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Reconnaissance Investigation of Critical Minerals in Historic Mine-Related Effluent, Colorado

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DISCLAIMER

The material presented here is from a limited reconnaissance study and is intended for general information purposes only. Those making use of or relying upon the material, previous exploration results, results of this investigation, and any other information provided herein assume all risks and liability arising from such use or reliance. Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. Government, Colorado Geological Survey, and the Colorado School of Mines.

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INTRODUCTION

Colorado contains an abundance of historic mine-related waste materials, some of which may contain elevated concentrations of critical minerals and other metals. Many of these sites are currently being remediated by several entities including the U.S. Environmental Protection Agency (EPA), Colorado Department of Public Health and Environment (CDPHE), and/or other entities. Metal-laden water flows continuously from some of these acid mine drainage (AMD) sites where it is collected, treated, and discharged to local streams and rivers, depending on its potential impact to human health and the environment. In Colorado, the typical driver for many of these AMD remediation efforts is elevated metals (such as cadmium, copper, and zinc) in water discharging to Colorado waterways that can impact downstream users and aquatic ecology. Many of these historic mining sites are associated with mineral deposits that may contain critical minerals, or historically produced a few of these minerals, and therefore, the water effluent from these sites may contain these materials as well. Several of the critical minerals typically occur in trace amounts in ore deposits and are not always included in AMD monitoring programs.

The primary objective of this reconnaissance study is to support the determination of potential critical mineral endowment of mine waste in Colorado. The U.S. Geological Survey (USGS), in conjunction with state geological surveys, is conducting a nationwide effort to evaluate the ability of mine waste to contribute to the U.S. critical minerals supply with the ultimate goal of estimating the potential critical mineral endowment of mine waste nationwide. To obtain this goal, they are developing a national mine waste database that includes locations of mine waste, volume and mass estimates, bulk geochemical composition, bulk mineralogical composition, and contained mineral commodities in mine-related waste (USGS, 2025a). This investigation was conducted in conjunction with this program under the U.S. Geological Survey (USGS) Earth Mapping Resources Initiative (EarthMRI) (USGS, 2025b) who provided funding, laboratory analysis, and the initial sampling protocols for this project. The data associated with this and

other EarthMRI investigations is published by the USGS and made available to the public (USGS, 2025b).

The tasks associated with this project included the sampling and analysis of effluent from select AMD sites to measure the concentrations and variability of critical minerals in this effluent over time. Discharge rates were also measured during the sampling effort to provide estimated loads of critical minerals at these sites. Other geochemical information was collected including the concentrations of other elements, precious metals, and anions to provide a complete data set of these waters for future evaluation by the USGS and others. The data collected during this investigation may also be used in the future to provide a preliminary evaluation of the characteristics of these mine wastes to assist with determining potential reprocessing, management, and reclamation strategies by others.

The scope of work included measuring water field parameters and collecting 10 water samples for laboratory analysis of critical minerals, and other analytes, from 11 AMD sources over two years. Solids, or residue, were also collected from 5 water treatment facilities and analyzed for the critical minerals and other parameters. This report presents the sample collection methodology, field data, laboratory data, and results of this study. Additionally, a preliminary assessment of critical minerals at these AMD sites is presented based on the data collected during this investigation. This information is provided to support future efforts to better understand the critical mineral endowment of these wastes as this investigation is reconnaissance in nature. Additional investigation of these sites, as well as an analysis of existing data (since several of these sites have been studied for the last several decades) and data collected during ongoing investigations by others (e.g., EPA, CDPHE, etc.), would be required to provide a more accurate evaluation of critical mineral concentrations, loading, and the geochemistry of these dynamic AMD sites. Additionally, analysis of the potential future recoverability of critical minerals from mine waste is beyond the scope of this investigation and will depend on a variety of factors including the development of extraction technologies,

commodity prices, transportation costs, financial incentives, as well as several other factors (USGS, 2025a; USGS, 2025b).

BACKGROUND

The following subsections discuss the background associated with critical minerals and the AMD sites sampled during this investigation.

Critical Minerals

Following a 2017 Presidential Executive Order (White House, 2017), the USGS released an updated list of critical minerals in 2022 (USGS, 2022) summarized in **Table 1**. These minerals are defined as non-fuel resources essential to U.S. economic and national security, with supply chains vulnerable to disruption. The rationale and methodology for developing the critical mineral list are provided by Fortier and others (2018). The critical mineral list and its definition are dynamic and subject to periodic review; it is scheduled to be reevaluated in 2025 by the USGS. The U.S. Department of Energy (DOE) has also released a critical materials assessment focused on energy applications, which includes several USGS designated critical minerals and additional elements such as copper (DOE, 2023). A summary of the critical minerals/materials and the U.S. apparent consumption of these commodities is provided in **Table 1**.

Most of the critical minerals occur as trace elements ($\sim <0.1\%$) in ore deposits and may not form economic deposits on their own. Therefore, many are not recovered during the mining process for other precious and base metals and are discarded in mine waste (Nassar and others, 2015). The USGS and state surveys identified critical mineral focus areas associated with critical mineral deposits in the U.S., including Colorado (Dicken and others, 2022), using a minerals system approach. Using this approach, minerals systems, mineral deposit types, and commodities are examined to determine the general probability of where critical minerals are likely to occur as mineral systems are larger than individual ore deposits (Hofstra and Kreiner, 2020).

Sample Locations

Numerous precious and base metal deposits in Colorado are associated with tectonic and magmatic events that occurred between ~75 and ~4 million years ago (Ma) in the Southern Rocky Mountains. While many of these deposits are concentrated along the ~400 km southwest–northeast-trending Colorado Mineral Belt (COMB) (Tweto and Sims, 1963; Wilson and Sims, 2003; Chapin, 2012; Wilson, 2017), significant mineralization also occurs in adjacent regions outside the traditional COMB footprint (**Figure 1**). These deposits reflect multiple mineralizing episodes across diverse geologic settings.

Several perpetual AMD sites were identified for this investigation that drain water from inactive mines associated with the COMB, historic mining districts (Burnell, 2015), and critical mineral focus areas (Dicken and others, 2022). Ten of these discharges were selected for sampling based on their discharge volumes, accessibility, and the general potential to contain critical minerals. The details associated with each sampling site are included in **Table 2**. The location of the sampling sites is included in **Figure 1** and a summary of the mineral system, deposit types, commodities, sample plan, and potential critical minerals at these sites is included in **Table 3**. The AMD sampling locations for this investigation include:

- Argo Tunnel, Big Five Tunnel, Virginia Canyon and North Clear Creek Water Treatment Plant (WTP) located in the Central City/Idaho Springs Mining District;
- Leadville Mine Drainage Tunnel WTP located in the Leadville Mining District;
- Eagle Mine WTP and North Groundwater Extraction Trench associated with the Eagle Mine located in the Battle Mountain Mining District;
- Nelson Tunnel located in the Creede Mining District;
- Reynolds Adit and Summitville Dam Impoundment associated with the Summitville Mine in the Summitville Mining District;
- Gladstone WTP located in the Eureka Mining District; and
- St. Louis Tunnel located in the Rico Mining District.

These AMDs are associated with EPA Superfund sites or other environmental clean-up programs, discharge year-round, and (except for the Nelson Tunnel) are currently being remediated by WTPs prior to discharge. The tunnels and mine water within these discharges are in contact with mine workings, mineral deposits in the subsurface, and/or receive groundwater infiltration from leaching of waste piles at the surface. While some critical minerals have been measured (e.g., zinc, magnesium, manganese) during AMD remediation activities, the concentrations and estimated loads of many of the trace critical minerals are not always included in these monitoring activities. Typically, concentrations of metals in the effluent, as well as the discharge volume, fluctuate seasonally due to changes in seasonal snow-melt infiltration, groundwater discharge to the mine workings, as well as other factors.

The mining, geologic, and environmental clean-up history of each of these sites is complex and therefore, only a summary is provided in the following sections. Generally, all the sites are associated with critical mineral focus areas and can drain several individual mines that are interconnected, either physically or hydrologically at depth. Additionally, many of these sites are frequently monitored and therefore, additional water geochemistry and flow-rate data sets are likely available. Analysis of these data sets was beyond the scope of this investigation.

A summary of the information provided below is included in **Table 3**. Additional background associated with the mining and geology of each site are included in **Appendix A**.

Eagle Mine WTP and North Groundwater Extraction Trench

Ten samples were collected from the Eagle Mine WTP (Eagle WTP) influent from the Eagle Mine and from the Eagle Mine north groundwater extraction trench (Eagle GW), both located to the north of the Eagle Mine portal, between October 2022 and July 2024. The Eagle Mine is in the Battle Mountain Mining District (a.k.a. Gilman, Red Cliff, Belden Mining District) and the portals are in the ghost town of Gilman just south of Minturn, Eagle County.

The Eagle Mine was added to the EPA Superfund NPL list in 1986. The historic mine contains ~70 miles of subsurface workings, most of which are now submerged. Several of the portals have been bulk-headed and water from the mine is transported ~2 miles to the north along the narrow Eagle River canyon to the Eagle WTP, in place since 1990, at the consolidated tailings pile (CTP) on the southern edge of Minturn. Groundwater is also collected from the Eagle GW, located on the north side of the CTP, and treated at the WTP. Tailings from the site were placed at the CTP and capped. Average annual flow from the mine is ~210 gallons per minute (gpm) and the discharge contains elevated concentrations of metals including arsenic, cadmium, copper, lead, and zinc (EPA, 2018).

Leadville Mine Drainage Tunnel

The Leadville Mine Drainage Tunnel (LMDT) WTP inlet pipe, located within the WTP, was sampled ten times between October 2022 and July 2024. The Leadville Mining District is in Leadville, Lake County. The LMDT WTP is located just north of town, near the south bank of the East Fork Arkansas River. The LMDT is ~2.1 miles long and was constructed between 1943 and 1952 to drain groundwater from the mines in the Leadville Mining District (USBR, 2008).

The LMDT is currently associated with the EPA California Gulch Superfund Site which covers ~16 square miles and includes the City of Leadville and parts of the Leadville Mining District. The U.S. Bureau of Reclamation (USBR) acquired the LMDT in 1959 and constructed the LMDT WTP in 1992 to treat metals discharging into the East Fork of the Arkansas River (USBR, 2008). Before 2005, discharge from the LMDT typically was greater than ~1,000 gpm and up to ~1,500 gpm. In March 2008, the LMDT had a flow of ~1,120 gpm (Wellman and others, 2011). The effluent from the LMDT contains elevated concentrations of several metals, including some deemed critical, including aluminum, cadmium, copper, iron, lead, manganese, silver, and zinc.

St. Louis Tunnel

The St. Louis Tunnel (SLT) effluent was sampled five times between November 2022 and September 2023 during this investigation. Due to relatively low metal concentrations and

circumneutral pH values, sampling of this site was discontinued after the first five sampling events (2022/2023) and replaced with the Summitville Mine locations. The mine is located within the historic Rico Mining District located in Rico, Dolores County. The SLT is located just north of the town of Rico, east of the Dolores River. The SLT was built starting in 1930s for exploration purposes and later connected to other tunnels and mine workings to dewater the Rico-Argentine mines. It was extended in the 1950s to mine workings on Silver Creek to the east of Rico (EPA, 2021; McKnight, 1974). The STL tunnel extends ~5,000 feet east into the mountains and the portal collapsed around 1996 (EPA, 2021; McKnight, 1974).

The STL Tunnel is currently part of the Rico-Argentine Superfund Site. Discharge from the STL Tunnel currently flows through a treatment system, into settling ponds (used for particulate settling prior to discharge), before entering the Dolores River (EPA, 2021). The discharged water is composed of groundwater impounded within several interconnected mine workings of the Rico-Argentine mines and surface water infiltrating along fractures and faults. Effluent from the STL Tunnel contains elevated concentrations of aluminum, arsenic, cadmium, copper, iron, lead, manganese, nickel, and zinc (EPA, 2021). Flow rates from the STL Tunnel generally range from 440 gpm to 1,400 gpm (Dean and others, 2022).

Argo Tunnel, Big Five Tunnel, and Virginia Canyon

Ten water samples were collected from the Argo Tunnel (Argo), Big Five Tunnel (Big5), and Virginia Canyon groundwater collection system (VC) discharges between November 2022 and July 2024. The Argo daylights in Idaho Springs, Clear Creek County, and extends ~4.2 miles north-northwest, at an average depth of ~1,500 feet, to a point west of Central City and north of Prosser Gulch in Gilpin County (Bastin and Hill, 1917; Lovering and Goddard, 1950; Stewart, 1994). The Argo was constructed between the late-1800s and 1910. It was originally constructed for mineral exploration, ore transportation, and for dewatering mine workings in the Central City and Idaho Springs Mining District.

The Big5 was extended in the 1930's to ~9,000 feet, trends north, and daylights over a mile to the west of the Argo portal (Bastin and Hill, 1917; Lovering and Goddard, 1950; Stewart, 1994). VC is located ~0.3 miles west of the AT portal. The VC groundwater collection system collects metal-laden water from the leaching of surface mine waste piles within Virginia Canyon, located in the Idaho Springs Mining District, which is piped to the Argo WTP.

The EPA placed most of the area on the Superfund National Priorities List (NPL) in 1983 (Central City-Clear Creek Superfund Site). The Argo WTP began full operation in 1998 and was constructed to treat the metals-impacted AMD to Clear Creek. AMD from the Argo, Big5, and VC is treated at the Argo WTP. The VC and the discharge from the Big5, both located to the west of the Argo, were added to the Argo WTP influent in 2006. Discharge from the Argo is collected through a grate near the tunnel entrance and both the VC and Big5 discharge from pipes located in front of the Argo WTP. These AMD sources drain through a grate to the equalization basins for treatment at the Argo WTP (EPA, 2007). All three sources of water are mixed before entering the Argo WTP. However, water samples were collected from each specific discharge prior to mixing (**Table 2**). Historic average flows from the Argo, VC, and Big5 ranged generally between ~200 to 450 gpm, up to ~180 gpm, and between ~10 and 90 gpm, respectively (EPA, 2007). This water contains elevated concentrations of metals including iron, arsenic, nickel, silver, zinc, cadmium, lead, copper, and manganese (EPA, 2007).

North Clear Creek WTP

Ten water samples were collected from the influent to the North Clear Creek (NCC) WTP between November 2022 and July 2024. The NCC WTP is in Black Hawk, Colorado, and, like the Argo/Big5/VC, is also a part of the EPA Central City-Clear Creek Superfund Site. The NCC WTP was constructed in 2017 and treats water collected from the National Tunnel, Gregory Incline, and Gregory Gulch (EPA, 2024) which are located within the Central City Mining District. The NCC WTP is designed to treat between 200 to 600 gpm but, between 2020 and 2021, it treated on average ~115 gpm (EPA, 2024). Mine effluent from these sources contains elevated concentrations of metals, including several critical minerals such as iron, zinc, copper, cadmium, manganese, lead, and arsenic (EPA, 2024).

Nelson Tunnel

Ten samples were collected from the Nelson Tunnel (Nelson), ~50 feet from the portal in an open channel between November 2022 and July 2024. The Nelson is located ~2 miles north of Creede, Mineral County, in the Creede Mining District. The Nelson likely drains water from several mines within this mining district including the Amethyst Mine, Commodore Mine, Happy Thought, Last Chance, and Park Regent (Emmons and Larsen, 1923).

Mine-impacted water flows from both the tunnel and the adjacent Commodore Mine waste pile, which drains directly to West Willow Creek, a tributary of the Rio Grande River. The site was placed on the EPA NPL list in 2008 due to adverse impacts to the creek. The tunnel consists of three parts collectively known as the Nelson, is ~13,100 feet long, and historically provided both haulage and drainage for several mines. Flows from the tunnel are currently measured by the Colorado Division of Reclamation, Mining and Safety (DRMS) using a flume and data logger. The average flow from the tunnel is 365 gpm based on 17 years of data (EPA, 2020). Though remediation of the site has occurred, and subsequent studies have supported additional site rehabilitation plans, there is currently no active water treatment facility at the site. The mine discharge contains elevated concentrations of cadmium, copper, lead, manganese, and zinc and may contain other critical minerals. Analyses of water samples collected in 1995 from the Nelson Tunnel reportedly had elevated concentrations of aluminum, cobalt, silver, and thallium (Neubert and Wood, 1999).

Gladstone WTP

The Gladstone WTP inlet pipe was sampled ten times between November 2022 and July 2024. The American Tunnel and Gladstone WTP is located along Cement Creek, north of Silverton, within the Eureka Mining District, San Juan County. The tunnel (originally known as the Lower Gold King adit and renamed in 1959) was extended from the old mill site at Gladstone ~6,233 feet northeastward as an exploration tunnel. In the early 1960s, it was extended east to the Sunnyside Mine workings to provide drainage (Burbank and Luedke, 1969). The Gladstone WTP

collets and treats drainage from several mines within the Central Colorado epithermal Au-Ag and San Juan tungsten veins critical mineral focus areas and is associated with several mineral/deposit types (**Table 3**) (Dicken and others, 2022). Several mines in this area are part of the Sunnyside Mine Group including the Gold King, American Tunnel, and Mogul Mine.

After mining ceased in ~1991 at the Sunnyside Mine, the American Tunnel was bulkheaded per an agreement with the CDPHE. As a result of these bulkheads, the flow from the American Tunnel decreased from about 1,700 gpm to about 100 gpm. Between 2000 and 2003, other mine portals (Mogul Mine, Red and Bonita, and Gold King) began discharging likely due to the bulkheads installed in the Sunnyside Mine. Additional bulkheads were installed in the Mogul Mine in 2003 but discharges from these mines increased over time. In 2011, the EPA initiated work at the Red and Bonita Mines and later a bulkhead was installed in 2015. Several phases of reclamation work were completed at the Gold King Mine over the next several years and finally, in August 2015, during EPA-led remediation activities, the Gold King mine pool drained ~3 million gallons of mine-impacted water into North Cement Creek and ultimately into the Animas River (U.S. Bureau of Reclamation, 2015).

The EPA constructed the Gladstone WTP to treat water from the Gold King Mine and the site is now part of the Bonita Peak Superfund Site. The mine water effluent contains elevated concentrations of several metals including aluminum, arsenic, cadmium, cobalt, copper, iron, magnesium, manganese, nickel, and zinc. Flows into the treatment plant ranged from ~400 to 960 gpm between 2015 and 2016 (CDM Smith, 2016).

