of screen (ft bgs[a])	13.8	6.0	3	3	3	3	3	1	3
Total depth/Bottom of screen (ft bgs)	16.2	8.3	5.4	5.4	5.4	5.4	5.4	5.4	5.4
Alluvial Wells									
	SWA-1-1	**SWA-1-2**	**SWA-1-3**	**SWA-2-4**	**SWA-2-6**	**SWA-4-10**		**SWA-4-11**	**SWA-4-12**
Ground elevation (ft amsl[b])	7239.90	7239.96	7239.23	7223.25	7222.90	7209.60	No collocated well	7210.70	7210.50
Total length (ft)	18.33	13.17	9.37	9.00	8.22	8.44		7.93	8.19
Stick up (ft)	3.03	4.57	3.37	3.23	2.86	3.46		3.37	2.54
Top of screen (ft bgs)	13.0	6.03	3.0	3.0	3.12	2.5		3.0	2.99
Bottom of screen (ft bgs)	15.5	8.53	5.5	5.5	5.62	5		5.5	5.49
Total depth (ft bgs)	16.0	9.03	6.0	6.0	6.12	5.5		6.0	5.99
Total depth (ft bTOC[c])	18.76	13.35	9.40	9.04	8.66	8.48		9.16	8.05

Note: Alluvial well shown below collocated piezometer.

[a] bgs = Below ground surface.

[b] amsl = Above mean sea level.

[c] ft bTOC = feet below top of casing (measured in field and could vary).

Table 2.2-5
Field Parameter Data for Surface Water Stations and Alluvial Wells—2024 Sampling Events

Location Name	Date	Dissolved Oxygen (mg/L)	Oxidation-Reduction Potential (mV)	pH	Specific Conductance (µS/cm)	Temperature (°C)	Turbidity (NTU[a])
Surface Water Stations							
Sandia right fork at Pwr Plant (E121)	2/22/2024	8.31	ND[b]	7.18	1081	10.8	1.00
	5/15/2024	7.90	ND	8.00	507	12.7	2.27
	7/23/2024	7.68	ND	7.58	367.1	15.0	9.29
	7/30/2024	7.50	ND	7.97	355.0	16.5	1.42
	10/28/2024	7.17	ND	7.91	460.8	15.3	4.29
South fork of Sandia at E122	2/22/2024	5.76	ND	7.45	963	11.4	5.33
	5/15/2024	7.08	ND	8.20	360.8	18.7	1.80
	7/30/2024	5.90	ND	7.92	371.9	21.2	0.88
	10/28/2024	6.69	ND	7.97	328.4	15.9	4.86
Sandia below Wetlands (E123)	2/22/2024	10.37	ND	8.02	1214	1.5	1.05
	5/15/2024	7.81	ND	7.52	472.1	8.7	3.49
	7/23/2024	7.18	ND	7.10	318.3	13.4	11.62
	7/30/2024	6.21	ND	7.32	456.5	16.2	5.00
	10/28/2024	8.65	ND	7.69	452.1	6.6	5.53
Alluvial Wells							
SWA-1-1	10/24/2024	0.45	-148.0	7.00	554	12.9	3.27
SWA-1-2	10/24/2024	0.54	-118.2	7.01	440.9	13.1	13.54
SWA-1-3	10/24/2024	1.69	-81.8	6.95	415.4	12.1	5.97
SWA-2-4	10/24/2024	0.22	-77.1	6.76	487.2	11.3	5.21
SWA-2-6	10/24/2024	0.18	-136.5	6.74	602	10.0	19.02
SWA-4-10	10/23/2024	2.11	-6.7	6.34	485.3	12.6	25.82
SWA-4-11	10/23/2024	0.28	-82.4	6.09	516	10.3	30.5
SWA-4-12	10/23/2024	0.21	-82.2	6.63	493.2	12.1	5.77

[a] NTU = Nephelometric turbidity unit.

[b] ND = No data.

Table 2.2-6
Installation and Calibration Information for Transducers in Alluvial Wells

Well	Installation Date	Transducer Calibration Date	Level TROLL 500 PSI Rating
SWA-1-1	6/21/2024	6/21/2024	15 psi
SWA-1-2	6/21/2024	6/21/2024	15 psi
SWA-1-3	6/21/2024	6/21/2024	15 psi
SWA-2-4	6/21/2024	6/21/2024	15 psi
SWA-2-6	6/21/2024	6/21/2024	15 psi
SWA-4-10	6/21/2024	6/21/2024	15 psi
SWA-4-11	6/21/2024	6/21/2024	15 psi
SWA-4-12	6/21/2024	6/21/2024	15 psi

Table 3.1-1
Precipitation, Stormwater Peak Discharge, and Samples Collected at Gaging Stations E121, E122, and E123 for Each Sample-Triggering Storm Event in 2024

Storm Event Date	RG121.9 Total Precipitation (in.)	E121 Peak Discharge (ft^3/s)	E122 Peak Discharge (ft^3/s)	E123 Peak Discharge (ft^3/s)
6/9/2024	0.63	43 S[a]	9.1 S	32 S
6/20/2024	0.46	3.9 S	5.5 S	16 S
6/21/2024	0.22	2.2 BT[b]	3.5 S	8.2 S
6/27/2024	0.17	2.9 BT	4.8 S	6.7 BT
6/29/2024	0.79	3.1 BT	5.3 BT	20 S
7/1/2024[c]	0.56	8.2 S	6.0 S	14 NS[d]
7/16/2024	0.23	4.0 BT	5.7 BT	8.4 S
7/17/2024	1.05	64 NS	9.8 S	57 S
9/5/2024	1.07	100 S	12 S	59 NS

[a] S = Sample was collected.

[b] BT = Flow was below the sampler trip level.

[c] E121and E122 collected two samples each on July 1, 2024.

[d] NS = Flow was above sampler trip level, but the samplers did not trigger.

Table 3.1-2
Travel Time of Flood Bore, Peak Discharge, Increase or Decrease in Peak Discharge, and Percent Change in Peak Discharge from Upgradient to Downgradient of the Wetland for Each Sample-Triggering Storm Event in 2024

Date	Travel Time from E121 to E123 (min)	Peak Discharge (ft^3/s)		+/–[a]	%[b]	Travel Time from E122 to E123 (min)	Peak Discharge (ft^3/s)		+/–	%
		E121	E123				E122	E123		
6/9/2024	85	43	32	-	26	90	9.1	32	+	252
6/20/2024	90	3.9	16	+	310	95	5.5	16	+	191
6/21/2024	115	2.2	8.2	+	273	110	3.5	8.2	+	134
6/27/2024	120	2.9	6.7	+	131	120	4.8	6.7	+	40
6/29/2024	160	3.1	20	+	545	85	5.3	20	+	277
7/1/2024	100	8.2	14	+	71	100	6.0	14	+	133
7/16/2024	110	4.0	8.4	+	110	115	5.7	8.4	+	47
7/17/2024	55	64	57	-	11	55	9.8	57	+	482
9/5/2024	60	100	59	-	41	60	12	59	+	392
Min	55	2.2	6.7	+	205	55	3.5	6.7	+	91
Mean	99	26	25	-	4	92	7	25	+	257
Max	160	100	59	-	41	160	9.8	59	+	502

[a] (+) = increase; (-) = decrease.

[b] % = Percent change in peak discharge.

Table 3.2-1
Significant Geomorphic Changes and Associated Peak Discharges

Date*	Station	Peak Discharge (cfs)	Noted Erosion in Geomorphic Surveying
9/13/2013	E123	108	Extensive repairs were required, including the design and construction of best management practice run-on control structures, replacement of boulders and repair of the cascade pool liner, removal of deposited sediments, and replanting of the lost vegetation in the GCS (section 3.4.2 of "Completion Report for Sandia Grade-Control Structure," (LANL 2013, 251743).
7/7/2014	E123	80	Overall, erosion within the system seems to be associated with scouring in small side channels outside the wetland proper or with channel rearrangement within the wetland proper. There is evidence of increased channelization in the lower part of the wetland and a new nick point, located upgradient of the most upstream sheet pile.
7/8/2014	E123	76	Overall, erosion within the system seems to be associated with scouring in small side channels outside the wetland proper or with channel rearrangement within the wetland proper. There is evidence of increased channelization in the lower part of the wetland and a new nick point, located upgradient of the most upstream sheet pile.

Table 3.2-1 (continued)

Date*	Station	Peak Discharge (cfs)	Noted Erosion in Geomorphic Surveying
7/31/2014	E123	109	Overall, erosion within the system seems to be associated with scouring in small side channels outside the wetland proper or with channel rearrangement within the wetland proper. There is evidence of increased channelization in the lower part of the wetland and a new nick point, located upgradient of the most upstream sheet pile.
7/26/2017	E121	87	Repeat GPS surveys in conjunction with field observations indicated that no significant geomorphic changes occurred in the wetland after the 2017 monsoon season. A small amount of deposition was detected in the plunge pool from storm runoff but has not affected the plunge pool area.
7/26/2017	E123	78	Repeat GPS surveys in conjunction with field observations indicated that no significant geomorphic changes occurred in the wetland after the 2017 monsoon season. A small amount of deposition was detected in the plunge pool from storm runoff but has not affected the plunge pool area.
7/27/2022	E123	77	Small log check dams upstream of gaging station E123 have failed or are completely full. Sediment has moved into wetland from just below building 60-0175.
8/25/2023	E121	56	Scouring occurred at staff plate. Non-fluvial sheet erosion occurred downstream of gaging station. Some minor bank erosion occurred on the north bank.
7/17/2024	E121	64	Minor scouring at gaging station. Gravel bar removed.
8/9/2024	E121	52	No apparent major changes. The channel bed above the gaging station has been scoured 1–2 ft. There is a small pool where previously there was a riffle.
8/9/2024	E123	29	Vegetation covering the majority of weir. Small spalling on north side of the concrete wall. Erosion above the cell barrier, 4 ft of capacity remaining. No sediment capacity remaining in log check dam 1. Log check dam 2 is full. Additional control dam 3 is backcutting downstream of dam 3. Earthen channel in tributary upstream of GCS is full. Erosion occurring downstream.
9/4/2024	E121	100	Minor aggregation in pool 60 feet upstream. Minor movement of woody debris throughout the channel. Dead tree fell downstream of gaging station. It crosses the channel 40 ft downstream and may cause debris collection. South slope of gaging station eroding pipe is exposed.
9/4/2024	E123	59	Vegetation covering majority of weir. Small spalling on north side of the concrete wall. Does not appear to have increased in size. Erosion above cell barrier is minimal and controlled by vegetation very well, 4 ft of capacity left at cell barrier. No sediment capacity remaining in log check dams 1,2, and 3. Erosion and cutting occurring downstream of log check dam 3. Erosion occurring downstream of the GCS Flow Spreader BMP. Flows flattened cattails in the wetland and moved sediment outside of the wetland.

* There were no large storm events in 2015, 2016, 2018, 2019, 2020, or 2021.

Table 3.3-1
Summary of Proposed Maintenance Activities with Timeline

Maintenance Activity	Timeline	Rationale for Timeline
Maintain new lower large log check dam	Deferred to spring 2025	Minor maintenance did not need to be addressed immediately, and resources were reprioritized.
Installing an engineered cap by applying shotcrete over a 2300- ft2 area to cover the majority of SWMU 03-056(c) as part of the IP corrective action	Certified September 2024	Installation was completed in August 2024.
Installing an engineered cap by applying shotcrete over a 600- ft2 area to cover the SMA drainage area below AOC 03-014(b2) as part of the IP corrective action	Certified September 2024	Installation was completed in August 2024.
Evaluate alternatives to manage sediment now that large log check dams are full	Spring 2025	Preferred alternative can be implemented during 2025 field season. No immediate risk to the wetland.

Table 3.3-2
Calculated Sediment Yield and Runoff Volume at Gaging Stations
E121, E122, and E123 for Each Sample-Triggering Storm Event from 2014 to 2024

Gage	Date	Sediment Yield (ton)	Sediment Volume (yd^3)	Runoff Volume (acre-ft)	Peak Discharge (cfs)
2024					
E121	6/9/2024	2.70	1.21	0.79	43.03
E121	6/20/2024	0.12	0.05	0.32	3.92
E121	6/29/2024	0.02	0.01	0.43	3.14
E121	7/1/2024	0.02	0.01	0.27	4.04
E121	9/5/2024	5.88	2.63	4.09	99.47
E122	6/9/2024	0.35	0.16	0.79	9.08
E122	6/20/2024	0.06	0.03	0.57	5.46
E122	6/21/2024	0.02	0.01	0.16	3.5
E122	6/27/2024	0.05	0.02	0.20	4.76
E122	6/29/2024	0.03	0.01	0.59	5.11
E122	7/1/2024	0.04	0.02	0.52	4.97
E122	7/17/2024	1.86	0.83	1.17	9.75
E122	9/5/2024	0.83	0.37	2.27	11.63
E123	2/22/2024	0.00	0.00	0.46	1.69
E123	6/9/2024	0.65	0.29	4.05	31.99
E123	6/20/2024	0.12	0.05	2.64	16.19
E123	6/21/2024	0.02	0.01	1.51	8.22
E123	6/29/2024	0.05	0.02	3.67	19.74
E123	7/16/2024	0.03	0.01	1.30	8.37
E123	7/17/2024	1.69	0.75	6.33	57.02

Table 3.3-2 (continued)

Gage	Date	Sediment Yield (ton)	Sediment Volume (yd^3)	Runoff Volume (acre-ft)	Peak Discharge (cfs)
2023					
E121	5/15/2023	0.72	0.32	0.39	11.6
E121	5/19/2023	0.19	0.09	0.32	4.16
E121	5/22/2023	0.09	0.04	0.08	4.67
E121	5/31/2023	0.31	0.14	0.42	36.0
E121	6/1/2023	0.15	0.07	0.21	3.80
E122	5/15/2023	0.71	0.32	0.53	1.94
E122	5/17/2023	0.04	0.02	0.05	1.04
E122	5/18/2023	0.04	0.02	0.10	1.18
E122	5/19/2023	0.17	0.08	0.52	1.65
E122	5/31/2023	0.38	0.17	0.51	2.07
E122	8/25/2023	0.63	0.28	0.78	2.65
E123	5/15/2023	1.10	0.49	1.94	16.2
E123	5/19/2023	0.61	0.28	2.11	13.3
E123	5/22/2023	0.46	0.21	1.07	8.22
E123	7/27/2023	0.42	0.19	0.91	7.91
E123	8/25/2023	2.27	1.02	4.03	52.8
2022					
E121	6/18/2022	0.49	0.22	0.30	4.8
E121	6/22/2022	0.31	0.14	0.74	11
E121	6/25/2022	1.34	0.60	1.18	27
E121	7/2/2022	0.82	0.37	0.45	9.8
E122	6/18/2022	0.13	0.06	0.13	4.7
E122	6/22/2022	1.91	0.85	0.65	5.4
E122	6/25/2022	9.42	4.21	0.77	6.7
E122	7/20/2022	0.32	0.14	0.24	5.9
E123	6/18/2022	0.76	0.34	0.86	6.9
E123	6/22/2022	0.83	0.37	2.36	12
E123	6/25/2022	1.32	0.59	3.60	28
E123	7/27/2022	14.2	6.38	7.12	72
2021					
E121	5/30/2021	0.52	0.23	0.32	15
E121	6/2/2021	2.06	0.92	0.36	8.8
E121	6/17/2021	0.31	0.14	0.20	7.3
E121	6/27/2021	0.29	0.13	0.55	7.3
E121	7/1/2021	0.13	0.06	0.12	3.9
E122	6/3/2021	0.02	0.01	0.03	2.0
E122	6/17/2021	0.18	0.08	0.23	3.6

Table 3.3-2 (continued)