Summitville Mine

The Reynolds Adit (Reynolds) effluent and/or water from the Summitville Dam Impoundment (SDI) was sampled five times between May and July 2024. This sample location replaced the St. Louis Tunnel sampling location as discussed above. The historic Summitville Mine is located ~40 miles directly west of Alamosa in the southern San Juan Mountains, Rio Grande County.

Most of the historic mining was underground while open-pit mining commenced in 1984. The Reynolds was completed in 1897 and was used to dewater the mine during its operation and, prior to its plugging in 1994, *“approximately 50% of the metals yield from the entire mine site (as high as 9,000 pounds of copper per day) issued from the Reynolds Adit”* (Ketellapper and others, 1996, page 6). Open-pit mining exposed large amounts of altered rock, containing pyrite and other sulfides, and collected water that infiltrated through fractures into other ore zones which likely caused metal concentrations in the Reynolds Adit effluent to increase during these operations (Gray and others, 1994; Ketellapper and others, 1996). Reportedly, copper concentrations in the Reynolds effluent prior to 1988 were as high as ~20-30 milligrams per liter (mg/L) and by 1992, they increased to ~130 mg/L. By 1993, concentrations of copper from this effluent were as high as 650 mg/L. Based on 10 years of monitoring prior to this, the higher metal concentrations correlated with the highest flow rates (Ketellapper and others, 1996).

After the mine was abandoned in 1992, the site was designated a Superfund Site by the EPA in 1994 (EPA, 2015). Currently, the SDI stores metal impacted water generated at the site for treatment at the Summitville WTP (EPA, 2015; EPA, 2020). The Summitville WTP was operational in 2012, operates generally between April to October due to its high elevation, and has a ~1,600 gpm (~6,057 liters per min [L/m]) capacity. Also, water in the underground workings is collected via a pipeline from the Reynolds to maintain a target mine pool level (EPA, 2020). Target metals for treatment at the Summitville WTP include aluminum, copper, iron, manganese, and zinc. Between 2015 and 2019, average treatment rates ranged between 1,317 and 2000 gpm (~4885 and 7,571 L/min). In 2019, the Summitville WTP removed an estimated 86, 20, 155, 17, and 10 tons of aluminum, copper, iron, manganese, and zinc, respectively (EPA, 2020).

METHODS

The sampling protocol used in this investigation was initially developed by the USGS and modified in the field as necessary. All water and solid WTP residue samples were submitted to the USGS Analytical Chemistry Project (ACP), which tracks samples, submits them to the analytical laboratory, performs quality assurance/quality control (QA/QC) of the data, and disseminates the analytical results to project managers and the public. Field parameters and water samples for each effluent were collected ~10 times over a two-year period between 2022 and 2024 (**Table 3**). As discussed above, the St. Louis Tunnel was sampled 5 times between 2022 and 2023 while the Reynolds and SDI were sampled 2 and 3 times, respectively, in 2024.

Field Measurements

Field parameters that were measured during each sampling event include pH, temperature, specific conductance (SC), and dissolved oxygen (DO). These parameters were measured by immersing a digital multimeter probe into collected effluent in the field. The pH electrodes were calibrated using pH 4, 7, and 10 buffers, and the SC probe was calibrated with a standard KCl solution prior to conducting field measurements.

Water Sampling

Water samples were collected in lab supplied two 1-liter high-density polyethylene (HDPE) disposable containers, one acid-washed and one washed with deionized-water, and labeled in the field. Containers and lids were field rinsed instream three times prior to sample collection. Water was then processed and split into five labeled 125 milliliter (mL) sub-sample bottles for delivery to the USGS laboratory for subsequent analyses with the methods listed below. During each sampling event, a field blank and duplicate sample were collected and submitted to the laboratory. Field blanks were collected using deionized water at each site. A duplicate and field blank sample were collected at least once per sampling trip or at a rate of one per 20 samples. The following samples were collected at each site:

- Raw Acidified – unfiltered water acidified (nitric acid) in the field to 1% volume/volume (v/v) dropwise using trace-metal grade nitric acid;
- Filtered – water samples filtered through field-rinsed 0.45mm nylon syringe filters and acidified (nitric acid) to 1% in the field dropwise using trace-metal grade nitric acid. Two samples were generated for different analytical methods; and
- Filtered unacidified - water samples filtered through field-rinsed 0.45-millimeter (mm) nylon syringe filters. One sample was collected for ion chromatography and the second for alkalinity/acidity titration analyses as described below.

Water Treatment Plant Residue Sampling

The WTP residue, or sludge/solids, samples were provided by treatment plant operators and were collected in clean labeled 2-gallon plastic bags (e.g. filter press, filter bag). Most of the solids all contained significant water content, with consistencies varying between a cohesive filter cake (e.g., Eagle Mine) and a slurry. Samples were placed in labeled clean 2-liter (L) glass beakers and dried at 40° C. The solids were then repackaged in clean 2-gallon plastic bags, labeled, and submitted to the USGS laboratory for analysis. The volume of sludge produced by these facilities was not available.

Laboratory Methods

Water samples were submitted to the laboratory and analyzed by several methods as documented by the ACP (USGS ACP, 2025). Acidified samples were analyzed by inductively coupled plasma (ICP) mass spectrometer (MS) and ICP optical emission spectroscopy (ICP-MS/ICP-OES) and the unacidified samples were analyzed by ion chromatography. Precious metals were analyzed by ICP-MS after preparation (USGS ACP, 2025). Alkalinity analysis was performed based on the field pH of the sample and is reported in units of mg/L as CaCO₃.

WTP solid samples were submitted to the laboratory, prepared, and analyzed by several methods as documented by the ACP (USGS ACP,2025) including:

- Major elements by wavelength dispersive x-ray fluorescence (WDXRF) or, in the case of the Eagle Mine samples, by (ICP-MS/ICP-OES);
- Hg was measured by cold vapor atomic absorption spectrometry;
- Au, Pt, and Pd were measured by lead fusion fire assay;
- Fluorine was measured by digestion and measurement with a F ion selective electrode;
- Total carbon and sulfur were measured by sample combustion and infrared detection of sulfur dioxide and carbon dioxide gas; and
- All other elements were analyzed by ICP-OES.

Although this investigation focuses on the critical mineral concentrations, many of the additional laboratory analyses were included to provide a complete set of data for this mine waste for future evaluation.

Quality Assurance and Quality Control

All lab results were reviewed by the USGS ACP for this project. More information about the laboratory analytical and QA/QC is available at the ACP website (USGS ACP, 2025). QA/QC practices managed by the USGS include submission of analytical duplicates and standard reference materials as unknowns to the laboratory. Samples were analyzed with 20% submitted as analytical duplicates and reference materials (included as blind samples to the analytical laboratory).

The laboratory reports and performance of the blanks, duplicates, and reference material were provided by the USGS. Generally, water results for the ICP-MS/ICP-OES analysis were deemed acceptable if recovery for all elements was $\pm 15\%$ at five times the Lower Limit of Determination (LOD), the calculated Relative Standard Deviation (RSD) of duplicate samples was no greater than 15%, or otherwise deemed acceptable by the ACP as noted. Several of the alkalinity and anion analyses were conducted outside of the hold time of the sample.

Flow Measurements and Estimated Loading

Effluent flow rates were collected from the on-site WTP operators, or in the case of Nelson, from monthly flow-measurement data. Flow rates were not obtained from the Eagle GW as it collects seasonal groundwater from the consolidated tailings pile and is intermittently pumped to the Eagle WTP. Flows in many of these facilities are measured and recorded within the inlet pipe to the WTP. **Table 2** provides a general summary of the flow measurement locations. Generally, daily metal loads were estimated by converting the flow rate (discharge), usually in gpm, to L/m and then estimating the load using the following equation:

- Estimated Load (kilograms per day [kg/d]) = $[x * 3.78541 \text{ L} * 1,440 \text{ minutes/day}] * [y * 1e-9 \text{ kg/ug}]$
- Where:
 - x is the flow in gpm; and
 - y is the analyte concentration in micrograms per liter (ug/L or ppb).

RESULTS

All the field and laboratory results are summarized in **Appendix B** and an electronic version of the results and field data sheets are provided as **Appendix C**. Field parameters, flow, and the total (unfiltered water samples) analyte concentrations for the critical minerals are summarized in **Tables 4** through **14**. The WTP residue critical mineral results are summarized in **Table 15** and a summary table with all these results is included in **Appendix C**. A summary of the ranges detected at each site is included in **Appendix D** and contains the minimum, maximum, median, mean, 25th percentile, and 75th percentile of the results. A summary of these ranges is included as **Table 16**. A summary of the average estimated loads is provided in **Appendix E**. The following results summary below uses total (unfiltered) concentrations unless otherwise noted. A large percentage (>70%) of these analytes and others occur in the dissolved state within these waters. At all the sites, the precious metals (Ag, Au, Pd, and Pt) were only sporadically detected above the reporting limit with all of the detections below 0.7 ppb except for a few detections of Ag up to ~3.8 ppb (**Appendix B**). As reported below, the total rare earth elements (TotalREEs) include the lanthanide elements, Y, and Sc. The light REEs (LREEs) include La, Ce, Pr, Nd, Sm, Eu, and Gd while the heavy REEs (HREEs) include Tb, Dy, Ho, Er, Tm, Yb, Lu, and Y. The following subsections present a summary of the water and WTP residue results with regards to critical minerals at each site.

Eagle Mine WTP and North Groundwater Extraction Trench

Field measurements and samples were collected at the Eagle WTP and Eagle GW between October 2022 and July 2024. A summary of the field parameters, laboratory results, and flow measurements for the Eagle WTP and Eagle GW is included in **Tables 4** and **5**, respectively. A summary of the analyte concentration ranges is provided in **Table 16**. The pH ranged from 5.1 to 6.1 and 6.2 to 6.6 at the Eagle WTP and Eagle GW, respectively. Field conductivity ranged from 2,005 to 3,040 and 167 to 2,850 microsiemens per centimeter (uS/cm) at the Eagle WTP and Eagle GW, respectively. Alkalinity ranged from 10 to 102 and <8 to 106 mg/L at the Eagle WTP and Eagle GW, respectively. Generally, most of the detected critical mineral total average

concentrations were below 40 parts per billion (ppb) at both sites except for the following average concentrations:

- Eagle WTP - critical minerals detected above 40 ppb included: Al (~366 ppb), As (~142 ppb), Cu (~347 ppb), Mg (199,100 ppb), Mn (24,640 ppb), Ni (~60 ppb), and Zn (53,280 ppb).
- Eagle GW - critical minerals detected above 40 ppb included: Al (~202 ppb), As (191 ppb), Li (~141 ppb), Mg (173,800 ppb), Mn (60,780 ppb), and Zn (12,890 ppb).

Flow rates at the Eagle WTP ranged between 500 and 871 L/m with higher flow rates observed in early May through June (**Table 4**). Although these higher flow rates were not observed in 2023, they were observed in 2024 after several sampling events were included during May and June to capture these increases. Flow rates are compared with some of the higher concentration elements (e.g., Mg, Mn, and Zn) over time in **Figure 2**. Estimated loads for select critical minerals are shown in **Figure 3**, summarized in **Table 17**, and additional estimated loads are provided in **Appendix F**. Flow was not measured from the Eagle GW as it is only pumped intermittently. Estimated loads at the Eagle WTP generally increase for Mg, Mn, and Zn during the spring (**Figure 3**).

Laboratory analysis of solids from the Eagle Mine WTP were composed primarily of Fe_2O_3 (62.45%) with lesser amounts of SiO_2 (2.62%) and Al_2O_3 (1.3%). Zinc, arsenic, and copper were detected at > 10,000; 6,748; and 5,692 parts per million (ppm), respectively, well above 10-times bulk continental crust concentrations (**Table 15**).

Leadville Mine Drainage Tunnel WTP

A summary of the field parameters, laboratory results, and flow measurements for the LMDT WTP is included in **Table 6**, respectively. A summary of the analyte concentration ranges is provided in **Table 16**. Field parameters and samples were collected from the LMDT WTP between October 2022 and

July 2024. Field conductivity ranged from 347 to 570 uS/cm and alkalinity ranged from 39 to 163 mg/L. Most of the detected critical mineral concentration were detected below 10 ppb except for (average): Al (~729 ppb), Ba (~76 ppb), Cu (~45 ppb), Mg (25,760 ppb), Mn (2,472 ppb), and Zn (5,906 ppb).

Flow rates at the LMDT WTP ranged from 3,104 and 5,129 L/m with the highest flows observed in late-September 2023, and lower flows observed in late May of 2023 and 2024. During the lower discharge rates, Mg, Mn, and Zn concentrations were generally elevated. Flow rates are compared with some of the higher concentration elements (e.g., Mg, Mn, and Zn) over time in **Figure 2**. Estimated loads are summarized in **Appendix F** and are shown over time for select critical minerals in **Figure 3**. Estimated loads for Mg, Mn, and Zn were generally higher in the early summer and decreased in the fall.

Laboratory analysis of solids from the LMDT WTP were composed primarily of SiO₂ (14.35%), Fe₂O₃ (13.67%), MgO (9.17%), CaO (7.19%), MnO (6.4%), and Al₂O₃ (2.31%). Zinc, barium, copper, and TotalREEs were detected at >10,000; 520; 451; and ~133 ppm, respectively (**Table 16**). Only a few (As, Cu, In, Mn, and Zn) were detected at concentrations 5 to 10-times greater than average bulk continental crust (**Table 16**).

St. Louis Tunnel

A summary of the field parameters, laboratory results, and flow measurements for the STL is included in **Table 7**. A summary of the analyte concentration ranges is provided in **Table 16**. The STL was sampled between November 2022, and September 2023. As discussed above, sampling ceased in 2023 because access to the Summitville site was obtained and due to the relatively lower concentrations of critical minerals and more neutral pH detected at the STL. Field pH ranged between 6.3 and 6.9 during this time. Field conductivity ranged from 1,027 to 1,155 uS/cm. Alkalinity ranged from 36 to 188 mg/L. Detections of critical minerals were generally below a mean of 30 ppb except for: Al (~1,216 ppb), Cu (~468 ppb), Mg (18,220 ppb), Mn (2,736 ppb), and Zn (7,838 ppb).

Flow rates ranged from 636 to 3,785 L/m. Flow rates increased in the late spring, increased into late July, and then decreased in the fall. Flow rates are compared with some of the higher concentration elements over time in **Figure 2**. Estimated loads for select critical minerals are shown in **Figure 3**, summarized in **Table 17**, and additional estimated loads are provided in **Appendix F**. The zinc load increased by an order-of-magnitude between late April and the end of May 2023 but decreased significantly by late July.

Laboratory analysis of solids from the SLT were composed primarily of SiO₂ (41.94%), Fe₂O₃ (21.41%), Al₂O₃ (10.91%), MnO (2.35%), and MgO (1.69%) (**Table 15**). Zn and Cu were detected at concentrations of >10,000 and 3,736 ppm, respectively. Additionally, TotalREEs were detected at a mean of ~359 ppm with mean concentrations of LREEs at ~268 ppm (~75% of the TotalREEs) and were comprised mostly of (in descending order) Ce, Y, La, and Nd. Several of the critical minerals were detected above 10 times the average bulk continental crust concentration including As, Cu, In, Mn, Sb, and Zn (**Table 15**).

Argo Tunnel, Big Five Tunnel, and Virginia Canyon

A summary of the field parameters, laboratory results, and flow measurements for the Argo, VC, and Big5 are included as **Tables 8, 9, and 10**, respectively. A summary of the analyte concentration ranges is provided in **Table 16**. Water samples were collected from these discharges ten times between November 2022 and July 2024. The field pH varied little during this time and ranged from 2.48 to 2.89, 3.24 to 3.49, and 5.28 to 5.88, at the Argo, VC, and Big5, respectively. Field conductivity ranged from 2,470 and 3,650 uS/cm, 1,519 to 2,450 uS/cm, and 1,943 and 2,840 uS/cm at the Argo, VC, and Big5, respectively. Alkalinity was generally < 25 mg/L at all the sites. Most of the detected critical mineral concentrations at the Argo, VC, and Big5 were below average concentrations of ~50 to 60 ppb except for the following average concentrations:

- Argo - Al (19,890 ppb), As (62 ppb), Co (~118 ppb), Cu (~4,307 ppb), Mg (91,300 ppb), Mn (75,710 ppb), Ni (~185 ppb), Zn (37,060 ppb), and TotalREE (~1,223 ppb). The TotalREE concentrations consist mostly of the LREE with (in descending order) Ce, Nd, La comprising ~65% of the TotalREE concentration. Y was also detected at an average of ~165 ppb.
- VC - Al (46,410 ppb), Co (~184 ppb), Cu (~6,108 ppb), Mg (70,230 ppb), Mn (46,980 ppb), Ni (~402 ppb), Zn (49,230 ppb), and TotalREEs (~1,357 ppb). The TotalREE concentrations are mostly LREEs with (in descending order), Ce, Nd, and La comprising ~62%, of the TotalREE concentration. Y was also detected an average of concentration of ~209 ppb.
- Big5 - Al (~1476 ppb), Co (~99 ppb), Cu (~198 ppb), Mg (122,600 ppb), Mn (27,000 ppb), Ni (~199 ppb), Zn (6,189 ppb), and TotalREEs (~100 ppb). Most of these concentrations were below the average total concentrations detected in the Argo and VC except for Mg. TotalREE concentrations are mostly LREEs with (in descending order), Ce, La, and Nd accounting for ~54%, of the TotalREE concentration.

Graphs showing the concentrations of the higher critical mineral concentrations and flow rates for these three sites over time are included in **Figure 4**. Flow rates at these three sites ranged from 545 to 861, 30 to 145, and 55 and 109 L/m at the Argo, VC, and Big5, respectively (**Table 16**). Higher flow rates were observed in the May-June time period, varied at the Argo, and generally were higher in 2024. Concentrations of Al, Mg, Mn, Mg, and TotalREEs increased during the higher flow rates observed in the late spring and early summer of 2024. The estimated loads for the Argo, VC, and the Big5 are summarized for select critical minerals in **Table 17** and are shown over time in **Figure 5**. Additional estimated loads are provided in **Appendix F**. At the Argo and Big5, estimated loads increased in late spring to early summer but decreased later in July. This trend was also observed at the VC but in 2024, although the

concentrations increased, the flows decreased in 2024 and therefore, the estimated loads decreased.