Gage	Date	Sediment Yield (ton)	Sediment Volume (yd^3)	Runoff Volume (acre-ft)	Peak Discharge (cfs)
E122	6/27/2021	0.05	0.02	0.14	4.6
E122	7/1/2021	0.06	0.03	0.24	3.2
E123	5/30/2021	0.51	0.23	1.14	13
E123	6/2/2021	0.37	0.17	1.18	12
E123	6/17/2021	0.30	0.13	0.71	7.4
E123	6/27/2021	0.49	0.22	2.42	15
2020					
E121	8/1/2020	0.70	0.31	0.39	19
E122	7/27/2020	0.07	0.03	0.02	2.1
E123	8/2/2020	0.51	0.23	1.3	14
2019					
E121	7/2/2019	1.43	0.64	0.8	25
E121	7/7/2019	0.17	0.08	0.7	16
E121	7/15/2019	0.72	0.32	1.2	33
E121	7/25/2019	0.32	0.14	1.0	34
E121	7/26/2019	1.21	0.54	2.2	36
E122	7/2/2019	0.12	0.05	0.1	3.7
E122	7/13/2019	0.04	0.02	0.1	1.8
E122	7/15/2019	0.18	0.08	0.3	5.2
E123	7/7/2019	0.36	0.16	1.4	12
E123	7/15/2019	0.62	0.28	2.1	24
E123	7/25/2019	0.45	0.20	1.8	29
E123	7/26/2019	1.75	0.78	6.1	40
2018					
E121	7/15/2018	0.09	0.04	0.4	14
E121	7/17/2018	0.46	0.21	0.9	29
E121	8/7/2018	0.19	0.09	0.5	18
E121	8/9/2018	0.63	0.28	0.6	21
E121	8/15/2018	0.57	0.25	0.9	42
E121	9/4/2018	0.40	0.18	1.3	38
E122	7/15/2018	0.03	0.01	0.1	3.3
E122	8/9/2018	0.23	0.10	0.2	3.8
E122	9/4/2018	0.40	0.18	0.4	4.3
E123	7/17/2018	1.72	0.77	3.6	31
E123	9/3/2018	0.68	0.30	2.7	21
E123	9/4/2018	2.02	0.90	3.7	35

Table 3.3-2 (continued)

Gage	Date	Sediment Yield (ton)	Sediment Volume (yd^3)	Runoff Volume (acre-ft)	Peak Discharge (cfs)
2017					
E121	6/6/2017	0.70	0.31	0.8	26
E121	6/25/2017	0.71	0.32	1.7	21
E121	7/18/2017	0.48	0.22	1.5	36
E121	7/26/2017	4.09	1.83	2.8	87
E121	7/29/2017	0.88	0.40	1.4	30
E122	7/18/2017	0.11	0.05	0.2	5
E122	7/27/2017	0.02	0.01	0.1	2
E122	7/29/2017	0.13	0.06	0.3	5
E122	8/21/2017	<0.01	<0.01	0.2	2
E123	6/25/2017	1.10	0.49	2.9	30
E123	7/26/2017	8.79	3.94	6.2	78
E123	7/29/2017	0.64	0.29	2.7	29
2016					
E121	7/1/2016	0.36	0.16	0.8	22
E121	7/15/2016	0.26	0.12	1.2	22
E121	7/31/2016	1.80	0.81	2.7	47
E121	8/3/2016	0.34	0.15	1.6	37
E121	8/27/2016	1.57	0.70	1.9	51
E121	9/6/2016	0.75	0.34	1.5	40
E121	11/4/2016	0.15	0.07	0.8	8.4
E122	10/3/2016	0.02	0.01	0.1	22
E122	10/8/2016	0.01	0.01	0.1	22
E122	11/4/2016	0.03	0.01	0.1	47
E123	7/31/2016	0.34	0.15	4.0	46
E123	8/3/2016	2.10	0.94	2.9	13
E123	8/27/2016	0.54	0.24	3.3	28
E123	9/6/2016	0.15	0.07	3.1	18
E123	11/5–11/6/2016	0.16	0.07	3.4	15
2015					
E121	6/1/2015	0.45	0.20	1.7	20
E121	6/26/2015	3.88	1.74	1.3	18
E121	7/3/2015	0.71	0.32	1.6	30
E121	7/15–7/16/2015	0.50	0.22	1.3	39
E121	7/20–7/21/2015	1.62	0.73	4.0	50
E121	7/29–7/30/2015	0.38	0.17	2.2	14
E121	7/31/2015	0.27	0.12	1.1	9.2
E121	8/17/2015	0.45	0.20	1.6	36

Table 3.3-2 (continued)

Gage	Date	Sediment Yield (ton)	Sediment Volume (yd^3)	Runoff Volume (acre-ft)	Peak Discharge (cfs)
E121	10/23–10/24/2015	0.38	0.17	2.0	28
E122	10/23–10/24/2015	0.07	0.03	0.4	5.1
E123	7/3/2015	1.26	0.56	3.9	35
E123	7/20–7/21/2015	2.58	1.16	10.6	64
E123	7/29–7/30/2015	0.84	0.37	5.8	29
E123	8/8/2015	0.15	0.07	1.8	16
E123	8/17/2015	1.06	0.47	3.2	38
E123	10/20/2015	0.25	0.11	1.9	16
E123	10/23/2015	1.19	0.53	4.6	48
2014					
E121	7/7/2014	0.84	0.38	2.3	63
E121	7/14–7/15/2014	0.19	0.09	0.7	4.8
E121	7/15–7/16/2014	1.64	0.73	0.6	10
E121	7/19/2014	3.22	1.44	0.6	11
E121	7/27–7/28/2014	0.57	0.26	0.9	29
E121	7/31/2014	15.4	6.91	2.9	66
E122	7/8/2014	0.60	0.27	1.0	10
E122	7/27–7/28/2014	0.05	0.02	0.6	6.2
E122	7/29/2014	0.73	0.33	1.2	12
E122	7/31/2014	1.55	0.69	1.0	19
E123	5/23/2014	1.62	0.73	2.7	18
E123	7/7/2014	4.12	1.84	6.4	80
E123	7/8/2014	18.2	8.14	7.0	76
E123	7/15–7/16/2014	2.01	0.90	3.1	20
E123	7/19/2014	0.39	0.17	1.7	18
E123	7/29/2014	7.36	3.30	7.5	62
E123	7/31/2014	28.6	12.8	7.2	109

Notes: Sediment yield and volume were not calculated for the storm events at E122 on July 2, 2022, July 27, 2022, June 19, 2021 or July 17, 2020 because the 24-bottle ISCO did not collect samples. Therefore, there were not enough SSC samples to make an accurate calculation.

Table 3.3-3
Analytical Exceedances in Surface Water at Gaging Stations E121, E122, and E123

Gage	Sample Date	Analyte	Field Prep Code[b]	Sample Type[c]	Result	MDL[d]	PQL[e]	Unit[f]	Hardness Used[g]	Exceedance Ratio[a]				
										LW[h]	WH[i]	AAL[j]	CAL[k]	HH-OO[l]
E121	5/15/2024	Total PCB Congeners	UF	WS	3.98E-03	—[m]	—	µg/L	—	—	0.28	<0.01	0.28	6.22
E121	6/9/2024	Iron	UF	WT	7720	30	100	µg/L	—	—	—	—	7.72	—
E121	6/9/2024	Total PCB Aroclors	UF	WT	3.96E-02	—	—	µg/L	—	—	2.83	0.02	2.83	61.88
E121	6/9/2024	Zinc	F	WT	34.3	3.3	20	µg/L	17.2 mg/L	<0.01	—	1.06	1.40	<0.01
E121	6/9/2024	Copper	F	WT	7.33	0.3	2	µg/L	17.2 mg/L	0.01	—	2.86	3.68	—
E121	6/9/2024	Aluminum	F10µ	WT	786	19.3	50	µg/L	17.2 mg/L	—	—	2.56	6.39	—
E121	6/9/2024	Lead	F	WT	0.512	0.5	2	µg/L	17.2 mg/L	0.01	—	0.06	1.44	—
E121	6/20/2024	Iron	UF	WT	2810	30	100	µg/L	—	—	—	—	2.81	—
E121	6/20/2024	Aluminum	F10µ	WT	538	19.3	50	µg/L	15.0 mg/L	—	—	2.11	5.28	—
E121	6/20/2024	Zinc	F	WT	35.4	3.3	20	µg/L	15.0 mg/L	<0.01	—	1.24	1.64	<0.01
E121	6/20/2024	Copper	F	WT	6.27	0.3	2	µg/L	15.0 mg/L	0.01	—	2.79	3.54	—
E121	7/1/2024 PM	Iron	UF	WT	1970	30	100	µg/L	11.7 mg/L	___	—	—	1.97	—
E121	7/1/2024 AM	Iron	UF	WT	2320	30	100	µg/L	11.3 mg/L	___	—	—	2.32	—
E121	7/1/2024 AM	Bis(2-ethylhexyl)phthalate	UF	WT	9.69	0.33	1.09	µg/L	—	—	—	—	—	2.62
E121	7/1/2024 PM	Total PCB Aroclors	UF	WT	0.105	—	—	µg/L	—	—	7.52	0.05	7.52	164.5
E121	7/1/2024 AM	Copper	F	WT	5.05	0.3	2	µg/L	11.7 mg/L	0.01	—	2.84	3.53	—
E121	7/1/2024 AM	Zinc	F	WT	31.3	3.3	20	µg/L	11.7 mg/L	<0.01	—	1.38	1.82	<0.01
E121	7/1/2024 AM	Aluminum	F10µ	WT	992	19.3	50	µg/L	11.7 mg/L	___	—	5.48	13.67	—
E121	7/1/2024 PM	Aluminum	F10µ	WT	892	19.3	50	µg/L	11.3 mg/L	___	—	5.16	12.89	—
E121	7/1/2024 PM	Lead	F	WT	0.502	0.5	2	µg/L	11.3 mg/L	0.01	—	0.09	2.28	—
E121	7/1/2024 PM	Copper	F	WT	4.79	0.3	2	µg/L	11.3 mg/L	0.01	—	2.78	3.45	—
E121	7/1/2024 PM	Zinc	F	WT	21.8	3.3	20	µg/L	11.3 mg/L	<0.01	—	0.99	1.31	<0.01
E121	7/1/2024 AM	Lead	F	WT	0.678	0.5	2	µg/L	11.7 mg/L	0.01	—	0.12	2.96	—

Table 3.3-3 (continued)

Gage	Sample Date	Analyte	Field Prep Code[b]	Sample Type[c]	Result	MDL[d]	PQL[e]	Unit[f]	Hardness Used[g]	Exceedance Ratio[a]				
										LW[h]	WH[i]	AAL[j]	CAL[k]	HH-OO[l]
E121	9/5/2024	Iron	UF	WT	15,400	30	100	µg/L	—	—	—	—	15.40	—
E121	9/5/2024	Aluminum	F10µ	WT	1650	19.3	50	µg/L	11.2 mg/L	___	___	9.67	24.14	—
E121	9/5/2024	Copper	F	WT	4.74	0.3	2	µg/L	11.2 mg/L	0.01	___	2.77	3.44	—
E121	9/5/2024	Lead	F	WT	0.901	0.5	2	µg/L	11.2 mg/L	0.01	___	0.16	4.14	—
E122	2/22/2024	Total PCB Congeners	UF	WS	9.21E-04	—	—	µg/L	—	—	0.07	<0.01	0.07	1.44
E122	5/15/2024	Total PCB Congeners	UF	WS	6.45E-04	—	—	µg/L	—	—	0.05	<0.01	0.05	1.01
E122	6/9/2024	Iron	UF	WT	6860	30	100	µg/L	—	—	—	—	6.86	—
E122	6/9/2024	Zinc	F	WT	47.9	3.3	20	µg/L	16.8 mg/L	<0.01	—	1.52	2.00	<0.01
E122	6/9/2024	Copper	F	WT	11.9	0.3	2	µg/L	16.8 mg/L	0.02	—	4.75	6.10	—
E122	6/9/2024	Aluminum	F10µ	WT	764	19.3	50	µg/L	16.8 mg/L	—	—	2.57	6.41	—
E122	6/21/2024	Iron	UF	WT	1860	30	100	µg/L	—	—	—	—	1.86	—
E122	6/21/2024	Copper	F	WT	8.98	0.3	2	µg/L	23.0 mg/L	0.02	—	2.67	3.52	—
E122	6/21/2024	Aluminum	F10µ	WT	664	19.3	50	µg/L	23.0 mg/L	—	—	1.45	3.63	—
E122	6/21/2024	Zinc	F	WT	38.5	3.3	20	µg/L	23.0 mg/L	<0.01	—	0.92	1.21	<0.01
E122	6/21/2024	Lead	F	WT	0.563	0.5	2	µg/L	23.0 mg/L	0.01	—	0.04	1.14	—
E122	6/27/2024	Iron	UF	WT	2900	30	100	µg/L	—	—	—	—	2.90	—
E122	6/27/2024	Benzo(a)pyrene	UF	WT	6.41E-2	0.03	0.12	µg/L	—	—	—	—	—	49.31
E122	6/27/2024	Dibenz(a,h)anthracene	UF	WT	9.62E-2	0.03	0.12	µg/L	—	—	—	—	—	74.0
E122	6/27/2024	Indeno(1,2,3-cd)pyrene	UF	WT	0.203	0.03	0.12	µg/L	—	—	—	—	—	15.62
E122	6/27/2024	Benzo(b)fluoranthene	UF	WT	8.55E-2	0.03	0.12	µg/L	—	—	—	—	—	6.58
E122	6/27/2024	Zinc	F	WT	52.3	3.3	20	µg/L	23.0 mg/L	<0.01	—	1.24	1.64	<0.01
E122	6/27/2024	Aluminum	F10µ	WT	726	19.3	50	µg/L	23.0 mg/L	—	—	1.59	3.96	—
E122	6/27/2024	Copper	F	WT	12.8	0.3	2	µg/L	23.0 mg/L	0.03	—	3.80	5.02	—
E122	6/29/2024	Iron	UF	WT	2840	30	100	µg/L	—	—	—	—	2.84	—

Table 3.3-3 (continued)

Gage	Sample Date	Analyte	Field Prep Code[b]	Sample Type[c]	Result	MDL[d]	PQL[e]	Unit[f]	Hardness Used[g]	Exceedance Ratio[a]				
										LW[h]	WH[i]	AAL[j]	CAL[k]	HH-OO[l]
E122	6/29/2024	Copper	F	WT	10.4	0.3	2	µg/L	19.2 mg/L	0.02	—	3.66	4.76	—
E122	6/29/2024	Zinc	F	WT	34.7	3.3	20	µg/L	19.2 mg/L	<0.01	—	0.97	1.28	<0.01
E122	6/29/2024	Aluminum	F10µ	WT	626	19.3	50	µg/L	19.2 mg/L	—	—	1.75	4.38	—
E122	7/1/2024	Iron	UF	WT	1510	30	100	µg/L	—	—	—	—	1.51	—
E122	7/1/2024	Copper	F	WT	5.82	0.3	2	µg/L	12.1 mg/L	0.01	—	3.17	3.95	—
E122	7/1/2024	Aluminum	F10µ	WT	1050	19.3	50	µg/L	12.1 mg/L	___	—	5.54	13.82	—
E122	7/1/2024	Zinc	F	WT	20.6	3.3	20	µg/L	12.1 mg/L	<0.01	—	0.88	1.16	<0.01
E122	7/17/2024	Iron	UF	WT	1110	30	100	µg/L	—	—	—	—	1.11	—
E122	7/17/2024	Copper	F	WT	3.61	0.3	2	µg/L	18.9 mg/L	0.01	—	1.29	1.67	—
E122	7/17/2024	Aluminum	F10µ	WT	1400	19.3	50	µg/L	18.9 mg/L	___	—	4.01	10.00	—
E122	9/5/2024	Iron	UF	WT	6460	30	100	µg/L	—	—	—	—	6.46	—
E122	9/5/2024	Benzo(b)fluoranthene	UF	WT	6.78E-2	0.03	0.11	µg/L	—	—	—	—	—	5.22
E122	9/5/2024	Aluminum	F10µ	WT	1050	19.3	50	µg/L	15.5 mg/L	—	—	3.94	9.84	—
E122	9/5/2024	Copper	F	WT	4.02	0.3	2	µg/L	15.5 mg/L	0.01	—	1.73	2.21	—
E122	10/28/2024	Copper	F	WS	14.1	0.3	2	µg/L	73.3 mg/L	0.03	—	1.41	2.05	—
E123	2/22/2024	Total PCB Congeners	UF	WS	6.51E-04	—	—	µg/L	—	—	0.05	<0.01	0.05	1.02
E123	5/15/2024	Total PCB Congeners	UF	WS	5.57E-03	—	—	µg/L	—	—	0.40	<0.01	0.40	8.70
E123	6/9/2024	Iron	UF	WT	5000	30	100	µg/L	—	—	—	—	5.00	—
E123	6/9/2024	Copper	F	WT	6.15	0.3	2	µg/L	21.0 mg/L	0.01	—	1.99	2.61	—
E123	6/9/2024	Aluminum	F10µ	WT	719	19.3	50	µg/L	21.0 mg/L	___	—	1.78	4.45	—
E123	6/21/2024 AM	Iron	UF	WT	1980	30	100	µg/L	—	—	—	—	1.98	—
E123	6/21/2024 PM	Iron	UF	WT	1290	30	100	µg/L	—	—	—	—	1.29	—
E123	6/21/2024	Copper	F	WT	6.19	0.3	2	µg/L	24.0 mg/L	0.01	—	1.77	2.34	—
E123	6/21/2024	Aluminum	F10µ	WT	560	19.3	50	µg/L	24.0 mg/L	—	—	1.16	2.88	—