Laboratory analysis of solids from the Argo WTP that treats water from these three discharges were composed primarily of Fe₂O₃ (17.57%), CaO (13.35%), MgO (9.76%), MnO (8.57%), SiO₂ (6.42%), Al₂O₃ (4.2%). Zinc, copper, and TotalREEs were detected at > 10,000; 4,097; and ~974 ppm, respectively. Lower concentrations of nickel and cobalt were also detected (**Table 15**). The TotalREEs detected in this material were the highest observed during this investigation with LREEs and HREEs detected at ~725 and 243 ppm, respectively. Ce, Y, Nd, and La (in descending order) made up over ~80% of the TotalREEs detected in the Argo WTP discharge solids. Detected concentrations of several critical minerals in these solids are 5- or 10-times over average bulk continental crust concentrations (including some of the REEs such as Pr and Gd) as shown in **Table 15**.

North Clear Creek WTP

A summary of the field parameters, laboratory results, and flow measurements for the NCC WTP is included as **Table 11**. A summary of the analyte concentration ranges is provided in **Table 16**. Field measurements and water samples were collected from the NCC WTP between November 2022 and July 2024. The field pH varied between 4.4 and 5.5 during this time. Field conductivity ranged from 1,616 and 2,420 uS/cm and the alkalinity was < 25 mg/L. Most of the detected critical minerals were detected below an average concentration of ~50 ppb during this time except the following average concentrations:

- Al (1,703 ppb), Co (~110 ppb), Cu (~408 ppb), Mg (72,180 ppb), Mn (23,450 ppb), Ni (~176 ppb), Zn (5,168 ppb), and TotalREEs (~513 ppb). Most of the REEs were LREEs (~71%) with (in descending order) Ce, Nd, and La making up ~59% of the TotalREE average concentration.

Flow rates are compared with some of the higher concentration elements (e.g., Mg, Al, Mn, and Zn) over time in **Figure 4**. Flow rates at the NCC WTP ranged from 511 to 681 L/m (**Table 16**) with higher flow rates observed in late September 2023 and between late May to late July in 2024 (**Figure 4**). The estimated loads are summarized for select critical minerals in **Table 17** and shown over time for these critical minerals in **Figure 5**. Additional estimated loads are provided in **Appendix F**. Estimated loads for select critical minerals increased during the higher discharge rates but were generally low compared to other sites in this area (e.g., Argo).

Laboratory analysis of solids from the NCC WTP were composed primarily of Fe_2O_3 (28.92%), CaO (18.35%), SiO_2 (7.09%), MgO (5.75%), MnO (5.45%), and Al_2O_3 (0.65%). Zinc, copper, and TotalREEs were detected at 9,219; 557; and ~739 ppm, respectively. Nickel and cobalt were also detected at lower concentrations (**Table 15**). The TotalREEs detected in this material were the second highest observed during this investigation with LREEs and HREEs detected at ~504 and 234 ppm, respectively. Ce, Y, Nd, and La concentrations (in descending order) made up over ~80% of the TotalREEs detected in the NCC WTP discharge solids. Detected concentrations of several critical minerals in these solids are 5- or 10-times over average bulk continental crust concentrations as shown in **Table 15**.

Nelson Tunnel

The Nelson was sampled between November 2022 and July 2024. A summary of the field parameters, laboratory results, and flow measurements for the Nelson is included in **Table 12**. A summary of the field parameter, flow, and critical mineral concentrations is provided in **Table 16**. Field pH measurements ranged between 4.3 and 5.2 during this time. Field conductivity ranged from 787 to 1,152 $\mu\text{S}/\text{cm}$. Alkalinity was detected below 25 mg/L. Most of the detected critical minerals at the site were below average concentrations of 30 ppb except for the following average concentrations:

- Al (~720 ppb), Cu (151 ppb), Li (~140 ppb), Mg (8,771 ppb), Mn (12,958 ppb), Zn (35,040 ppb), and TotalREEs (~320 ppb). The higher average TotalREEs were mostly associated

with LREEs (92%) with (in descending order) Ce, La, and Nd making up ~82% of the TotalREEs.

Flow rates at the Nelson ranged from 1,192 to 1,310 L/m with small flow rate increases observed in late May of both 2023 and 2024 (**Table 16**). Flow rates are compared with some of the higher concentration elements (e.g., Mg, Mn, and Zn) over time in **Figure 6**. In 2024, concentrations increased from early May to June but decreased by mid-July. Estimated loads are summarized for select critical minerals in **Table 17** and are shown over time in **Figure 7**. Additional estimated loads are provided in **Appendix F**. Estimated loads generally increased during this time, but this relationship was not as discernible in 2023.

Gladstone WTP

The Gladstone WTP was sampled between a November 2022 and July 2024. A summary of the field parameters, laboratory results, and flow measurements for the Gladstone WTP is included as **Table 13**. A summary of the analyte concentration ranges is provided in **Table 16**. Samples were collected from the discharge after the first settling pond therefore, the reported concentrations and field parameters may not be representative of the discharge directly from the mine. Field pH at the Gladstone WTP ranged between 2.8 and 5.5. Field conductivity ranged from 1,564 and 2,760 uS/cm. Alkalinity was generally <25 mg/L.

Most of the detected critical mineral were below average concentrations of 50 ppb except for the following: Al (23,009 ppb), Co (~67 ppb), Cu (~4,749 ppb), Mg (18,835 ppb), Mn (20,754 ppb), Zn (17,590 ppb), and TotalREEs (220 ppb). As with most of these sites, the TotalREE was comprised dominantly of LREEs (~72%) with Ce, Nd, and La making up ~57% of this average. Although both Te and In were detected at low (~<20 ppb) average concentrations, they had the highest average concentration at the Gladstone WTP (**Table 16**). Again, most of these detections on average were relatively low, but these critical minerals occur as trace elements in these deposits, or at least, with regards to Te, in veins or other smaller areas where they are enriched or associated with gold.

Flow at the Gladstone WTP ranged from 757 and 1,741 L/m (**Table 16**) and lower flows were observed in Late July 2023 and mid-June 2024. Flow rates are compared with some of the higher concentration elements (e.g., Al, Mg, Mn, and Zn) over time in **Figure 6**. The concentrations of select critical minerals appeared to generally increase during the lower flows. Estimated loads for select critical minerals are included in **Table 17** and shown over time in **Figure 7**. Additional calculated loads are provided in **Appendix F**. Higher loads for some of the critical minerals were observed in late September 2023 and again in June 2024 however, the TotalREE concentrations, and load, appeared to increase due to decreases in pH (**Figure 7**).

Laboratory analysis of solids from the Gladstone WTP were composed primarily of Fe_2O_3 (26.69%), Al_2O_3 (11.55%), MnO (7.13%), SiO_2 (6.29%), CaO (5.0%), and MgO (2.36%). Manganese, zinc, and copper were detected at 18,895; >10,000; and 3,736 ppm, respectively, well above 10-times bulk continental crust concentrations (**Table 15**). TotalREEs were detected at ~500 ppm with Total LREEs and HREEs at 314 and 187 ppm, respectively. About 63% of the TotalREE average concentration included, in descending order, Y, Ce, Nd, and La comprising ~72% of the TotalREEs. Several other critical minerals were detected above 5- or 10-times average bulk continental crust including As, Be, Bi, In, Sm, Gd, Tb, Dy, and Ho (**Table 15**).

Summitville Mine – Reynolds Adit and Summitville Dam Impoundment

As described above, the Summitville Mine area was sampled during 2024 after sampling ceased at the SLT in 2023. The Reynolds was sampled in May and June 2024, and the SDI was sampled three times between May and July 2024. A summary of the field parameters, laboratory results, and flow measurements for the SDI and Reynolds is included as **Table 14**. A summary of the analyte concentration ranges is provided in **Table 16**. Field pH at the Reynolds was 2.7 and 2.9 and ranged between 2.9 and 3.6 at the SDI. The field conductivity ranged from 2,360 to 4,160 and 827 to 1,261 $\mu\text{S}/\text{cm}$ at the Reynolds and SDI, respectively. The alkalinity was generally < 25 mg/L at both sites. Most of the detected critical mineral total concentrations at both sampling sites were below average concentrations of 60 ppb:

- Reynolds - the following were detected above 60 ppb including: Al (156,500 ppb), As (~646 ppb), Co (~456 ppb), Cu (34,200 ppb), Mg (43,350 ppb), Mn (19,650 ppb), Ni (556 ppb), Zn (18,400 ppb), and TotalREEs (~750 ppb). Average TotalREE were mostly LREEs (~76%) and were comprised mostly of (in descending order) Ce, Nd, and La comprising ~63% of this average.
- SDI - the following were detected at average concentrations above 60 ppb including: Al (~30,667 ppb), Co (126 ppb), Cu (7,140 ppb), Mg (19,700 ppb), Mn (6,277 ppb), Ni (~149 ppb), Zn (~3,533 ppb), and TotalREE (~212 ppb). Over ~77% of the TotalREEs were LREEs with (in descending order) Ce, La, and Nd comprising ~65% of the average TotalREE concentrations.

At the Reynolds, As, V, Cr, Be, In, Ge, Ga, and Te were detected at the highest average concentrations (**Table 16**) than all the other sites. Again, most of these detections on average were relatively low (<40 ppb on average, except for As) but several of these critical minerals (e.g., Ga, Ge, In, Te) occur as trace elements in these deposits, or at least, with regards to Te, in veins or other smaller areas where they are enriched or associated with gold. At the SDI, these elements were detected at concentrations much lower (**Table 16**) than the Reynolds.

Flow rates at the Reynolds and SDI ranged from 121 to 549 and 4,573 and 6,814 L/m, respectively (**Table 16**). At the Reynolds and the SDI, where only two flows were measured at each, the higher flow was observed in late June at the Reynolds and late May at the SDI. Flow rates are compared with some of the higher concentration elements (e.g., Al, Mg, Mn, and Zn) over time in **Figure 6**. Concentrations of select critical minerals increased between early May and late June at the Reynolds and between late May and mid-July at the SDI. A summary of the estimated loads provided in **Table 17** shows the loads over time for select critical minerals in **Figure 7**. Additional estimated loads are provided in **Appendix F**. At the Reynolds Adit,

increasing flow rates were correlative with lower pH and higher analyte concentrations.
Estimated loads increased with increases in concentrations.

SUMMARY AND DISCUSSION

The discussion presented here is meant to provide a summary of the critical mineral concentrations, discharge, and estimated calculated loads observed during this investigation at all the sites and is not intended to be a comprehensive critical mineral resource or geochemical assessment. Rather, it is intended that the data could be used to assist with delineating potential targets for future investigations and, at least, gives a broad and better understanding of differences between these sites based on a limited data set. The published literature and reports for these sites are numerous. The EPA and others have a better understanding of these sites, as many of them have been studied for decades, and any future investigations should include input from these parties. The concentrations discussed below are associated with the total (unfiltered) sample results unless otherwise noted.

Critical Mineral Concentrations

A summary of the field and laboratory results is provided in **Tables 4** through **14** and the averages are provided in **Table 16**. **Figure 8** shows the average concentration (all sampling events) for each critical mineral by location as well as the field pH and discharge range observed during this investigation for comparison purposes. As presented above in the results section, the concentrations and discharge change over time. **Figure 8** gives a general summary of the magnitudes of critical minerals in these AMDs. The data used in **Figure 8** are based on averages, limited to the data averaged over two years, and do not capture the variation of these concentrations over the entire timeframe of this investigation (e.g., winter). Also, although most of the sites were sampled 10 times, the STL was only sampled 5 times and the Reynolds and SDI were only sampled 2 and 3 times, respectively, which impacts the average especially for the latter two.

Critical minerals with the highest concentrations at all the sites included Mg, Zn, Mn, Cu, and sometimes Al. Most of these occurred as dissolved concentrations. The following concentration ranges (total, unfiltered) of these elements were detected for all sites during this investigation:

- Aluminum: 0.5 to 181,000 ppb.
- Copper: 1.4 to 47,100 ppb.
- Magnesium concentrations ranged from 5,830 to 231,000 ppb.
- Manganese concentrations ranged from 634 to 90,100 ppb.
- Zinc concentrations ranged from 1,410 to 96,200 ppb.

TotalREEs, Co, and Ni were also detected at higher concentrations than many of the other critical minerals. Cobalt and nickel were detected between 0.321 and 592 ppb and 0.9 to 701 ppb, respectively. Generally, the concentrations of most of the critical minerals in AMD from the sites sampled during this investigation were below a mean of ~60 ppb. Be, Cr, Cs, Ga, Ge, In, Sb, Sn, Te, Sc, Gd, Dy, Er, Tm, and Lu were detected below an average maximum of 50 ppb at all the AMD sites (**Table 16**). Many were detected well below this concentration. Critical minerals such as Bi, Hf, Nb, Ta, Zr, Y, and Yb were detected below the reporting limit or below a maximum average of 10 ppb in all the AMD samples (**Table 16**) (**Figure 8c** and **8d**). At the Reynolds, As, V, Cr, Be, In, Ge, Ga, and Te were detected at the highest average concentrations (**Table 16**) compared to all the other sites but were relatively low (<40 ppb on average, except for As). Although both Te and In were detected at low (~<20 ppb) average concentrations, they had the highest average concentrations at the Gladstone WTP (**Figure 8d**).

Average TotalREE concentrations ranged from 9.1 (Eagle WTP) to 1,357 ppb (VC) at all the sites. Compared to the other sites, the Eagle WTP, Eagle GW, and STL had the lowest concentrations. Most of the TotalREEs were LREEs with most (>50% generally) associated with (in descending order) Ce, Nd, La, and sometimes Y which made up most of the average concentrations. VC, Argo, Reynolds, and the NCC WTP (in descending order) had the highest average TotalREE

concentrations measured during this investigation which may be associated with the lower pHs, as is Al, as discussed below (**Figure 8**).

Many of the elevated critical mineral concentrations are also likely related to the pH as appears to be the case with regards to other more immobile elements such as Ni, Co, or the TotalREEs. Generally, the field pH at these sites ranged between 2.48 (Argo) and 7.4 (LMDT WTP) and some of the highest concentrations for the TotalREEs, Ni, and Co were detected at AMD sites sampled with lower field pHs (below 4) including the Reynolds, Argo, and VC. Generally, the following field parameter ranges were observed between sites including (**Table 16**):

- Field pH ranged between 2.48 and 7.40. The lowest and highest average pH was observed at the Argo and LMDT: 2.75 and 6.95, respectively.
- Field conductivity ranged between 347 and 4160 uS/cm with the lowest average (467 uS/cm) and highest (2,924 uS/cm) observed at the LMDT and Argo, respectively.

With regards to dissolved concentrations, several sites with elevated critical minerals tended to have a greater portion of metals in the dissolved phase. For example, **Figure 9** shows that the TotalREE concentration tends to increase as pH decreases. In these low pH samples, the majority of the REEs were in the dissolved phase. Additionally, **Figure 9** shows the percent particulate TotalREEs plotted against pH. Percent particulates were calculated by subtracting the filtered (dissolved) from the unfiltered (total) concentrations and dividing by the unfiltered. Below pH 5, >90% of TotalREE concentrations were in the dissolved state. A similar pattern is observed for Al (**Figure 10**) where, generally, dissolved and total Al concentrations are closer at lower pHs indicating that more of the Al is associated with particulates at higher pHs.

Most of these AMD sites drain large areas and multiple mines as indicated above, however, it is difficult to relate the concentrations detected in the AMD to mineral deposit types. For example, many of the sulfides occur at all these sites including pyrite, chalcopyrite, sphalerite,

galena, and other primary sulfides. It is unknown how much of this material remains underground or is in contact with groundwater/surface water infiltration. Additionally, because pH and other general geochemistry factors play a role with some metal solubilities, the concentrations observed are dependent on these factors and may not represent the mineralogy, or critical mineral content, in these deposits. There are a few instances where the elevated concentrations may generally indicate something about the ore deposit type. For example, the highest total concentrations of Al (132,000 to 181,000 ppb) were detected in the Reynolds samples collected at the Summitville Mine where the deposit is hosted in Al-rich (alunite) altered rocks. Additionally, the highest concentration of zinc (96,200 ppb) was detected at the Eagle Mine, which historically was primarily a zinc mine.

Background Critical Mineral Concentrations

The comparison of these results to background groundwater and/or surface water concentrations was outside the scope of this investigation although a synopsis is provided in the following paragraphs. Additionally, local groundwater concentrations of these elements may be elevated near the AMD sites, or nearby tributaries, due to the naturally occurring mineralization at these sites or local geology. The background concentrations of some of the major critical minerals detected during this investigation such as Al, Mg, Zn, Mn, Cu and some of the other critical minerals have been monitored in surface water and groundwater in the state and at most of these AMD sites. Background concentrations in many AMD sites in Colorado are unavailable for many of the critical minerals that occur as trace elements (e.g., In, Ce, Ge, Ga, Hf, Te, and the REEs). However, the concentrations of several individual REEs at several sites (e.g., VC, Argo, Reynolds, etc.) were elevated when compared to general REE background concentrations as reported by Noack and others (2014). Although many of these trace critical minerals were detected below 60 ppb, and several well below this concentration, many may be above background. Many of the detected concentrations Mn, Zn, Al, and Cu are well above concentrations measured in major rivers throughout Colorado when compared to the available surface water data summarized for Colorado (USGS, 2018).

Although Mg was detected at higher concentrations than other elements during this investigation, it is detected in some Colorado surface waters within the range of some concentrations detected during this investigation. It was evaluated here because it is listed as a critical mineral. However, Mg at the AMD sites may represent background groundwater concentrations and therefore, is likely not a potential Mg resource. For example, analysis of Mg in some surface waters in Colorado detected Mg with maximum concentrations between 16,700 and 53,770 ppb at the Colorado River near Cameo and the Gunnison River near Grand Junction, CO (USGS, 2018). In comparison, the dissolved Mg concentrations detected during this investigation ranged from ~5,830 to 234,000 ppb. The highest Mg detection (234,000 ppb) was from a sample collected from the Eagle WTP that collects the drainage from the Eagle Mine where the flooded mine workings are associated with the Mississippi Leadville Limestone, which is dolomite (calcium magnesium carbonate) in this area, and may provide the elevated Mg observed in these water samples. Additionally, for comparison purposes, the highest detection observed during this study was a magnitude below the concentrations reported for sea water (~1.29 million ppb) (Curcio and Profio, 2019) and well below Mg concentrations in brines like the Great Salt Lake, UT, where concentrations generally range from 2 to 16 million ppb (Rupke, 2025).