Table 3.3-3 (continued)

Gage	Sample Date	Analyte	Field Prep Code[b]	Sample Type[c]	Result	MDL[d]	PQL[e]	Unit[f]	Hardness Used[g]	Exceedance Ratio[a]				
										LW[h]	WH[i]	AAL[j]	CAL[k]	HH-OO[l]
E123	6/29/2024	Indeno(1,2,3-cd)pyrene	UF	WT	8.59E-02	0.32	0.11	µg/L	—	—	—	—	—	6.61
E123	6/29/2024	Iron	UF	WT	1670	30	100	µg/L	—	—	—	—	1.67	—
E123	6/29/2024	Bis(2-ethylhexyl)phthalate	UF	WT	11.3	0.34	1.12	µg/L	—	—	—	—	—	3.05
E123	6/29/2024	Copper	F	WT	5.43	0.3	2	µg/L	51.6 mg/L	0.01	___	0.75	1.07	—
E123	7/16/2024	Iron	UF	WT	2910	30	100	µg/L	—	—	—	—	2.91	—
E123	7/16/2024	Copper	F	WT	5.78	0.3	2	µg/L	48.1 mg/L	0.01	—	0.86	1.21	—
E123	7/17/2024	Iron	UF	WT	9540	30	100	µg/L	—	—	—	—	9.54	—
E123	7/17/2024	Lead	F	WT	0.821	0.3	2	µg/L	17.1 mg/L	<0.01	—	—	2.33	—
E123	7/17/2024	Aluminum	F10µ	WT	2680	19.3	50	µg/L	17.1 mg/L	—	—	8.80	21.96	—
E123	7/17/2024	Copper	F	WT	4.7	0.3	2	µg/L	17.1 mg/L	0.01	—	1.85	2.37	—

[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] Field Preparation Code: UF = unfiltered, F10µm = filtered to 10 µm, F = filtered to 0.45 µm.

[c] Sample Type: WS = base flow, WT = stormwater.

[d] MDL = Method detection limit.

[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. Hardness units are mg/L.

[h] LW = Livestock watering.

[i] WH = Wildlife habitat.

[j] AAL = Acute aquatic life.

[k] CAL = Chronic aquatic life.

[l] HH-OO = Human health-organism only.

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

Table 3.3-4
Summary of 2024 Base Flow and Stormwater Surface Water Quality Criteria Exceedances (SWQC)

Gage	Media Type	Filtration	Analyte	Total Samples	Number of Samples Exceeding SWQC	Average of Sample Results Exceeding SWQC	Maximum Sample Results Exceeding SWQC	Unit
E121	Stormwater	F10µm[a]	Aluminum	5	5	971.6	1650	µg/L
E121	Stormwater	Unfiltered	Bis(2-ethylhexyl) phthalate	5	1	9.69	9.69	µg/L
E121	Stormwater	Filtered[b]	Copper	5	5	5.636	7.33	µg/L
E121	Stormwater	Unfiltered	Iron	5	5	6044	15,400	µg/L
E121	Stormwater	Filtered	Lead	5	4	0.648	0.901	µg/L
E121	Stormwater	Unfiltered	Total PCB Aroclors	2	2	0.073	0.105	µg/L
E121	Stormwater	Filtered	Zinc	5	4	30.7	35.4	µg/L
E121	Base flow	Unfiltered	Total PCB Congeners	2	1	3.98E-03	3.98E-03	µg/L
E122	Stormwater	F10µm	Aluminum	7	7	897.14	1400	µg/L
E122	Stormwater	Unfiltered	Benzo(a)pyrene	6	1	0.064	0.064	µg/L
E122	Stormwater	Unfiltered	Benzo(b)fluoranthene	6	2	0.077	0.086	µg/L
E122	Stormwater	Filtered	Copper	7	7	8.22	12.8	µg/L
E122	Stormwater	Unfiltered	Dibenz(a,h)anthracene	6	1	0.096	0.096	µg/L
E122	Stormwater	Unfiltered	Indeno(1,2,3-cd)pyrene	6	1	0.203	0.203	µg/L
E122	Stormwater	Unfiltered	Iron	7	7	3362.86	6860	µg/L
E122	Stormwater	Filtered	Lead	7	1	0.563	0.563	µg/L
E122	Stormwater	Filtered	Zinc	7	5	38.8	52.3	µg/L
E122	Base flow	Unfiltered	Total PCB Congeners	2	2	7.83E-04	9.21E-04	µg/L
E123	Stormwater	F10µm	Aluminum	6	3	1319.67	2680	µg/L
E123	Stormwater	Unfiltered	Bis(2-ethylhexyl) phthalate	4	1	11.3	11.3	µg/L
E123	Stormwater	Filtered	Copper	6	5	5.65	6.19	µg/L
E123	Stormwater	Unfiltered	Indeno(1,2,3-cd)pyrene	6	1	0.086	0.086	µg/L
E123	Stormwater	Unfiltered	Iron	6	6	3731.67	9540	µg/L
E123	Stormwater	Filtered	Lead	6	1	0.821	0.821	µg/L
E123	Base flow	Unfiltered	Total PCB Congeners	2	2	3.11E-03	5.57E-03	µg/L

[a] F10µm = Filtered to 10 µm.

[b] Filtered = Filtered to 0.45 µm.

Table 3.4-1
Analytical Exceedances in the Alluvial System

Location ID	Sample Date	Analyte	Field Prep Code	Sample Usage Code	Sample Purpose	Result	Units	MDL	Screening Value	Screening Value Type
SWA-1-1	10/24/2024	Iron	F[a]	INV	REG[b]	5430	µg/L	30.0	1000	NM GW STD[c]
SWA-1-1	10/24/2024	Manganese	F	INV	REG	1160	µg/L	2.0	200	NM GW STD
SWA-1-2	10/24/2024	Iron	F	INV	REG	2100	µg/L	30.0	1000	NM GW STD
SWA-1-3	10/24/2024	Iron	F	INV	REG	1820	µg/L	30.0	1000	NM GW STD
SWA-1-3	10/24/2024	Manganese	F	INV	REG	211	µg/L	2.0	200	NM GW STD
SWA-2-4	10/24/2024	Iron	F	INV	REG	1630	µg/L	30.0	1000	NM GW STD
SWA-2-4	10/24/2024	Iron	F	QC	FD[d]	1410	µg/L	30.0	1000	NM GW STD
SWA-2-4	10/24/2024	Manganese	F	INV	REG	610	µg/L	2.0	200	NM GW STD
SWA-2-4	10/24/2024	Manganese	F	QC	FD	573	µg/L	2.0	200	NM GW STD
SWA-2-6	10/24/2024	Iron	F	INV	REG	7160	µg/L	30.0	1000	NM GW STD
SWA-2-6	10/24/2024	Manganese	F	INV	REG	1390	µg/L	2.0	200	NM GW STD
SWA-4-11	10/23/2024	Iron	F	INV	REG	5190	µg/L	30.0	1000	NM GW STD
SWA-4-11	10/23/2024	Manganese	F	INV	REG	728	µg/L	2.0	200	NM GW STD
SWA-4-12	10/23/2024	Chromium	F	INV	REG	52.2	µg/L	3.0	50	NM GW STD
SWA-4-12	10/23/2024	Iron	F	INV	REG	5510	µg/L	30.0	1000	NM GW STD
SWA-4-12	10/23/2024	Manganese	F	INV	REG	1090	µg/L	2.0	200	NM GW STD

Note: All results have a dilution factor of 1.0.

[a] F = Filtered.

[b] REG = Regular sample.

[c] NM GW STD= New Mexico groundwater standard.

[d] FD = Field duplicate sample.

Appendix A

Acronyms and Abbreviations,
Metric Conversion Table, and Data Qualifier Definitions

A-1.0 ACRONYMS AND ABBREVIATIONS

AAL	acute aquatic life
As(III)	arsenite
bgs	below ground surface
bTOC	below top of casing
CAL	chronic aquatic life
cfs	cubic foot per second
Cr(III)	trivalent chromium
Cr(VI)	hexavalent chromium
CY	calendar year
DC	direct current
DOE	Department of Energy (U.S.)
EM-LA	Environmental Management Los Alamos Field Office (DOE)
EPA	Environmental Protection Agency (U.S.)
F	filtered
Fe(II)	ferrous iron
GCS	grade-control structure
gpd	gallons per day
HH-OO	human health-organism only
IR	investigation report
LANL	Los Alamos National Laboratory
LiDAR	light detection and ranging
LW	livestock watering
MDL	method detection limit
Mn(IV)	manganese dioxide
MY	monitoring year
N3B	Newport News Nuclear BWXT-Los Alamos, LLC
NA	not analyzed
ND	no data
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NPDES	National Pollutant Discharge Elimination System
PAH	polycyclic aromatic hydrocarbon

PCB	polychlorinated biphenyl
PFAS	per- and polyfluoroalkyl substances
ppb	parts per billion
PQL	practical quantitation limit
PVC	polyvinyl chloride
redox	oxidation-reduction
SCC	Strategic Computing Complex
SERF	Sanitary Effluent Reclamation Facility
SSC	suspended sediment concentration
SVOC	semivolatile organic compound
SWMU	solid waste management unit
SWQC	surface water quality criteria
SWWS	Sanitary Waste Water System
TA	technical area
TAL	target analyte list
TSS	total suspended sediment
UF	unfiltered
USGS	U.S. Geological Survey

A-2.0 METRIC CONVERSION TABLE

Multiply SI (Metric) Unit	by	To Obtain U.S. Customary Unit
kilometers (km)	0.622	miles (mi)
kilometers (km)	3281	feet (ft)
meters (m)	3.281	feet (ft)
meters (m)	39.37	inches (in.)
centimeters (cm)	0.03281	feet (ft)
centimeters (cm)	0.394	inches (in.)
millimeters (mm)	0.0394	inches (in.)
micrometers or microns (µm)	0.0000394	inches (in.)
square kilometers (km^2)	0.3861	square miles (mi^2)
hectares (ha)	2.5	acres
square meters (m^2)	10.764	square feet (ft^2)
cubic meters (m^3)	35.31	cubic feet (ft^3)
kilograms (kg)	2.2046	pounds (lb)
grams (g)	0.0353	ounces (oz)
grams per cubic centimeter (g/cm^3)	62.422	pounds per cubic foot (lb/ft^3)
milligrams per kilogram (mg/kg)	1	parts per million (ppm)
micrograms per gram (µg/g)	1	parts per million (ppm)
liters (L)	0.26	gallons (gal.)
milligrams per liter (mg/L)	1	parts per million (ppm)
degrees Celsius (°C)	9/5 + 32	degrees Fahrenheit (°F)

A-3.0 DATA QUALIFIER DEFINITIONS

Data Qualifier	Definition
U	The analyte was analyzed for but not detected.
J	The analyte was positively identified, and the associated numerical value is estimated to be more uncertain than would normally be expected for that analysis.
J+	The analyte was positively identified, and the result is likely to be biased high.
J-	The analyte was positively identified, and the result is likely to be biased low.
UJ	The analyte was not positively identified in the sample, and the associated value is an estimate of the sample-specific detection or quantitation limit.
R	The data are rejected as a result of major problems with quality assurance/quality control (QA/QC) parameters.

Appendix B

2024 Watershed Mitigation Inspections

B-1.0 INTRODUCTION

Watershed mitigations and GCSs are inspected biannually and after greater than 50-cfs flow events at gaging stations E121, E122, or E123. Additional inspections and monitoring will occur, including a walkdown of the channel, after large disturbance events (approximately 100 cfs at gaging station E123).

Inspections are completed to ensure watershed mitigations are functioning properly and to determine if any maintenance is required. Examples of items evaluated during inspections include

- debris/sediment accumulation that could impede operation;
- water levels behind retention structures;
- physical damage of 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; and
- erosion.

The photographs in this appendix show control conditions during the biannual inspections of watershed mitigations in Sandia Canyon. Each set of photographs is associated with a specific feature (e.g., standpipe, weir, upstream, downstream, vegetated cover). Photographs of features were taken to replicate previous inspection photos as closely as possible.

Four greater than 50-cfs inspections were performed for flows recorded on June 9, 2024, July 17, 2024, August 9, 2024, and September 5, 2024. Two biannual inspections were conducted in May and October of 2024. The post-monsoon walkdown of the Sandia wetland with NMED occurred on October 16, 2024.

The photographs in section B-2.0 document the health of the wetland in and around the GCS, revegetation of adjacent slopes, and the best management practices put in place to help maintain the integrity of the GCS and the wetland vegetation.

B-2.0 SANDIA CANYON GRADE-CONTROL STRUCTURE INSPECTION PHOTOGRAPHS

B-2.1 Grade-Control Structure South Bank Vegetation

Photo B-2.1-1 May 5, 2024 – South bank vegetation, looking upstream/west

Photo B-2.1-2 October 30, 2024 – South bank vegetation, looking upstream/west

B-2.2 Grade-Control Structure North Bank Vegetation

Photo B-2.2-1 May 5, 2024 – North bank vegetation, looking upstream/southwest

Photo B-2.2-2 October 30, 2024 – North bank vegetation, looking upstream/southwest

B-2.3 Upper Grade-Control Structure

Photo B-2.3-1 May 5, 2024 – Upper grade-control structure, looking north

Photo B-2.3-2 October 30, 2024 – Upper grade-control structure, looking north

B-2.4 Middle Grade-Control Structure

Photo B-2.4-1 May 5, 2024 – Middle grade-control structure, looking north

Photo B-2.4-2 October 30, 2024 – Middle grade-control structure, looking north

B-2.5 Lower Grade-Control Structure

Photo B-2.5-1 May 5, 2024 – Lower grade-control structure, looking north

Photo B-2.5-2 October 30, 2024 – Lower grade-control structure, looking north

B-2.6 Cascade Structure

Photo B-2.6-1 May 5, 2024 – Cascade structure, looking upstream/northwest

Photo B-2.6-2 October 30, 2024 – Cascade structure, looking upstream/northwest

B-2.7 Run-On Defense Cell Barriers

Photo B-2.7-1 May 5, 2024 – Lower run-on cell barrier, looking west. Sediment level 4 ft below top of spillway

Photo B-2.7-2 October 30, 2024 – Lower run-on cell barrier, looking west. Sediment level 4 ft below top of spillway

B-2.8 Log Check Dams and Other Sediment Controls

Photo B-2.8-1 May 5, 2024 – Upper large log check dam, looking west. Approximately 4 in. of sediment capacity remaining

Photo B-2.8-2 October 30, 2024 – Upper large log check dam, looking southwest. No sediment capacity remaining

Photo B-2.8-3 May 5, 2024 – Middle large log check dam, looking southwest. Approximately 4 in. of sediment capacity remaining

Photo B-2.8-4 October 30, 2024 – Middle large log check dam (second from front), looking north. No sediment capacity remaining

Photo B-2.8-5 May 5, 2024 – Lower large log check dam, looking southwest. Approximately 12 in. of sediment capacity remaining

Photo B-2.8-6 October 30, 2024 – Lower large log check dam, looking southwest. No sediment capacity remaining

Appendix C

Polychlorinated Biphenyls Investigation

C-1.0 INTRODUCTION

Over the past 6 years, stormwater samples from Upper Sandia Canyon gaging stations E121 and E122 show an increasing trend in total PCB concentrations. In response to these observations, additional sediment samples were collected beginning in 2023 to identify potential sources and pathways of PCB contaminants. Sampling efforts focused on locations upstream and downstream of gaging stations E121 and E122, prioritizing areas with historical PCB releases and considering modern hydrological flow patterns to optimize source identification.