In addition, monitoring of two sites on the Colorado River above Glenwood Springs and near Cameo, CO, (USGS, 2018; see Table 4 and 8 of this publication), outside of impacts from mine sites, detected maximum total Al concentrations of 429 and 1,800 ppb, respectively, well within the range of detections of several of the AMD sites sampled during this investigation. Al was detected at (total) 254 to 2,080 ppb, 270 to 1,800, and 244 and 848 ppb at the STL, Nelson, and Eagle WTP during this investigation. Other critical minerals, such as Ni (maximum total detection of 574 ppb) and Co (maximum total detection of 592 ppb), were detected at elevated concentrations at most of these AMD sites when compared to general surface water concentrations measured in Colorado as summarized by others (USGS, 2018).

Discharge and Critical Mineral Load Estimates

Flow rates ranged from ~30 to 6,814 L/m with the highest average flow rates observed at the LMDT WTP (~4,108 L/m) and SDI effluent (~5,693 L/m) followed by the STL, Gladstone WTP, and Nelson (**Table 16** and **Figures 2, 4, and 6**). Concentrations of the critical minerals and flow rates vary over time and therefore, the estimated daily loads in this study varied as well. One of the goals of this project is to estimate the volume of critical minerals in these perpetual mine discharges to assist with determining the potential critical mineral endowment of mine wastes and the ability of these wastes to contribute to the U.S. critical mineral supply. Due to the variability associated with concentration and flow, these loads are general estimates calculated using the data collected during this limited study. Additional data, and/or analyses of existing data sets, is needed to accurately determine the variability of these loads due to changes in concentrations and flow rates especially in years with relatively higher precipitation events, snowfall, or early/late snow melt influences.

Appendix F includes a summary table with all the estimated loads and box and whisker plots associated with each critical mineral. **Figure 11** shows the average daily load of all sampling events at each site for Mn, Mn, Zn, Al, Cu, TotalREEs, Ni, and Co. **Figure 12** includes box and whisker plots showing the ranges of estimated loads for select critical minerals. For all sites, most of the following critical minerals have lower estimated loads (< 1 kg/d and many likely below < 0.01 kg/d): As, Ba, Be, Bi, Cr, Cs, Ga, Ge, Hf, In, Li, Nb, Rb, Sb, Sn, Ta, Te, Ti, V, and all the REEs. With regards to the REEs, relatively higher loads were calculated for Ce, La, Nd, and Y with the maximum measured estimated load for each individual REE below ~0.8 kg/d. Maximum estimated loads observed at all the sites for the higher concentration critical minerals include: Al (326 kg/d), Mg (273 kg/d), Mn (102 kg/d), Zn (97 kg/d), and Cu (86 kg/d). The maximum estimated loads for Co and Ni were between ~1.5 and 1.6 kg/d. Aluminum, magnesium, manganese, and zinc all had significantly higher load estimates than all other critical mineral elements, generally by several orders of magnitude. Based on the average estimated loads as presented in **Figure 11**, the higher estimates were detected at the following AMD sites:

- SDI – 232 kg/d Al, 1 kg/d Co, 55 kg/d Cu, 1.2 kg/d Ni, 1.7 kg/d TotalREEs (1.3 kg/d LREE, 0.36 kg/d HREE). As discussed above, the SDI effluent was only sampled 3 times during this investigation and therefore, these estimates would need to be verified.
- Reynolds – 83 kg/d Al, 23 kg/d Mg, 20 kg/d Cu, 10 kg/d Zn, 0.26 kg/d Co, 0.44 kg/d, 0.31 kg/d Ni, 0.44 kg/d TotalREE (0.34 kg/d LREE, 0.10 kg/d HREE). The Reynolds was only sampled twice and therefore, these estimates would need to be verified.
- Eagle WTP – 191 kg/d Mg, 51 kg/d Zn, 23 kg/d Mn.
- LDMT WTP – 150 kg/d Mg, 32 kg/d Zn.
- Argo – 99 kg/d Mg, 82 kg/d Mn, 0.13 kg/d Co, 0.2 kg/d Ni, 1.2 kg/d TotalREEs (0.95 kg/d LREE, 0.27 kg/d HREE).
- VC – Loads were low and below 6 kg/d for the higher concentration critical minerals due to the low flow.
- Big5 – 13 kg/d Mg, and the others were at or below 3 kg/d to lower relative flows.
- NCC WTP – 61 kg/d Mg, 20 kg/d Mn.
- Nelson – 62 kg/d Zn, 23 kg/d Mn, 16 kg/d Mg 0.57 kg/d Total REEs (0.52 kg/d LREEs, 0.05 kg/d HREEs).
- Gladstone WTP – 37 kg/d Mn, 37 kg/d Al, 32 kg/d Mg, 30 kg/d Zn, 8 kg/d Cu, 0.12 kg/d Co, 0.37 kg/d TotalREEs (0.27 kg/d LREEs, 0.10 kg/d HREE).

- STL – 67 kg/d Mg, 33 kg/d Zn, 11 kg/d Mn.

Even at the highest estimated loads for critical minerals like Mg, Al, Mn, and Zn, with 100% extraction rates, potential recovery of these would be minimal when compared to the apparent consumption of these metals (**Table 1**). Additionally, although Mg was evaluated during this investigation, it likely is not a potential resource due to its presence at relatively high concentrations in sea water and other brines. However, some of the critical minerals in the AMD discharges could be used as a perpetual secondary source or feedstock, depending on the extraction method and other factors, as these sites will likely be treated in perpetuity.

Water Treatment Plant Residues

Although the solid samples collected and analyzed during this investigation were one-time grab samples, the elevated total concentrations in these solids generally correlate with the concentrations of some of the elevated concentrations of critical minerals detected in the discharges (e.g., MgO, MnO, Al₂O₃, depending on the site). WTP residues were mostly comprised of Fe₂O₃, CaO, MgO, MnO, Al₂O₃, and SiO₂ (especially at the LMDT WTP and STL) as summarized in **Table 15**. Elevated concentrations, greater than 5- to 10-times average bulk continental crust concentrations, of several critical minerals were detected including:

- Argo WTP - Zinc, copper, and TotalREEs were detected at > 10,000; 4,097; and ~974 ppm, respectively. The TotalREEs detected in this material were the highest observed during this investigation with LREEs and HREEs detected at ~725 and 243 ppm, respectively. Ce, Y, Nd, and La (in descending order) made up over ~80% of the TotalREEs detected in the Argo WTP residues.
- NCC WTP - Zinc, copper, and TotalREEs were detected at 9,219; 557; and ~739 ppm, respectively. Ce, Y, Nd, and La concentrations (in descending order) made up over ~80% of the TotalREEs detected in the NCC WTP discharge residues.

- LMDT WTP - Zinc was detected at >10,000 ppm.
- Eagle WTP - Zinc, arsenic, and copper were detected at > 10,000; 6,748; and 5,692ppm, respectively.
- Gladstone - Manganese, zinc, and copper were detected at 18,895; >10,000; and 3,736 ppm, respectively. TotalREEs were detected at ~500 ppm with Total LREEs and HREEs at 314 and 187 ppm, respectively. Most of the TotalREE average concentration included, in descending order, Y, Ce, Nd, and La.
- SLT - Zn and Cu were detected at concentrations of >10,000 and 3,736 ppm, respectively. Additionally, TotalREEs were detected at a mean of ~359 ppm with mean concentrations of LREEs at ~268 ppm (~75% of the TotalREEs) and were comprised mostly of (in descending order) Ce, Y, La, and Nd.

Several other critical minerals were detected above 5 to 10-times the average bulk continental crust concentrations. Volumes were not available for these materials and the samples collected during this investigation were one-time grab samples and may not be representative of the discharges over time. Future investigations should include additional sampling of these materials and estimates of volume as they could provide, at least, feedstock as this material will also be produced in perpetuity.

CONCLUSIONS AND RECOMMENDATIONS

The AMD sites included in this investigation contain elevated concentrations of several critical minerals. Mg, Mn, Zn, Al, and Cu were present at the highest concentrations at these sites. Mg was consistently the most abundant critical mineral detected at most sites; however, many of these concentrations (as well as Al) may be closer to background concentrations at some sites. Higher concentrations of TotalREEs, nickel, and cobalt were also detected at several AMD sites. **Figure 10** and **Figure 11** summarize the average concentrations and estimated average loads, respectively, at these sites and provide an overview of potential critical mineral endowment in AMD at these locations. Due to the variability associated with concentration and flow measurements, as well as the limited sampling conducted during this investigation, these loads should be considered general estimates. Additional data, and/or analyses of existing data sets, are needed to accurately determine the variability of these estimates due to changes of these parameters over time. Critical minerals from these effluents could be used as a perpetual secondary source or feedstock, depending on the extraction method, as these sites will likely be treated in perpetuity.

Critical minerals such as Bi, Hf, Nb, Ta, Zr, and Yb were detected below the reporting limit or below an average maximum of 10 ppb in all the samples analyzed from these AMD sites. Additionally, the critical minerals Be, Cr, Cs, Ga, Ge, In, Sb, Sn, Te, Sc, Gd, Dy, Er, Tm, and Lu were detected below a maximum average of 50 ppb (and lower in many cases) at all the AMD sites indicating that they may not be a target for future extraction. At the Reynolds, As, V, Cr, Be, In, Ge, Ga, and Te were detected at the highest average concentrations (**Table 16**) as compared to all the other sites but were relatively low (<40 ppb on average, except for As). Although both Te and In were detected at low (~<20 ppb) average concentrations, they had the highest average concentrations at the Gladstone WTP (**Figure 8d**). Further assessment of these trace elements at these sites may be warranted to determine if they could be recovered at these sites in conjunction with other critical minerals.

As indicated above, further study is needed to better estimate the concentrations and loads of these lower concentration critical minerals. However, several of these also occur at elevated concentrations (5- to 10-times higher than average bulk continental crust) in WTP residue collected from some sites which also could be a secondary perpetual source of these materials.

Additional sampling of these discharges is recommended to better characterize the seasonal variation of critical mineral concentrations over time and to better determine an estimated annual load from these sources. This may include additional sampling at the sites with larger estimated average loads of the critical minerals such as the Summitville Mine site, including the SDI and Reynolds, as this site was only sampled 2 to 3 times during this investigation. Other sites, especially associated with elevated TotalREEs (e.g., Argo, SDI, and Nelson) could support pilot studies for developing critical mineral extraction technologies for AMD sites. Other parameters measured during this study might assist with determining the best sites suited for future sampling. Additionally, an evaluation of background concentrations using groundwater and/or surface water data is recommended to evaluate the concentrations of the critical minerals (especially, Mg and Al) as many of the concentrations detected during this investigation may be from natural sources (e.g., bedrock) and similar to background concentrations.

WTP residue should also be further evaluated as elevated concentrations of several critical minerals exist in this waste. Furthermore, the volume of these solids should be determined to assist with determining the estimated critical mineral endowment of these wastes and potential use as feedstock as this material will also be produced in perpetuity.

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FIGURES

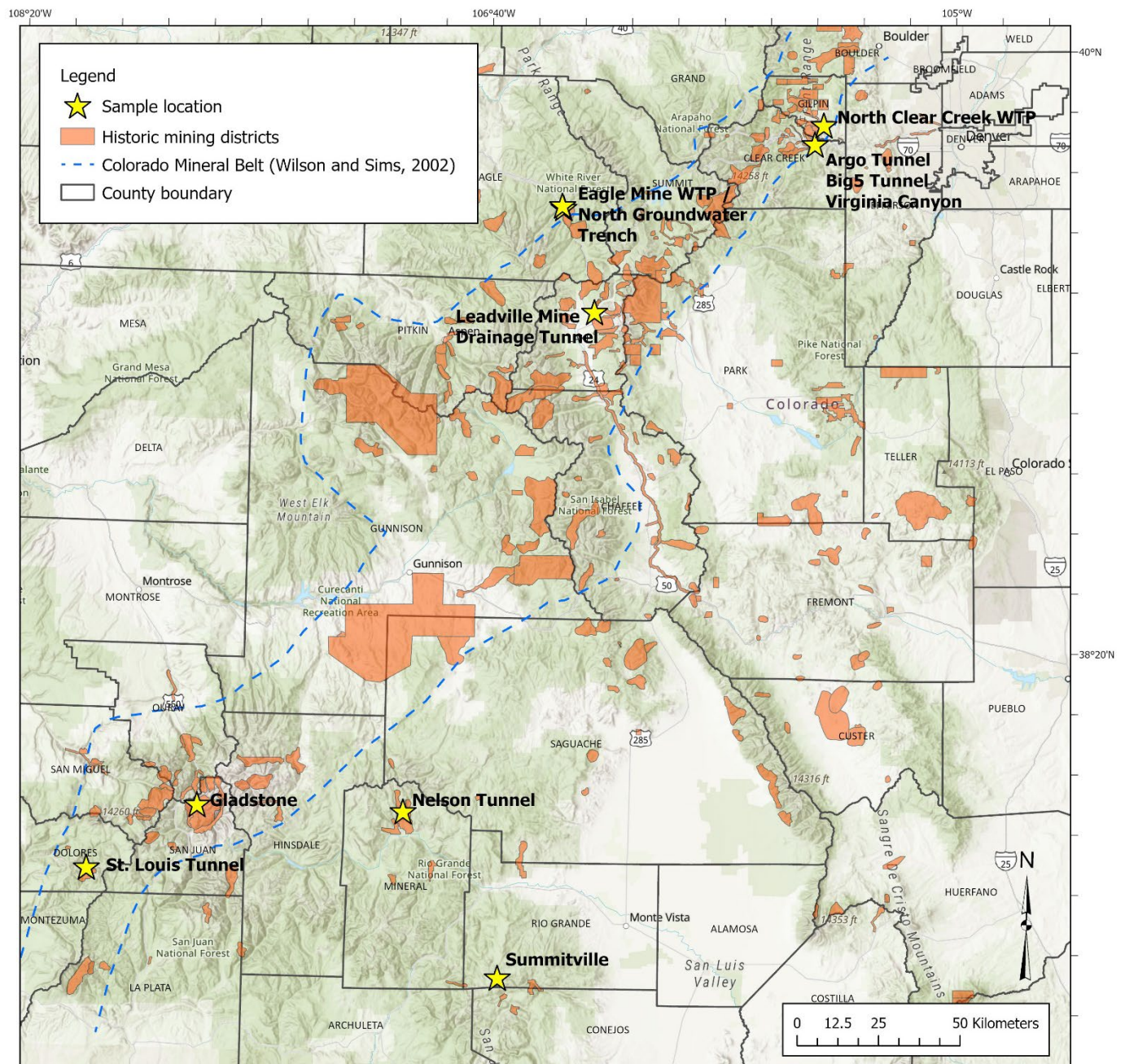


Figure 1 – Map showing sampling sites.

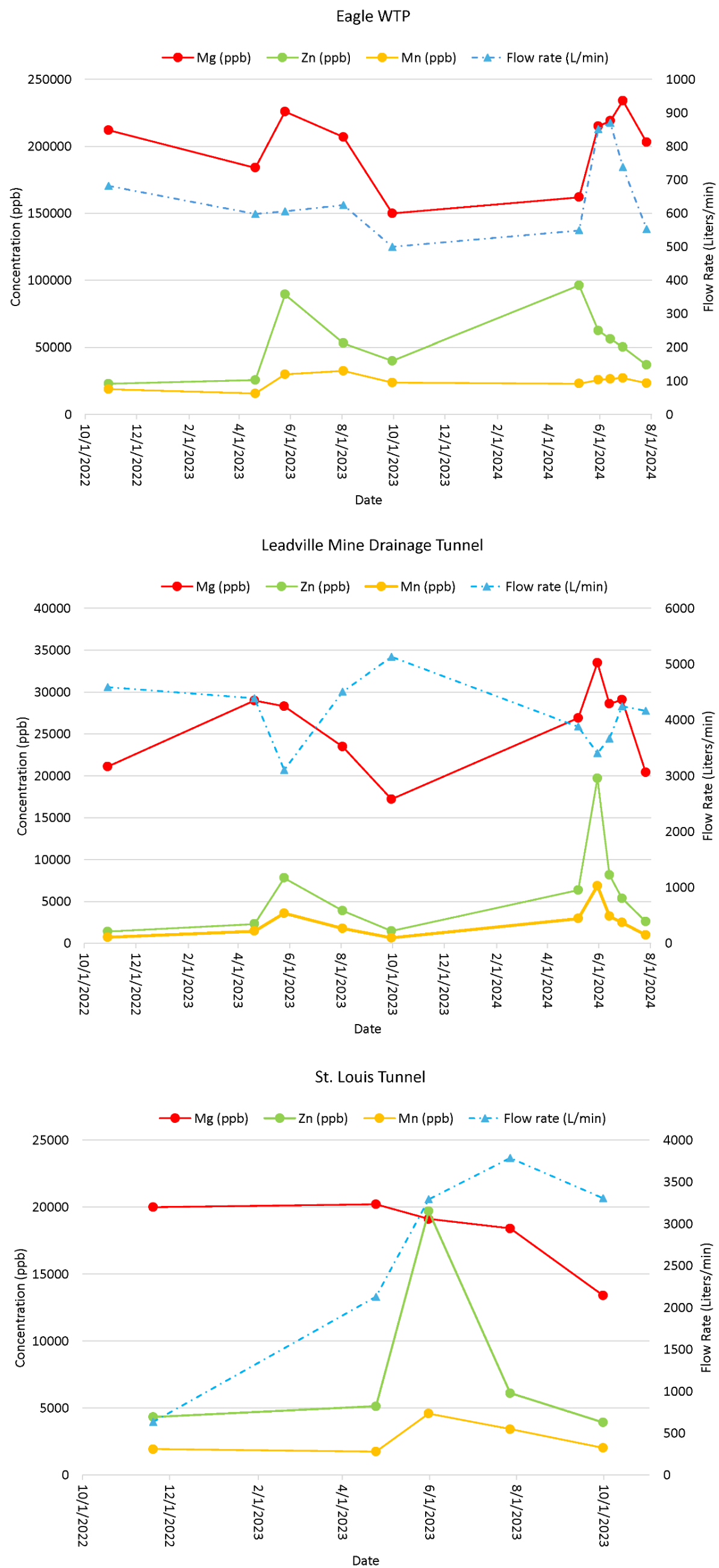


Figure 2 – Concentration of select critical minerals over time vs. flow at the Eagle WTP, Leadville Mine Drainage Tunnel WTP, and St. Louis Tunnel.