This appendix summarizes the results of the 2024 sediment sampling efforts and a discussion of site-specific control measures implemented under the Environmental Protection Agency National Pollution Discharge Elimination System Individual Permit. This corrective action was undertaken to address exceedances of the background threshold value and target action limit (TAL) for PCBs and includes the recent installation of a shotcrete cap at SWMU 03-056(c).

C-2.0 BACKGROUND

An increase in total PCB concentrations in stormwater samples was first observed at gaging stations E121 in 2020 and at E122 in 2021 (Figure C-2.0-1). These trends prompted targeted sediment investigations to identify potential PCB source areas. In November 2023, 15 sediment samples, including 2 field duplicates, were collected from strategic locations upstream and downstream of gaging stations E121 and E122. Analytical results returned four PCB congener exceedances at sample location SA-61673, situated immediately below SWMU 03-056(c), a site with documented PCBs releases.

Monitoring efforts in 2024 built upon the findings of the 2023 sampling campaign by targeting additional locations to further assess PCB distribution and transport pathways. In December 2024, seven sediment samples, including one field duplicate, were collected near SWMU 03-056(c) (Figure C-2.0-2). This sampling effort was designed to characterize residual PCB contamination and evaluate the effectiveness of the shotcrete cap installed over the SWMU in August 2024. These sediment samples were analyzed for both PCB congeners and PCB Aroclors to allow direct comparisons between congener-specific data and historical Aroclor-based data. Analytical requirements for PCB congeners and Aroclors are shown in Table C-2.0-1.

SWMU 03-056(c), located northeast of the utilities shop (building 03-223) and upstream of gaging station E121, was historically used as an outdoor storage area for PCB-containing transformers, electrical cables, dielectric fluids, capacitors, and oil-filled drums (LANL 2001, 071259). Operational activities resulted in significant PCB releases (up to 10,000 ppm), primarily due to spills, leaks, and poor handling practices (LANL 2001, 071259).

PCB contamination was first identified in 1991, during sampling and analysis conducted in support of a slope stabilization project. The contamination spanned approximately 9000 ft^2 area to depths of 0–3 ft below surface. An expedited cleanup removed 1000 yd^3 of soil with PCB concentrations exceeding 10 ppm by the end of 1995.

In 2000, a voluntary corrective action (VCA) was initiated to comply with EPA Region 6’s cleanup standard of <1 ppm, a requirement driven by the site’s proximity to a watercourse. Beginning in 2000, remedial activities included the excavation of approximately 2400 yd^3 of contaminated soil from the SWMU. Following excavation activities, 89 confirmation samples were collected from 79 locations. All samples were submitted for laboratory analysis of PCBs. Aroclor-1260, a refined PCB product containing 60% chlorine by weight, was detected at the highest frequency. The highest concentrations of Aroclor-1260 were found mainly in or near SWMU 03-056(c)’s boundary.

In March 2001, the areas with elevated PCB detections were excavated and in April 2001, additional confirmation sampling was conducted. Confirmation sampling results indicated that the site met the EPA cleanup criterion for less than 1 ppm (LANL 2001, 071259). The VCA report for SWMU 03-056(c) was approved by EPA in November 2001 (EPA 2001, 072810) and by NMED in September 2002 (NMED 2002, 073363).

C-3.0 RESULTS AND DISCUSSION

C-3.1 Sediment Exceedances

Sediment analytical results from the 2024 sampling campaign were screened against NMED's Soil Screening Levels (SSLs) for PCB congeners and Aroclors provided in the Risk Assessment Guidance for Site Investigations and Remediation: Volume I, Soil Screening Guidance for Human Health Risk Assessments (NMED 2022, 702484). No exceedances were identified for any analyzed PCB congeners or Aroclor compounds at any of the sampling locations. These results indicate that PCB concentrations in sediment samples collected within Upper Sandia Canyon during 2024 were below their applicable SSL thresholds.

A new sediment sample location, SA-61712, was selected just downstream of last year's sampling location SA-61673, based on observed sediment deposition patterns within the stream channel. Sample location SA-61673 had previously exhibited PCB congener exceedances for PCB-118, PCB-126, PCB-169, and PCB-170 in 2023. Analytical results from the 2024 sample collected at SA-61712 revealed that all PCB congener and PCB Aroclor concentrations were within regulatory thresholds.

The shotcrete cap, installed in 2024, has not been fully evaluated for its long-term effectiveness in mitigating PCB migration. However, the absence of exceedances in the 2024 sediment samples suggests that the cap is functioning as intended to reduce contaminant transport. Continued monitoring and additional sampling efforts will be necessary to further assess the cap's performance under varying hydrological conditions and to ensure sustained compliance with regulatory standards.

Sediment analytical results for all 2024 sampling locations are included in Appendix D (on CD included with this document).

C-3.2 Control Measures

In August 2024, the installation of a shotcrete cap as an enhanced control measure for SWMU 03-056(c) was completed in accordance with the recommendations from the 2023 alternatives analysis (Figure C-3.2-1 and Figure C-3.2-2). The cap covers approximately 2300 ft^2 and is designed to mitigate PCB migration to downstream areas, including the Sandia wetland.

Coir logs, installed in March 2023 at the lower end of SWMU 03-056(c) as a temporary erosion control measure, have been retained in place to provide additional stabilization and support. These measures are intended to reduce sediment transport and minimize the potential for downstream PCB contamination.

C-4.0 FUTURE MONITORING

C-4.1 2025 Monitoring Plan

In 2025, additional sediment sampling will be conducted in Upper Sandia Canyon to monitor PCB contamination and assess the effectiveness of the shotcrete cap installed over SWMU 03-056(c) in 2024. The sampling plan will again target key locations upstream and downstream of the SWMU to evaluate potential changes in PCB concentrations and transport pathways.

The analytical results will be integrated with historical monitoring data to evaluate long-term trends in PCB concentrations, identify residual contamination, and refine source attribution. These findings will inform adaptive management strategies and guide future sediment management efforts in Upper Sandia Canyon.

C-5.0 REFERENCES AND MAP DATA SOURCES

C-5.1 References

EPA (U.S. Environmental Protection Agency), November 28, 2001. “Approval of the VCA Report under the Toxic Substance and Control Act (TSCA) 761.61(c) for PCB Site 3-056(c) at Los Alamos National Laboratory (LANL),” U.S. Environmental Protection Agency letter to M. Johansen (DOE-LAAO) from D. Neleigh (EPA Region 6), Dallas, Texas. (EPA 2001, 072810)

LANL (Los Alamos National Laboratory), September 2001. “Voluntary Corrective Action Completion Report for Potential Release Site 03-056(c),” Los Alamos National Laboratory document LA-UR-01-5349, Los Alamos, New Mexico. (LANL 2001, 071259)

NMED (New Mexico Environment Department), September 20, 2002. “Approval of VCA Completion Report for PRS 3-056(c),” New Mexico Environment Department letter to J.C. Browne (LANL Director) and E. Trollinger (DOE-OLASO) from J.E. Young (NMED-HWB), Santa Fe, New Mexico. (NMED 2002, 073363)

NMED (New Mexico Environment Department), November 2022. “Risk Assessment Guidance for Site Investigations and Remediation, Volume 1, Soil Screening Guidance for Human Health Risk Assessments,” Hazardous Waste Bureau and Ground Water Quality Bureau, Santa Fe, New Mexico. (NMED 2022, 702484)