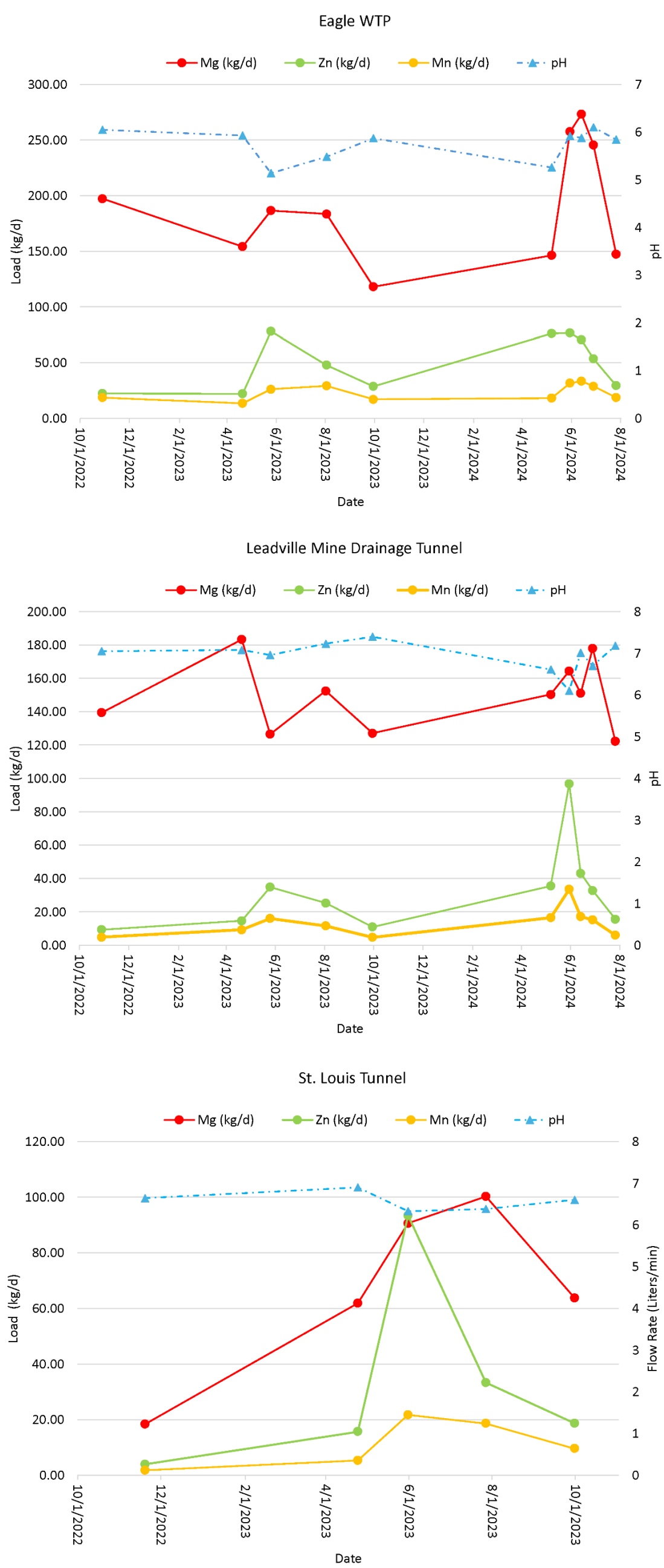


Figure 3 – Estimated loads of select critical minerals over time vs. flow at the Eagle Mine WTP, Leadville Mine Drainage Tunnel WTP, and St. Louis Tunnel.

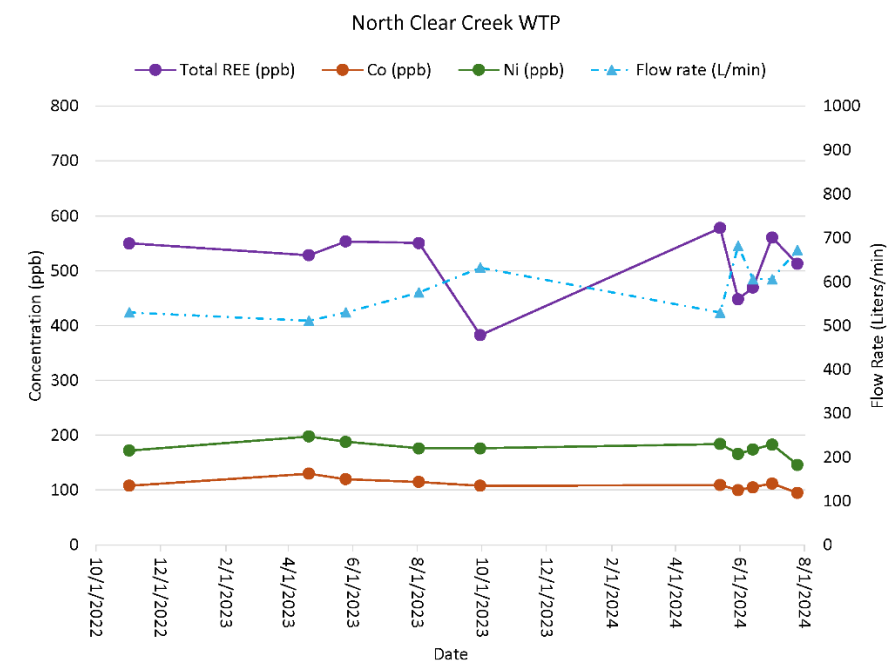
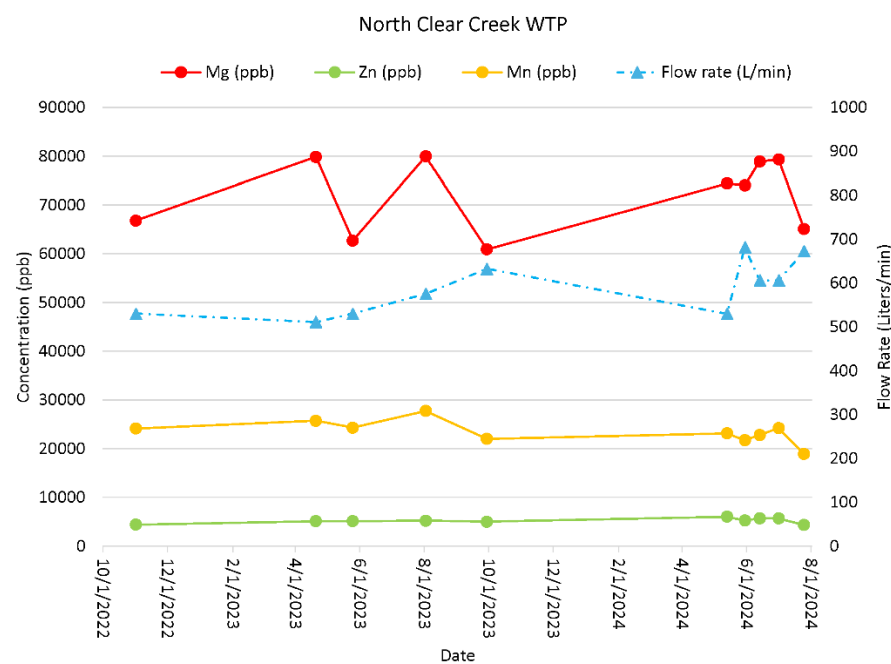
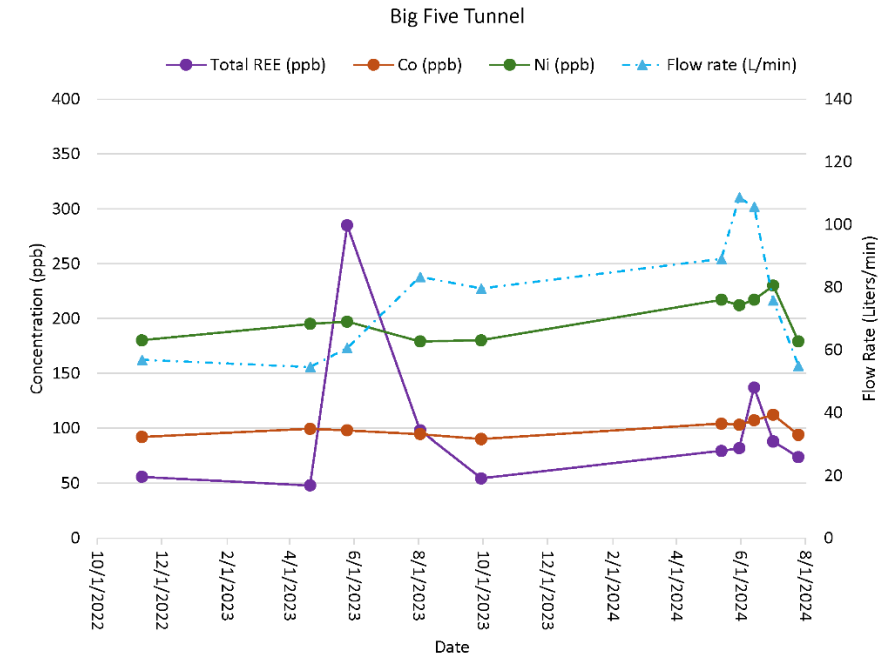
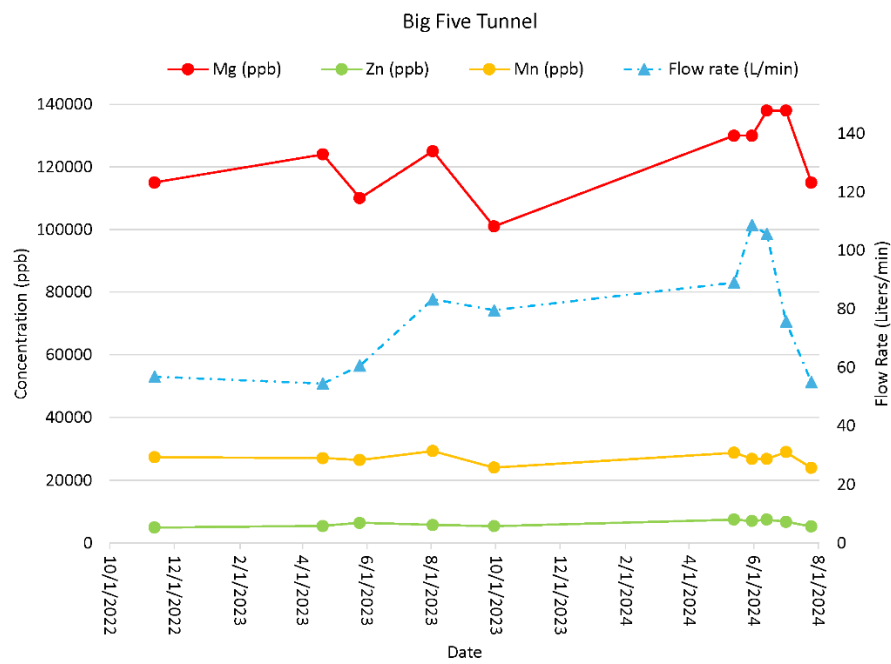
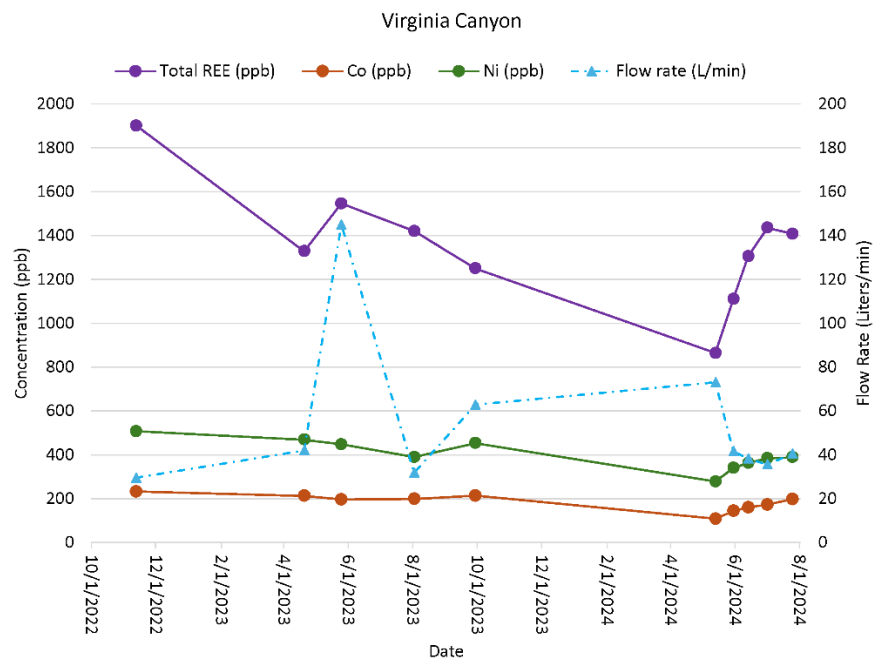
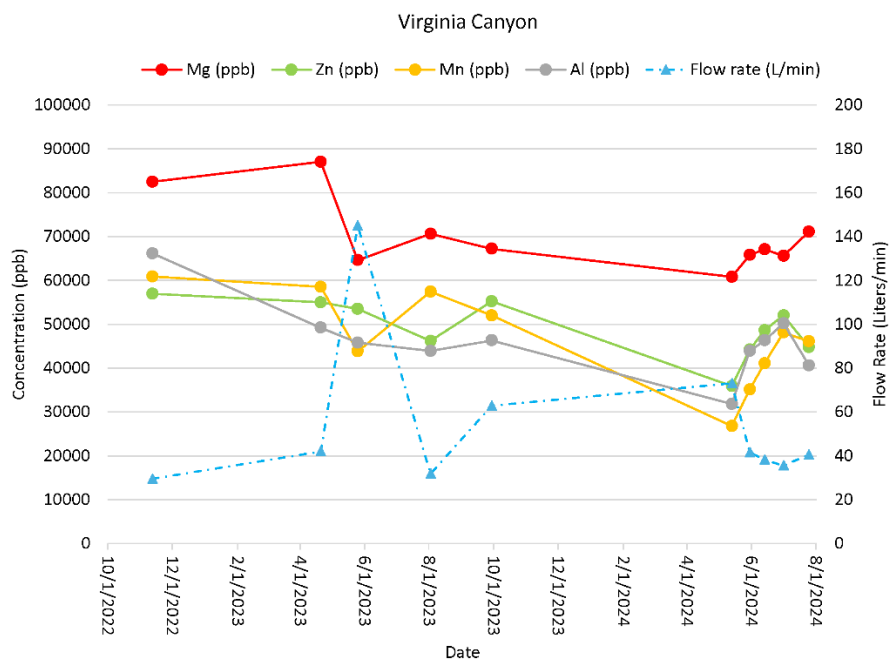
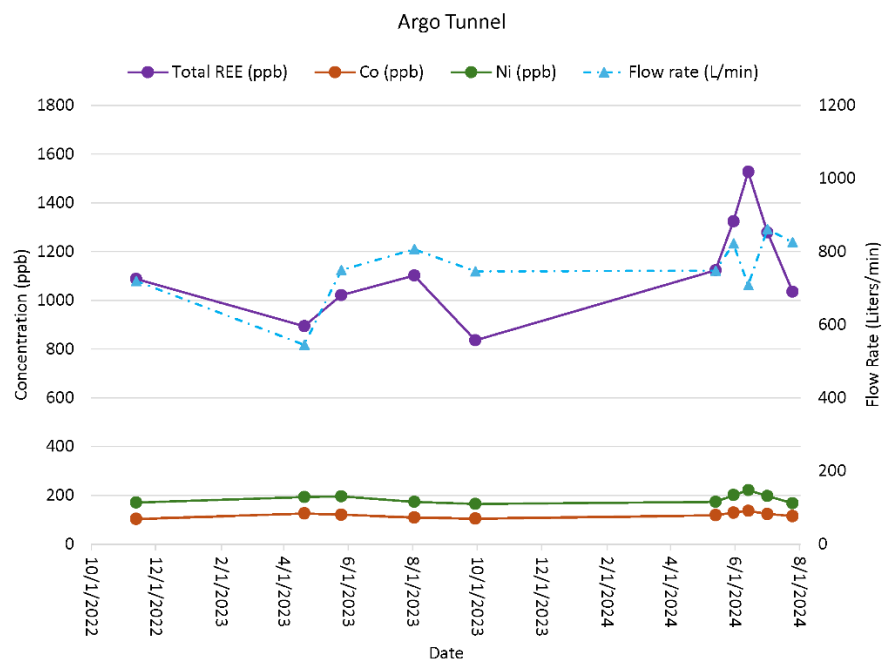
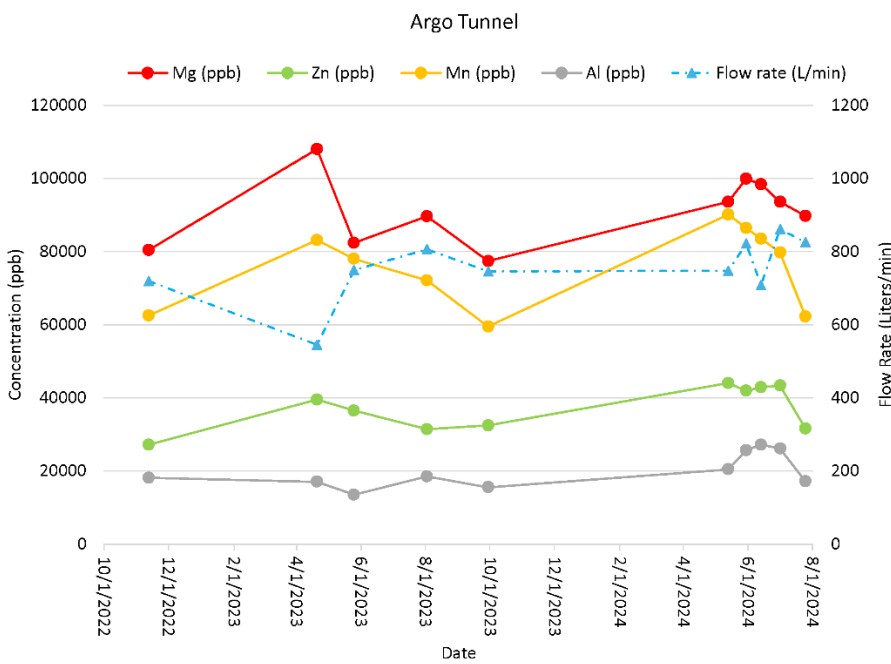


Figure 4 – Concentration of select critical minerals over time vs. flow at the Argo Tunnel, Virginia Canyon, Big Five Tunnel, and North Clear Creek WTP.

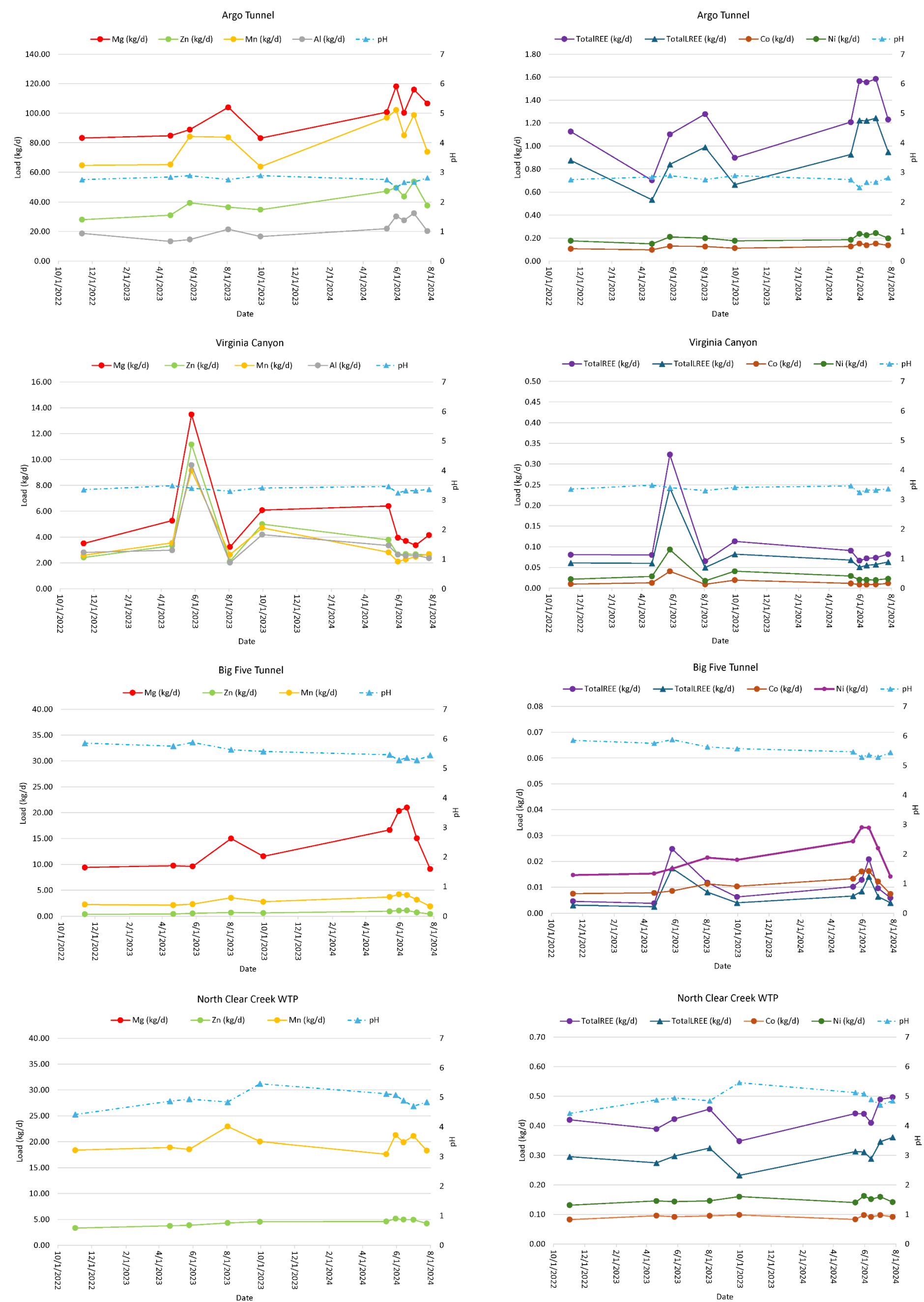


Figure 5 – Estimated loads of select critical minerals over time vs. flow at the Argo Tunnel, Virginia Canyon, Big Five Tunnel, and North Clear Creek WTP.

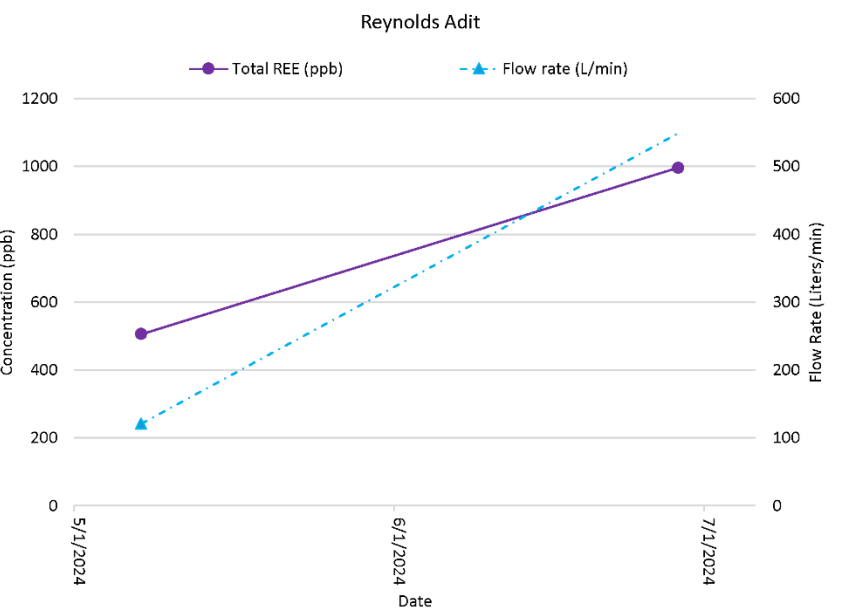
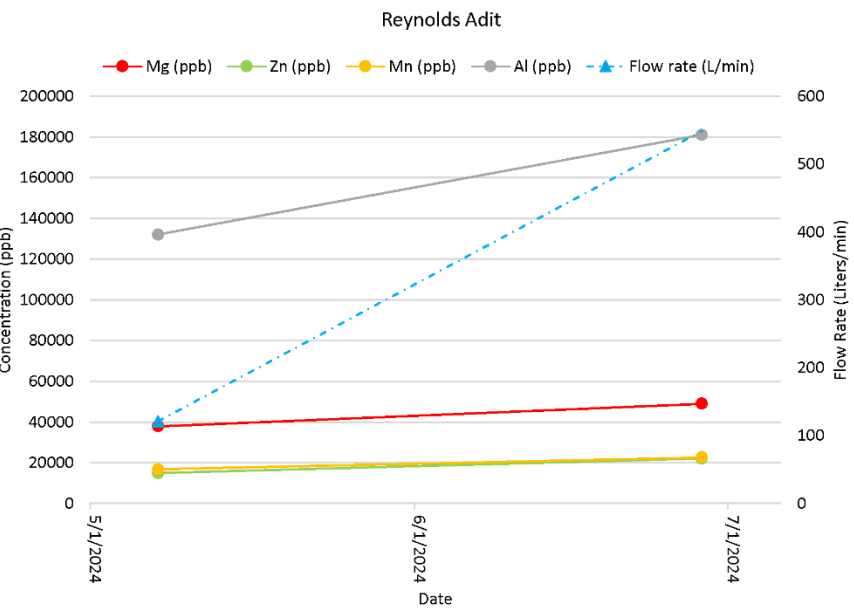
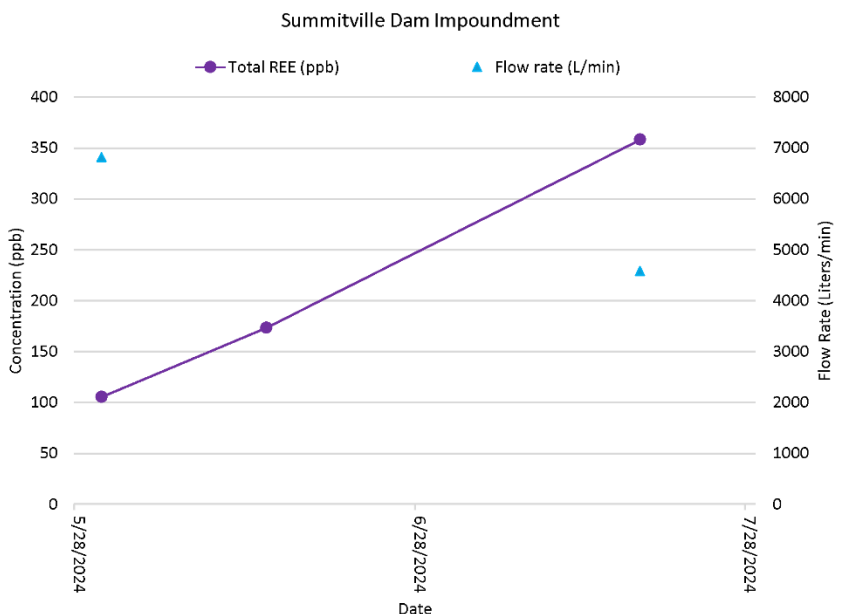
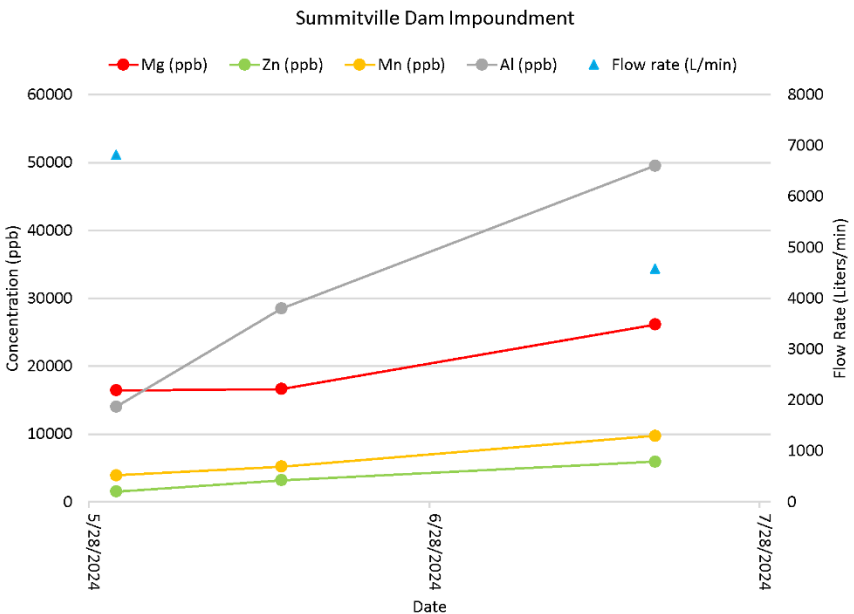
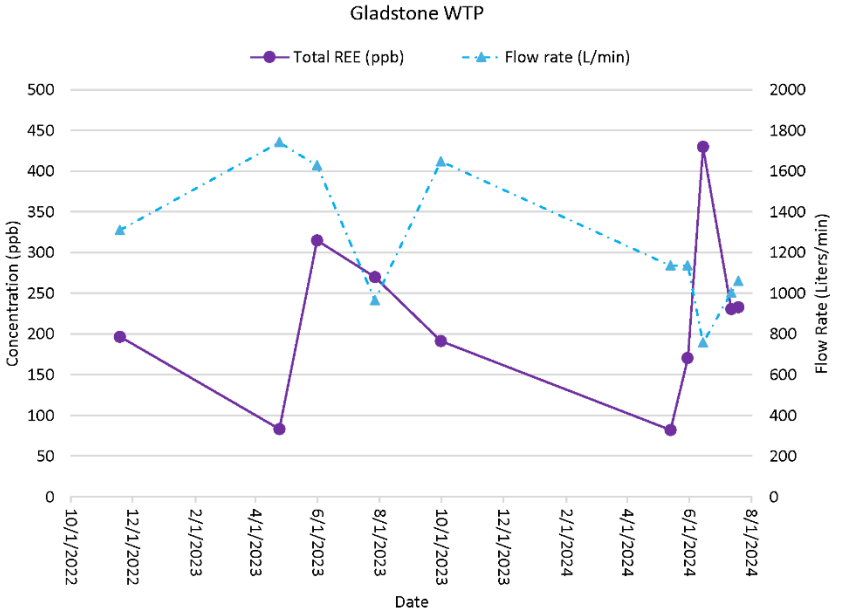
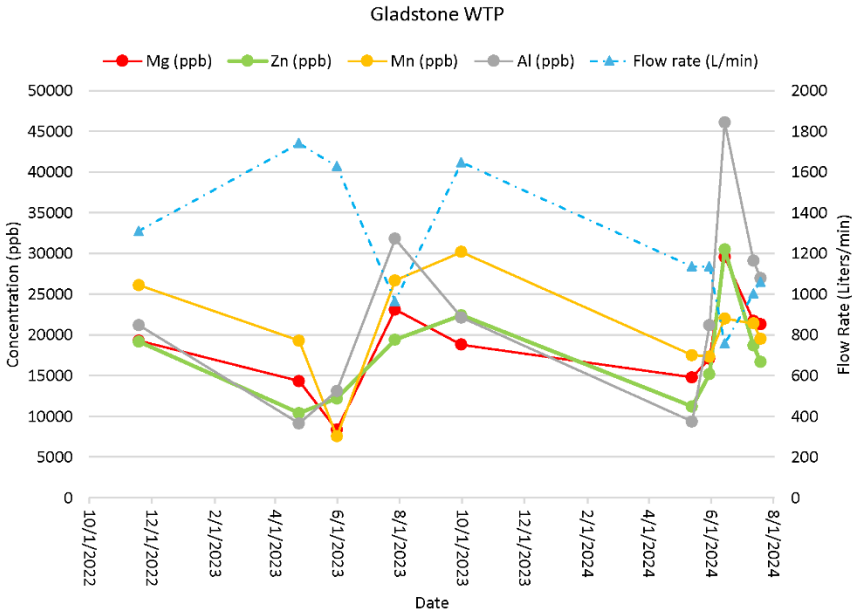
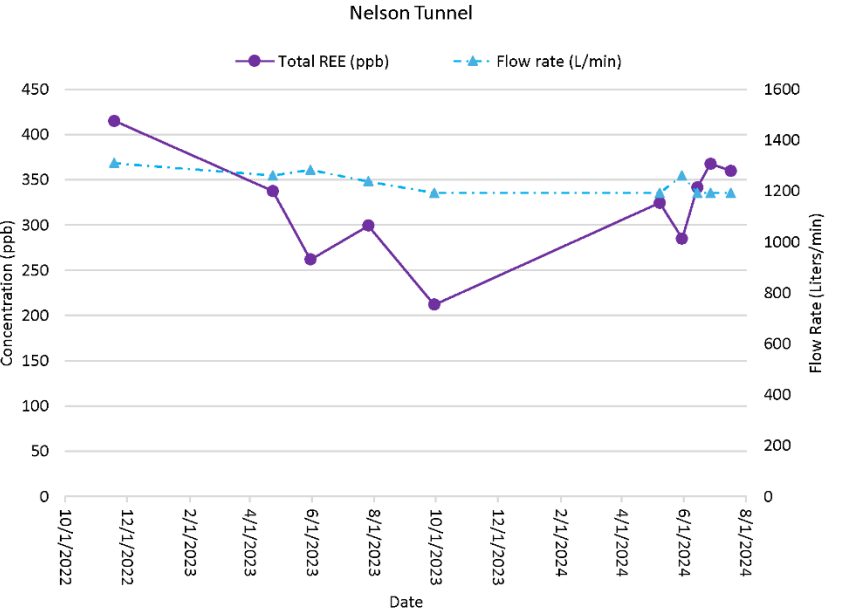
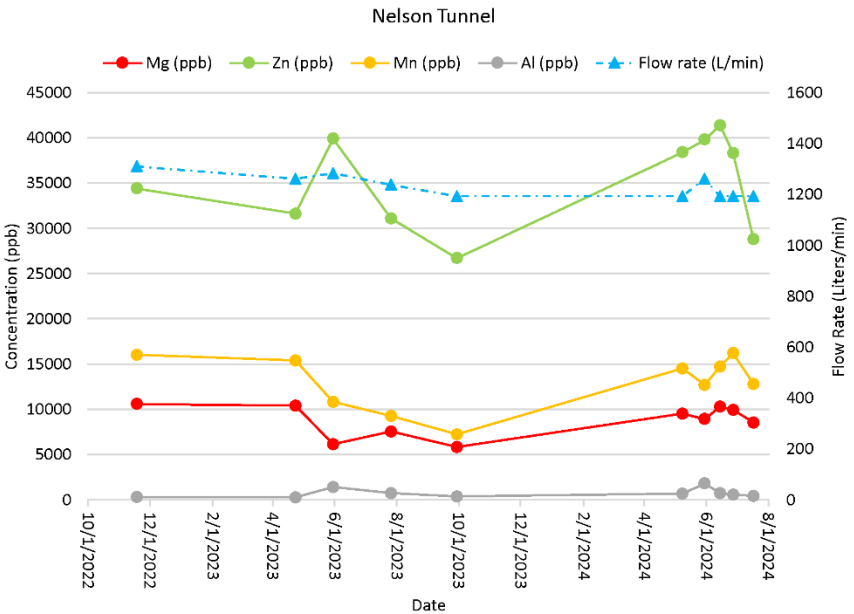


Figure 6 – Concentration of select critical minerals over time vs. flow at Nelson Tunnel, Gladstone WTP, Summitville Dam Impoundment, and Reynolds Adit.