C-5.2 Map Data Sources

Gage Station; 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

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

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

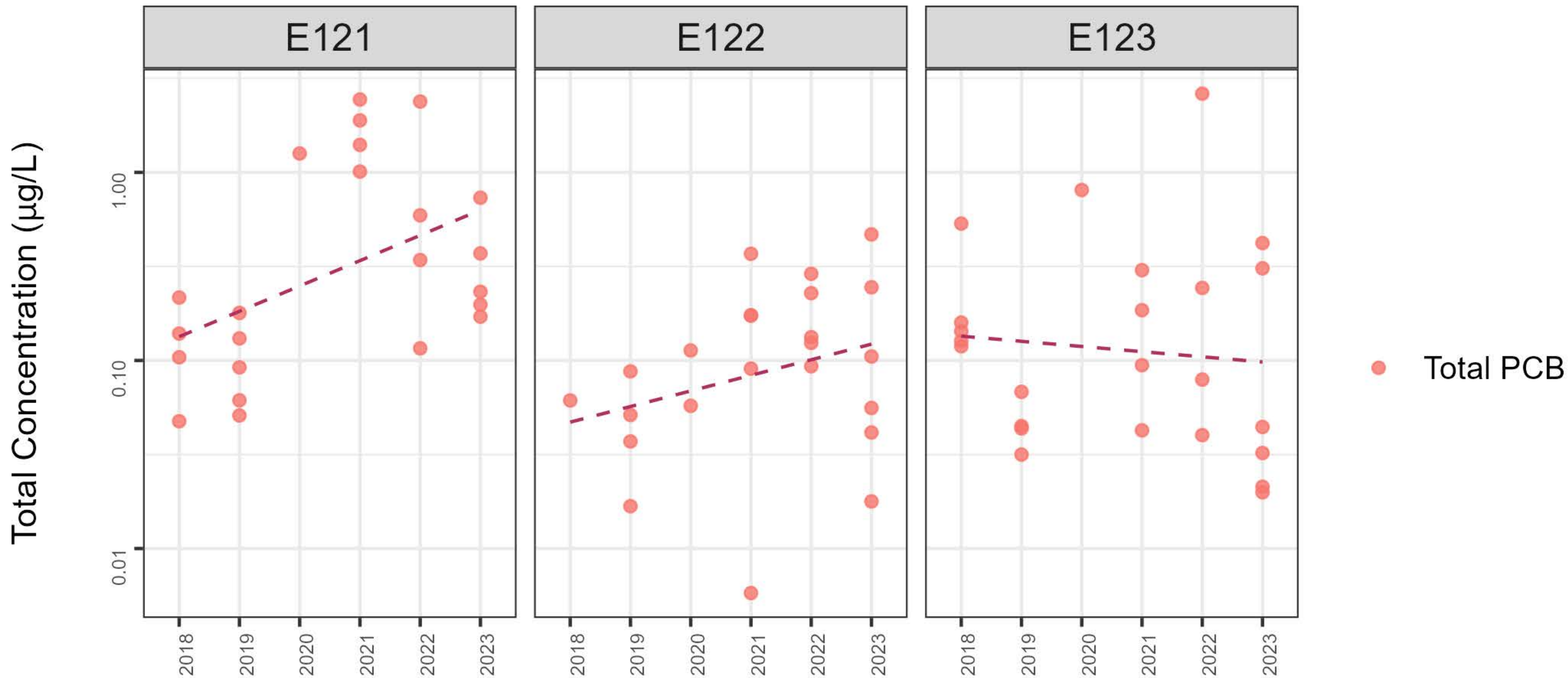


Figure C-2.0-1 Stormwater total PCB concentrations with trend lines at E121, E122, and E123 from 2018 to 2023 (2024 data are not included because PCB analyses switched from congeners to Aroclors)

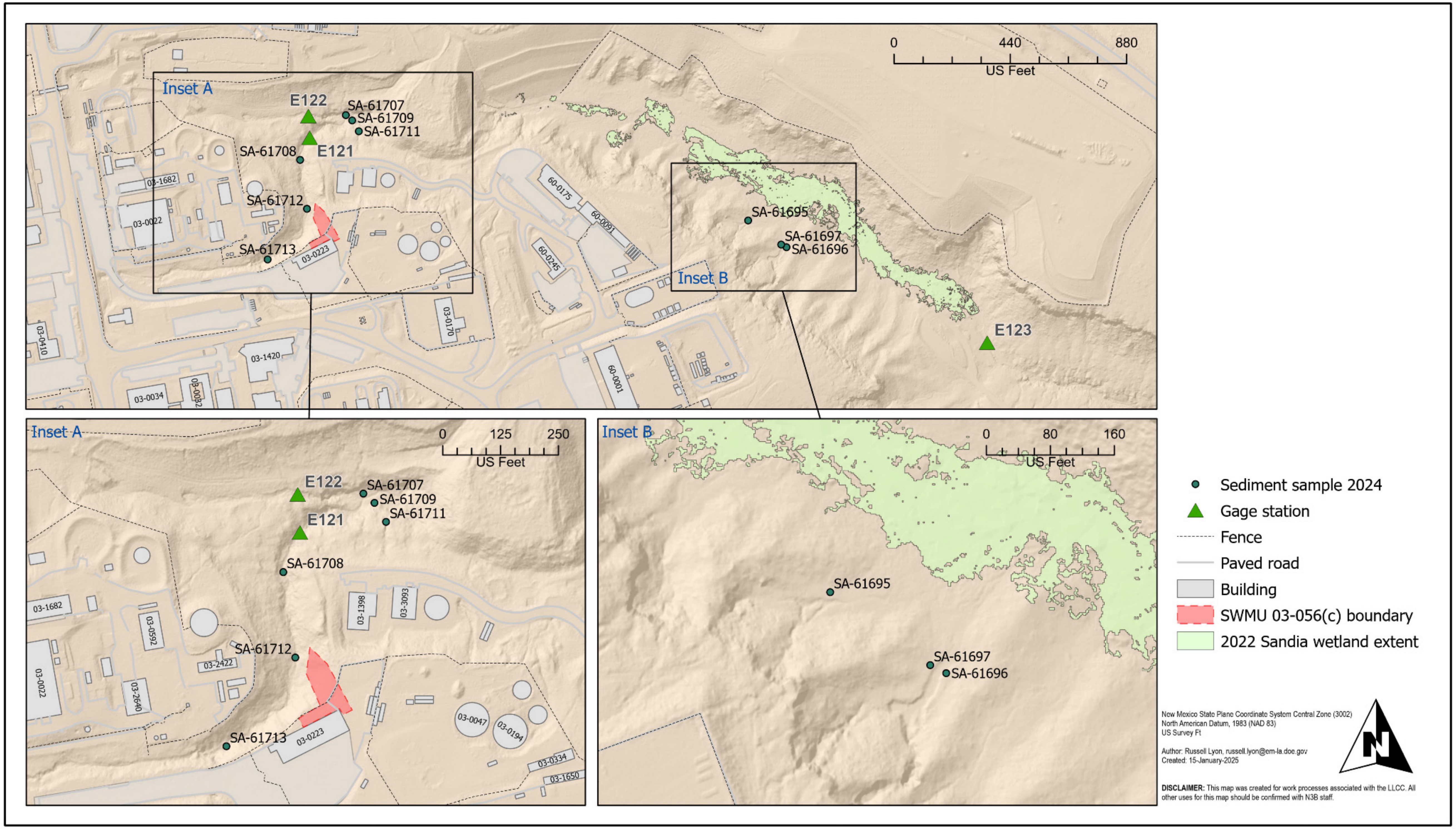


Figure C-2.0-2 2024 sediment sample locations near SWMU 03-056(c)

Figure C-3.2-1 Photo looking east towards the shotcrete cap installed August 2024 and coir logs installed March 2023

Figure C-3.2-2 Photo looking west towards the shotcrete cap installed August 2024

Table C-2.0-1
Analytical Requirements

Analytical Group	EPA:1668_PCB_Congeners	SW-846:8082_PCB_Aroclor
Lab	CFA	GEL
Analytical Method	EPA:1668	SW-846:8082A
Sample Matrix	SED	SED
Preservation	ice	ice
Holding Time (Days)	360	360
Minimum Volume	50 g	50 g
Shipping Container	250 ml glass	125 ml amber glass

Appendix D

Analytical Gaging Station, Alluvial Well, and Sediment Data; Water-Level Data; and 5 Min Stage, Discharge, and Precipitation Data (on CD included with this document)

N3B RECORDS	
Media Information Page	
This is a placeholder page for a record that cannot be uploaded or would lose meaning or content if uploaded. The record can be requested through regdocs@em-la.doe.gov	
Document Date: 3/31/2025	**EM ID number:** EMID-703772-01
Document Title: Appendix D Submittal of the 2024 Sandia Wetland Performance Report	☒ **No restrictions** ☐ **UCNI** ☐ **Copyrighted**
Media type and quantity: 1 CD	**Software and version required to read media:** Adobe Acrobat 9.0
Other document numbers or notes: Files are too numerous and large to upload.	