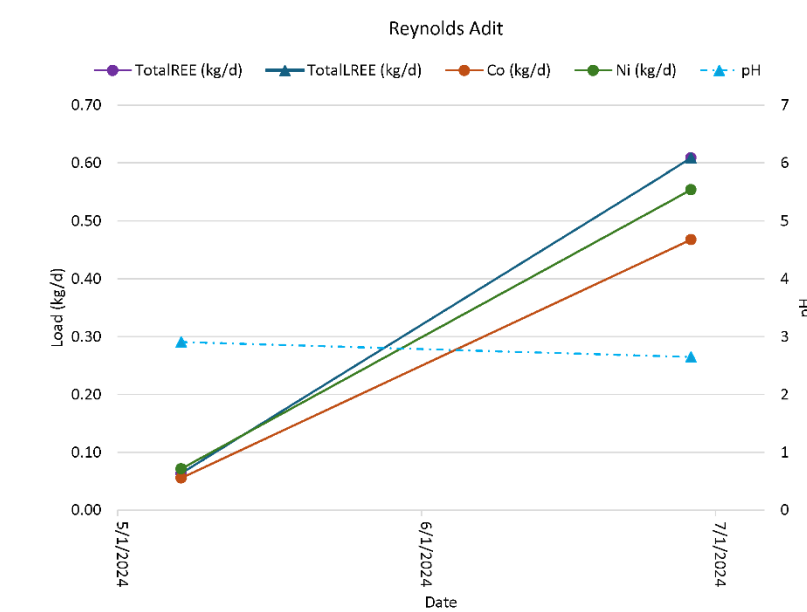
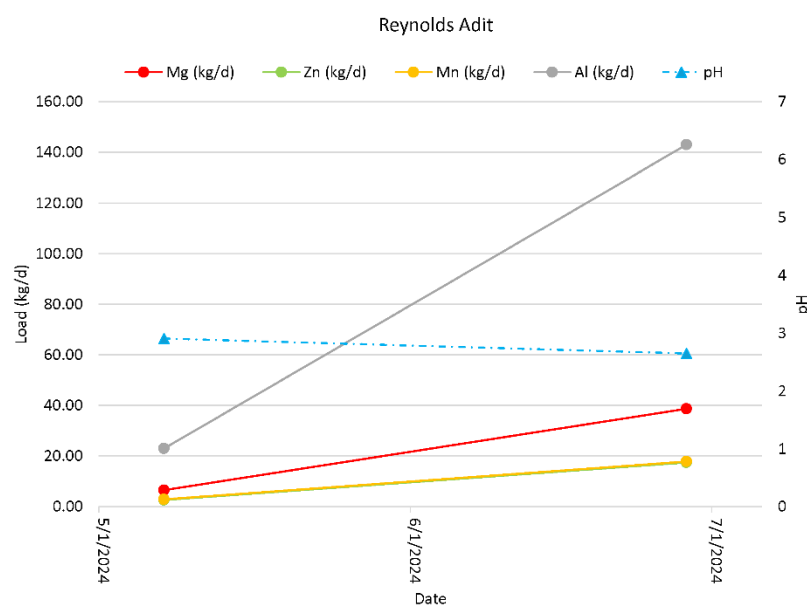
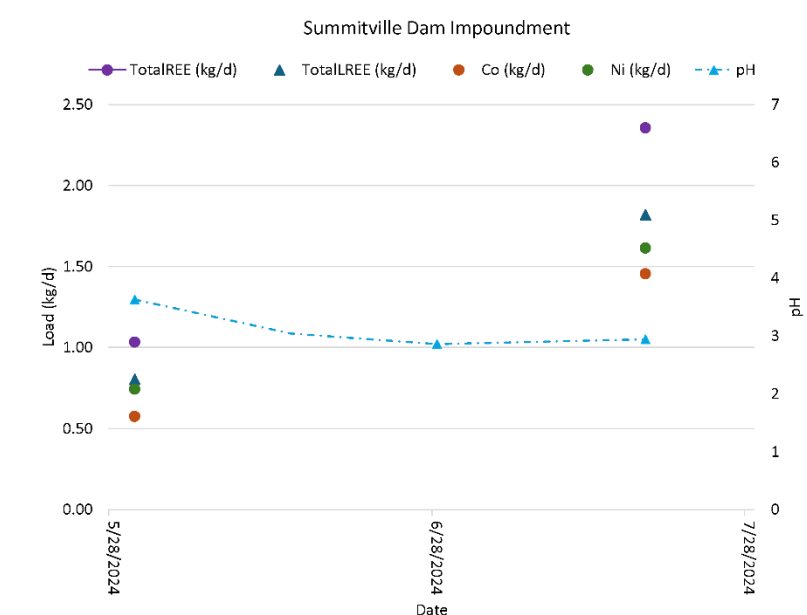
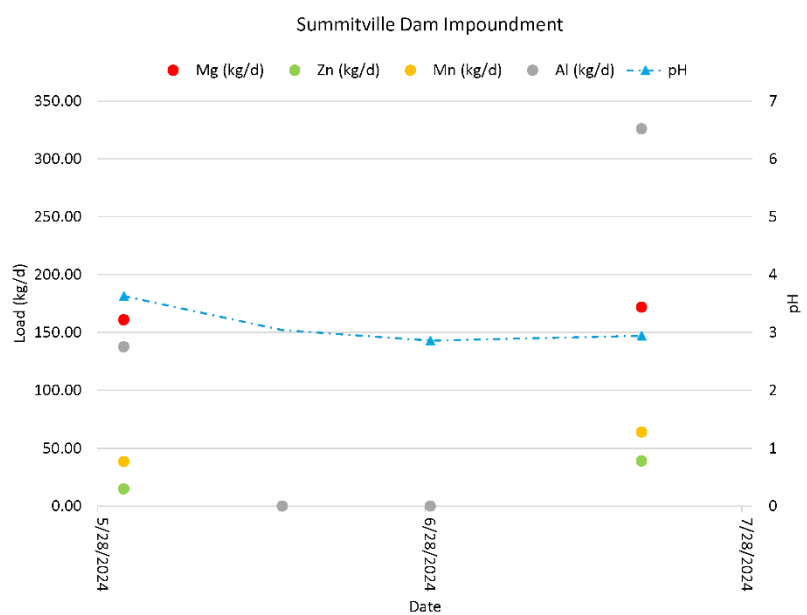
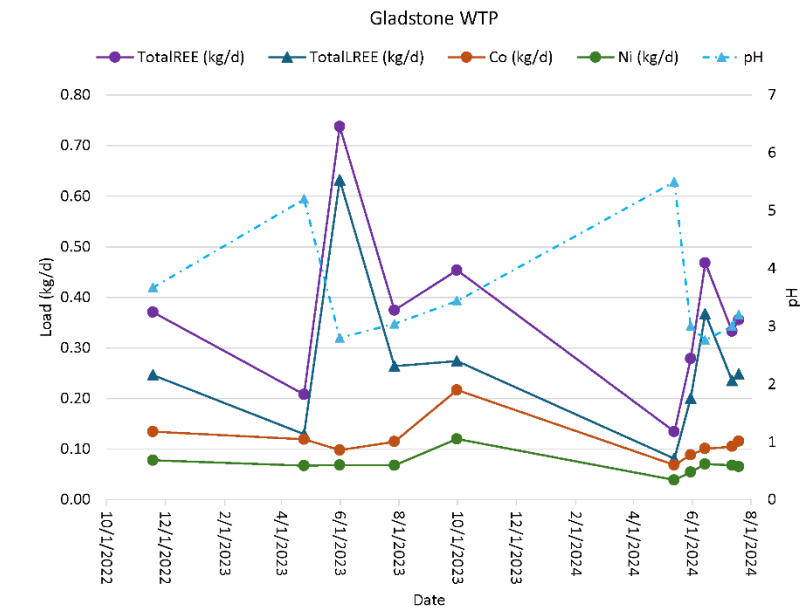
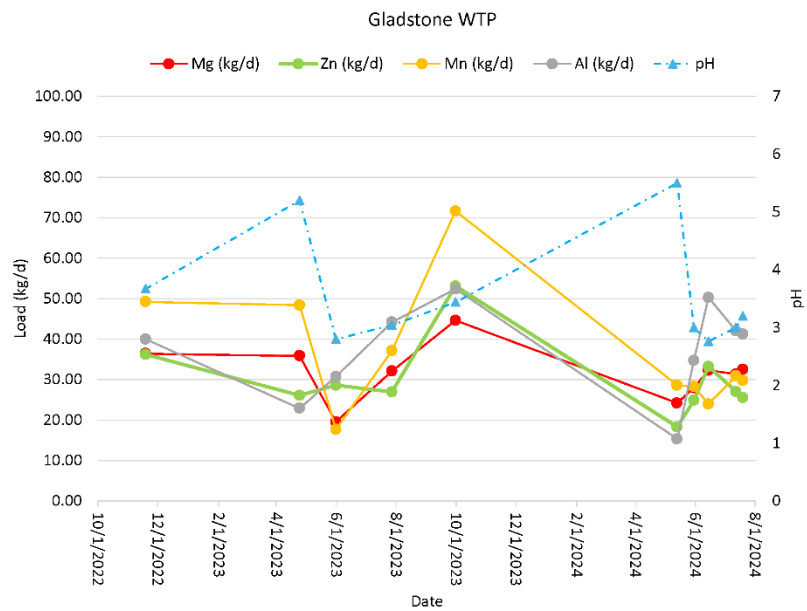
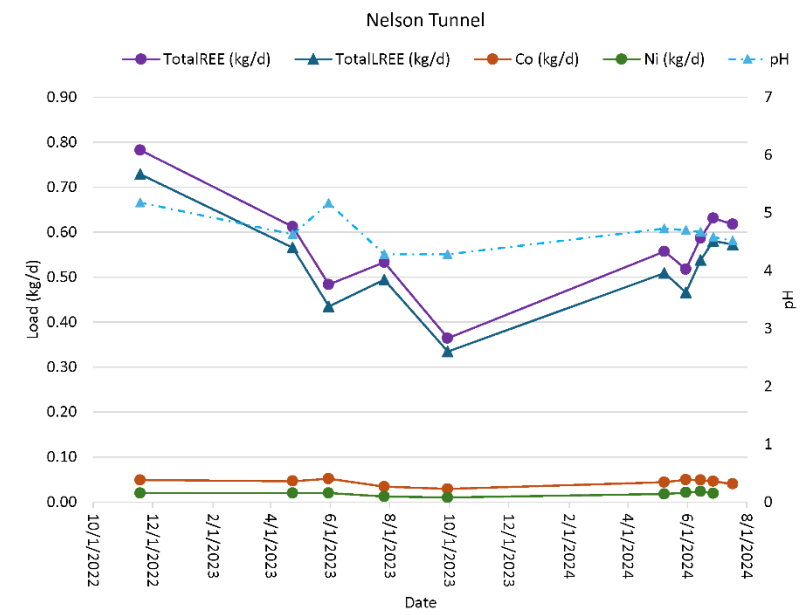
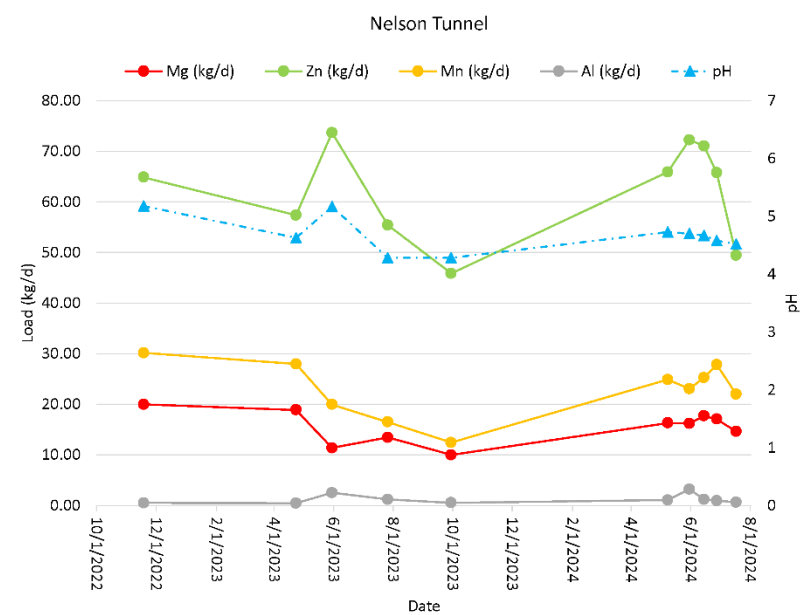


Figure 7 –Loads of select critical minerals over time vs. flow at Nelson Tunnel, Gladstone WTP, Summitville Dam Impoundment, and Reynolds Adit.

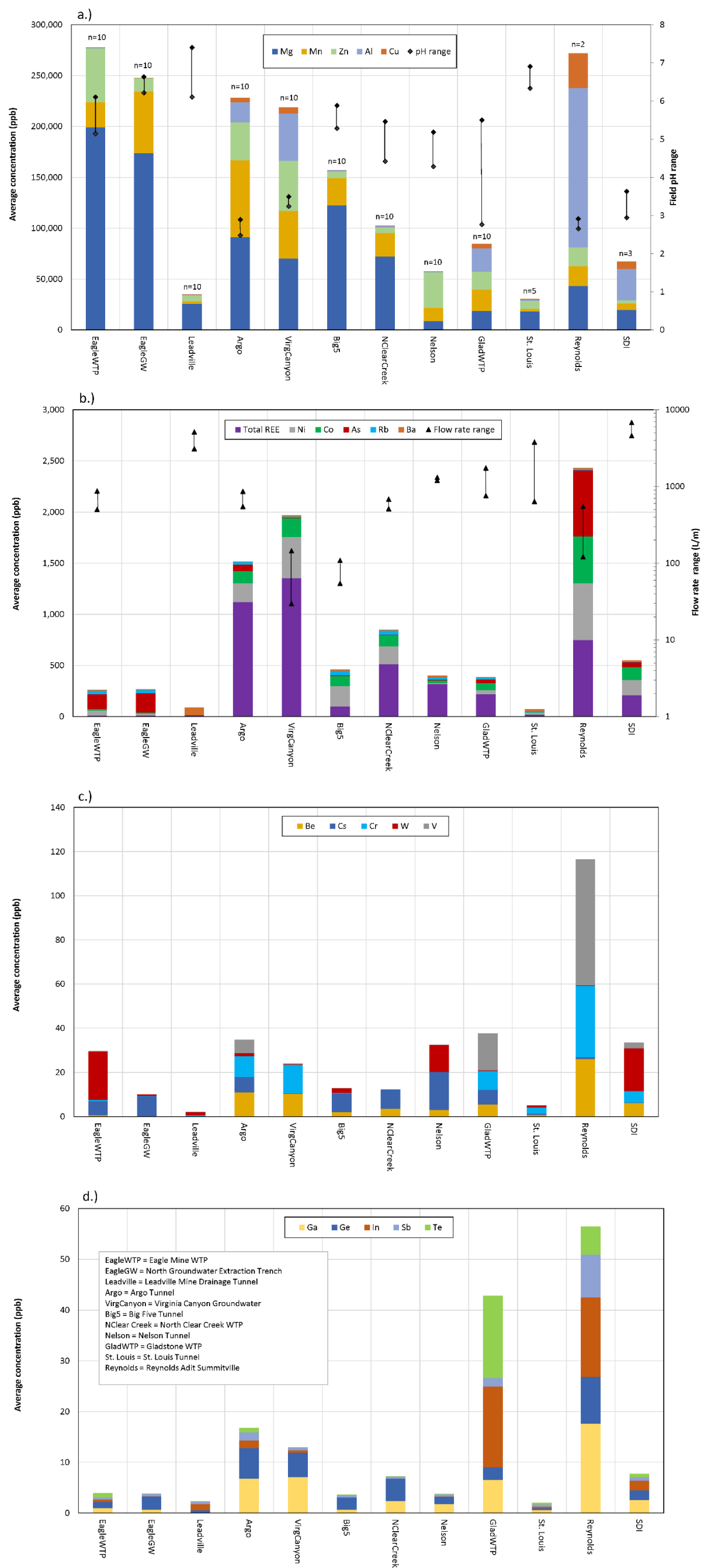


Figure 8 – Distribution of average critical mineral total (unfiltered) concentrations, field pH ranges, and discharge ranges at each site.

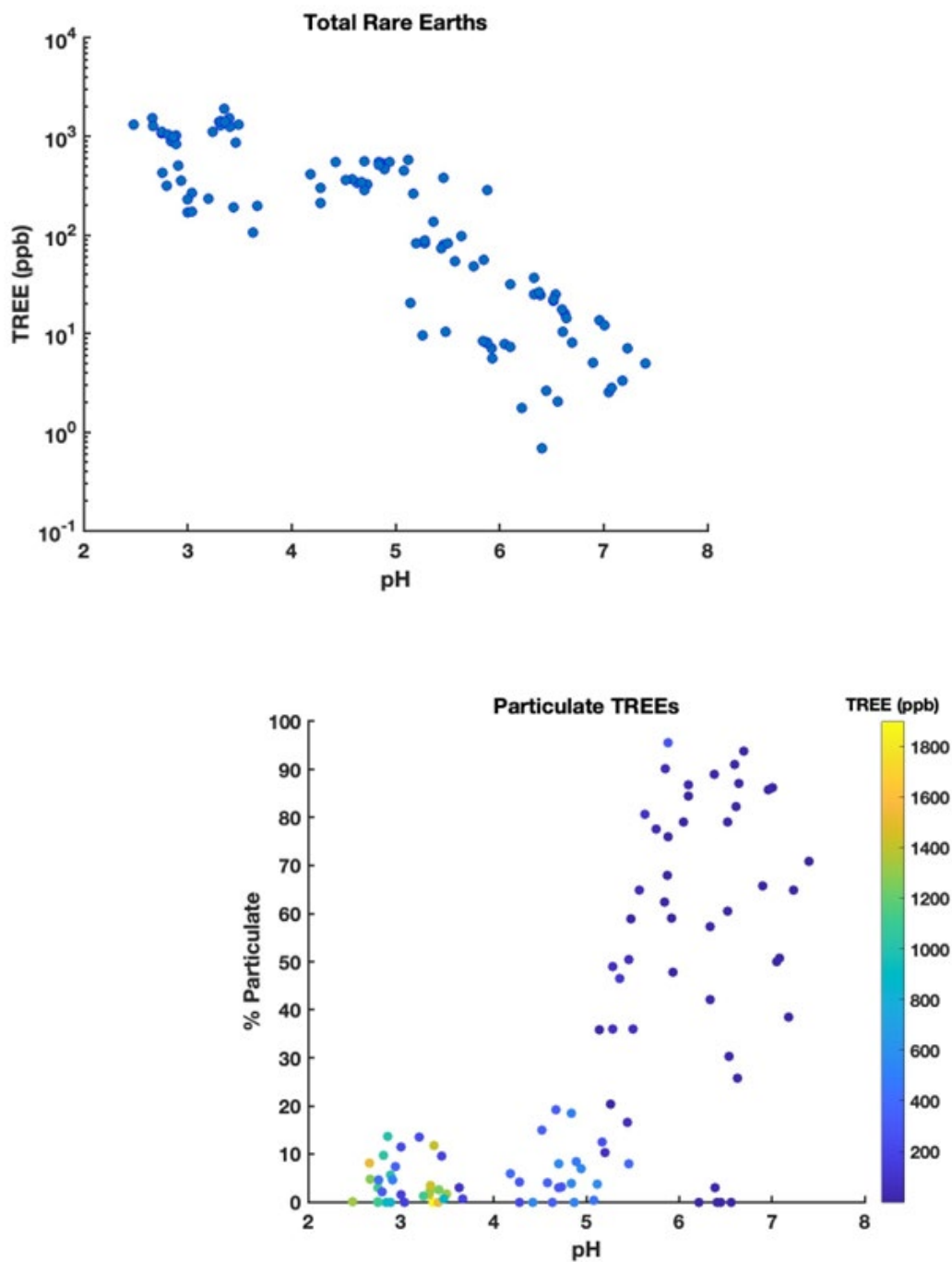


Figure 9 – Graphs showing the relationship between pH, TotalREE (TREE) concentrations, and particulates. Top: The concentration of TotalREEs plotted in log space against pH. This graph demonstrates a linear relationship where greater concentration of TotalREEs tend to be found in samples at lower pH. Bottom: Percent particulates (>0.45 μm) TotalREEs plotted against pH, and TotalREE concentration (ppb) in color.

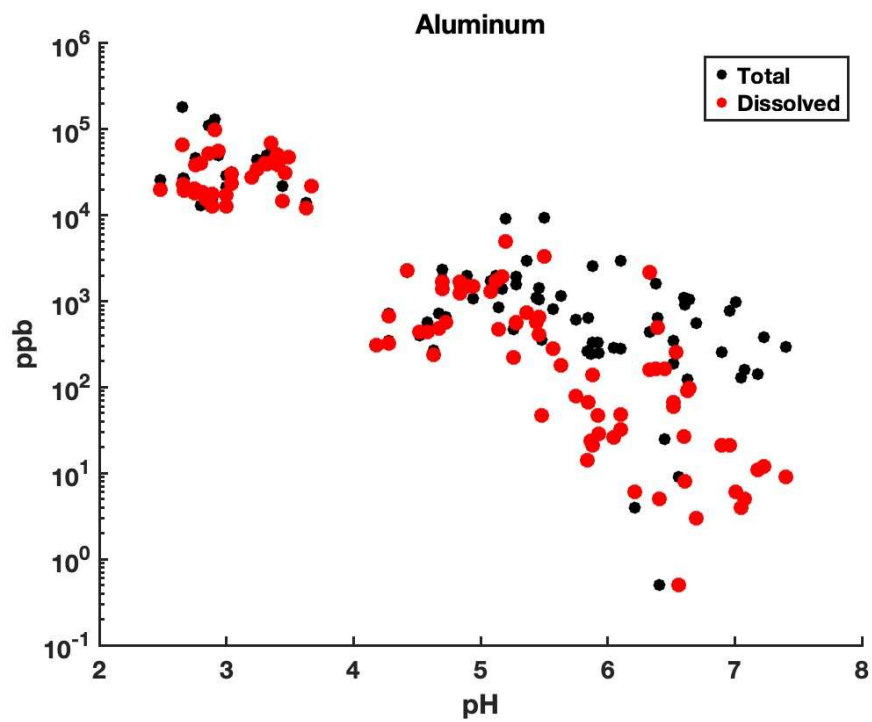


Figure 10 – Graph showing total and dissolved aluminum concentration in water samples plotted against pH (log scale).

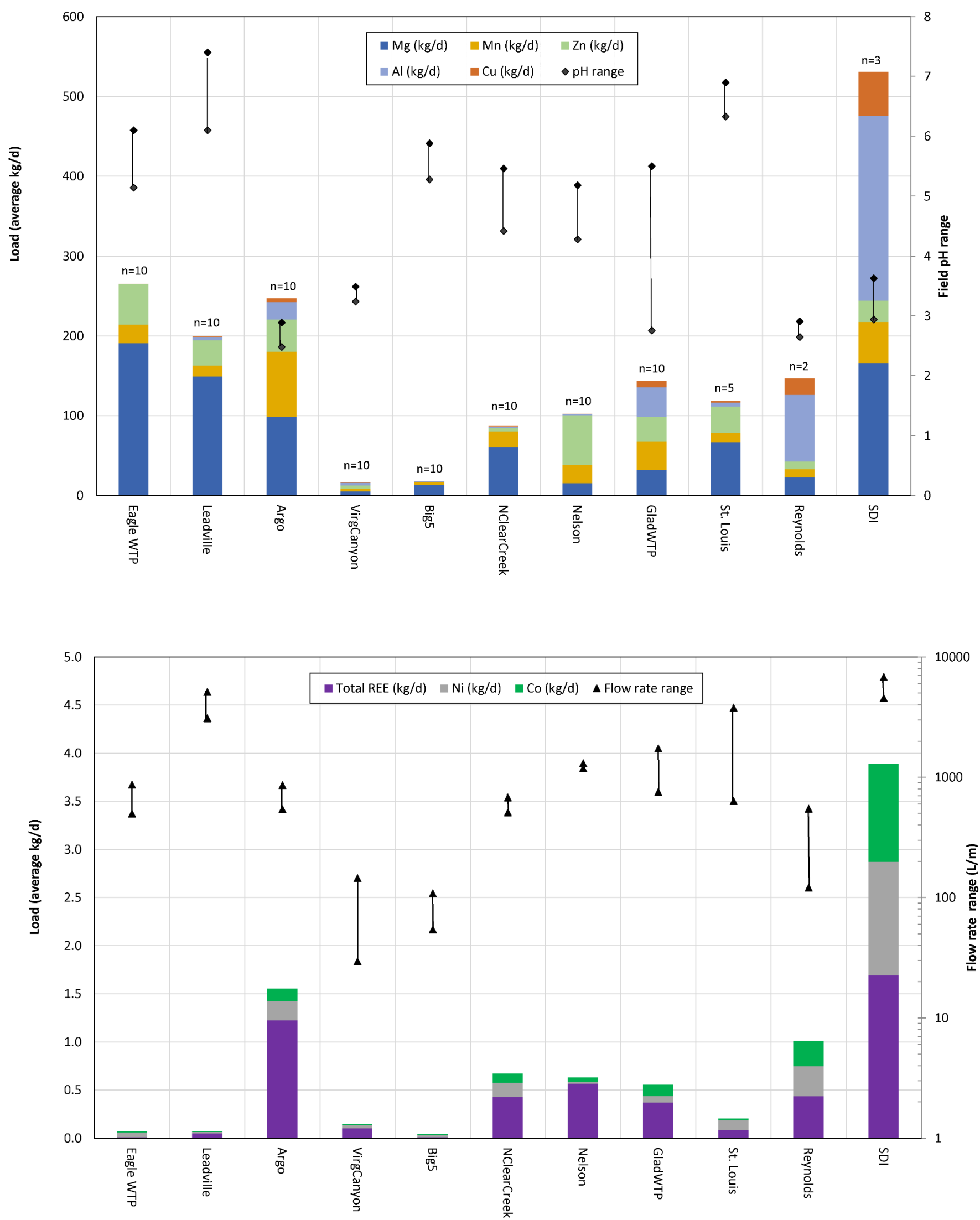


Figure 11 – Estimated daily average loads of select critical minerals, field pH ranges, and discharge ranges at each site. Average daily loads using the average critical mineral concentrations at each site.

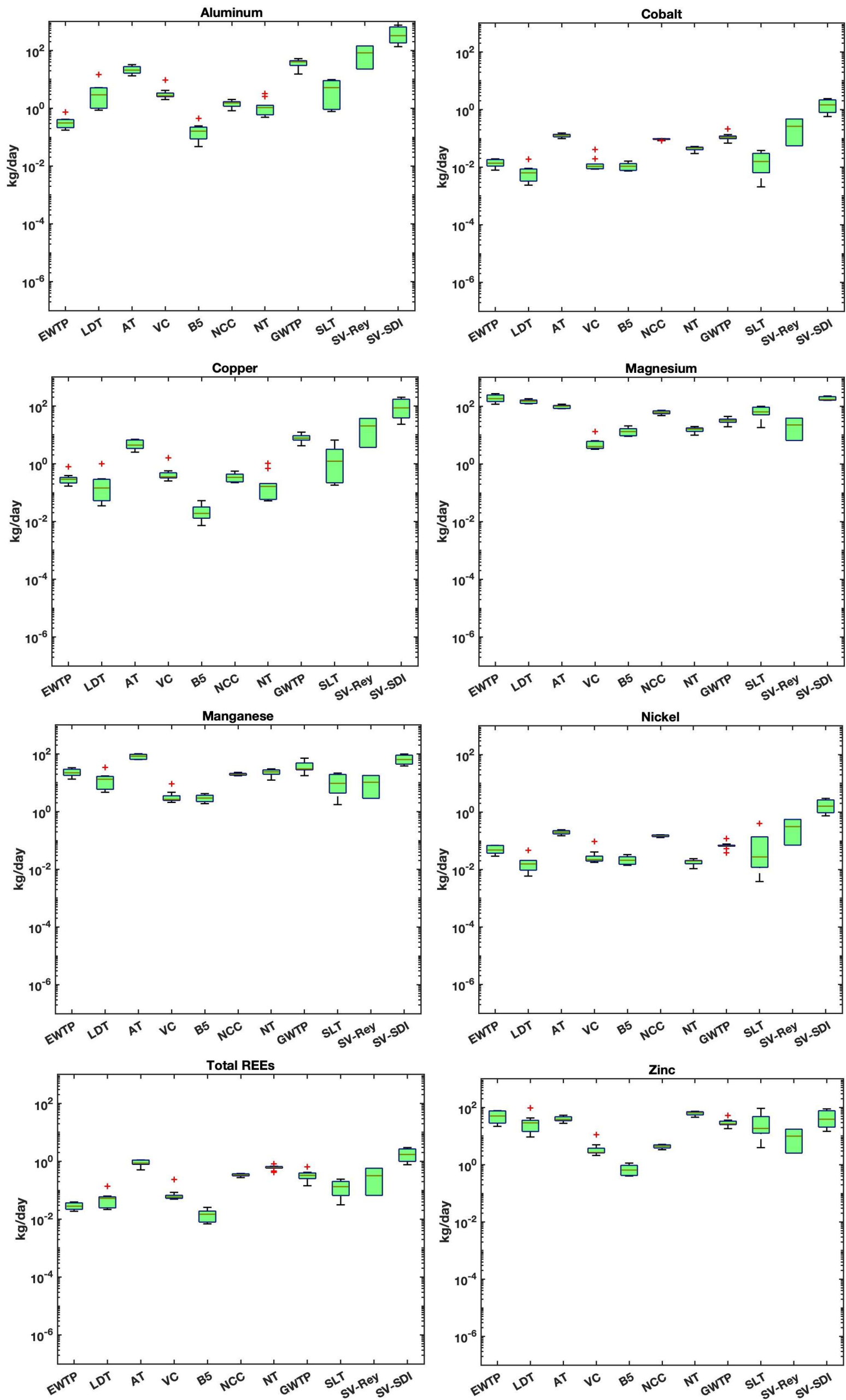


Figure 12 – Box and whisker plots showing a comparison of estimated loads across sites for critical minerals with significant loads/concentrations. Eagle Mine WTP (EWTP), Leadville Mine Drainage Tunnel (LDT), Argo Tunnel (AT), Virginia Canyon (VC), Big Five Tunnel (B5), NCC WTP (NCC), Nelson Tunnel (NT), Gladstone WTP (GWTP), St. Louis Tunnel (SLT), Summitville Reynolds Adit (SV-Rey), and the Summitville Dam Impoundment (SV-SDI). Box includes the 25 to 75 percentile range, line within the box indicates the median value, lines extending from the box represent the minimum and maximum values, and outliers are shown as crosses.

TABLES

Table 1 - Critical minerals, apparent consumption, and net import reliance.

Element/Material	Abbreviation	USGS Critical Mineral (Fortier and others, 2018)	DOE (DOE, 2023) Medium-term criticality (2025-2035)			Estimated apparent consumption (metric tons)*	Estimated net import reliance as a percentage of apparent consumption*
			Critical	Near critical	Not critical		
Aluminum (bauxite/alumina)	Al	*		*		1,800,000	>75
Antimony	Sb	*				22,000	82
Arsenic	Ar	*				6,400	100
Barite	BaSO ₄	*				na	>75
Beryllium	Be	*				150	0
Bismuth	Bi	*				1,400	94
Cesium	Cs	*				na	100
Chromium	Cr	*				380,000	74
Cobalt	Co	*	*			6,400	67
Copper	Cu			*		1,800,000	46
Electrical Steel				*		na	na
Fluorine	F			*		na	na
Fluorspar	CaF ₂	*				370,000	100
Gallium	Ga	*	*			19	100
Germanium	Ge	*				na	>50
Graphite	C	*	*			76,000	100
Hafnium	Hf	*				na	na
Indium	In	*				300	100
Iridium	Ir		*			na	na
Lithium	Li	*	*			na	>25
Magnesium	Mg	*	*			55,000	>50
Manganese	Mn	*			*	690,000	100
Nickel	Ni	*	*			190,000	57
Niobium	Nb	*				8,400	100
Palladium	Pd	*				82	37
Phosphorus	P				*	na	na
Platinum	Pt	*	*			70	83
Rhodium	Rh	*				na	na
Rubidium	Rb	*				na	100
Ruthenium	Ru	*				na	na
Scandium	Sc	*				na	100
Silicon	Si			*		na	<50
Silicon Carbide	SiC		*			na	na
Tantalum	Ta	*				370	100
Tellurium	Te	*			*	na	>25
Tin	Sn	*				39,000	74
Titanium	Ti	*			*	42,000	>95
Tungsten	W	*				na	>50
Uranium	U			*		na	na
Vanadium	V	*				14,000	58
Zinc	Zn	*				970,000	77
Zirconium	Zr	*				<100,000	<25
Rare Earth Elements						8,800	>95
LREEs							
Lanthanum	La	*				na	na
Cerium	Ce	*				na	na
Praseodymium	Pr	*	*			na	na
Neodymium	Nd	*	*			na	na
Samarium	Sm	*				na	na
Europium	Eu	*				na	na
Gadolinium	Gd	*				na	na
HREEs							
Terbium	Tb	*	*			na	na
Dysprosium	Dy	*	*			na	na
Holmium	Ho	*				na	na
Erbium	Er	*				na	na
Thulium	Tm	*				na	na
Ytterbium	Yb	*				na	na
Lutetium	Lu	*				na	na
Yttrium	Y	*				200	100

Notes

* from USGS, 2024 (see Table 5, page 23).

na - not applicable or not available

Values for cesium, hafnium, iridium, rhodium, rubidium, and ruthenium are not shown because available information is insufficient to make estimates of U.S. or world production.

Apparent consumption is a USGS calculated value (general formula is the production + imports - exports +/- stock change). In some cases, when data was unavailable or withheld, these were estimated by the USGS. For more on the how these values are calculated see the following link:

<https://www.usgs.gov/centers/national-minerals-information-center/historical-statistics-mineral-and-material-commodities>

Additionally, apparent consumption for several commodities measures more than one form of the commodity (metal, ferroalloys, ore, etc.).

Table 2 - Site location summary.

Location	Latitude	Longitude	Main effluent type ¹	Flow measurement location ²	Notes
Argo Tunnel	39.74354	-105.50758	mine water	WTP	Argo Tunnel effluent at Argo WTP.
Big Five Tunnel	39.74354	-105.50758	mine water	WTP	Samples collected from the outfall which flows into the WTP.
Virginia Canyon	39.74354	-105.50758	groundwater	WTP	Samples collected from an inlet pipe into the WTP from the groundwater collection system.
North Clear Creek WTP	39.79667	-105.4761	mine water and groundwater	WTP	Collected from the inlet vault (WTP plant holding tank) with a pole sampler. Includes effluent from mines and from a groundwater collection system.
Leadville Mine Drainage Tunnel	39.27402	-106.2884	mine water	WTP	Collected from an influent pipe within the WTP.
Eagle Mine WTP	39.56091	-106.40356	mine water	WTP	Influent vault just south of the storage ponds at the WTP located on the consolidated tailings pile. Collected with a pole sampler.
Eagle Mine North Groundwater Trench	39.56746	-106.40804	groundwater	na	Sampled trench vault in the north groundwater extraction trench. This water is pumped to the WTP intermittently. Collected with a pole sampler.
Nelson Tunnel	37.883889	-106.931944	mine water	flume	Effluent from the Nelson Tunnel, above the confluence with Willow Creek.
Summitville Mine	37.42877	-106.593567	mine water	Reynolds Adit, SDI	Discharge from Reynolds Adit, Summitville Dam Impoundment influent to WTP, or Summitville Dam Impoundment effluent (see text).
Gladstone WTP	37.89009	-107.650663	mine water	WTP	Influent to the WTP, after the first settling pond.
St. Louis Tunnel	37.707778	-108.029444	mine water	WTP	Effluent from the tunnel before settling ponds. Flow is from the WTP.

Notes:

1 - General source of water collected during sampling.

2 - Flows were provided by the plant or site operators.

na - not applicable.

SDI - Summitville Dam Impoundment

WTP - water treatment plant

Table 3 - Summary of the mining history, minerals, mineral systems, and other information associated with each site.

Mining District	Historic production	Dominant ore minerals	USGS critical mineral focus area ¹	Mineral system/deposit types ¹	Potential critical minerals in deposit ¹	Other potential commodities in deposit ¹	General sample location	Description	Associated mines	Water sample type	Historic flow rates	Sampling events	Notes
Central City/Idaho Springs	gold, silver, copper, lead, zinc	pyrite, sphalerite, galena, chalcopyrite, tennantite, enargite	Central City-Idaho Springs polymetallic veins	Alkalic porphyry/Polymetallic sulfide S-R-V-IS	bismuth, gallium, germanium, indium, tellurium, zinc	copper, gold, lead, silver, uranium	Argo Tunnel	Perpetual inactive mine discharge	several	mine effluent	Flows ~200 and 450 gpm on average (EPA, 2007).	10	~4.2 mile tunnel that extends from Idaho Springs to just west of Central City.
							Big Five Tunnel	Perpetual inactive mine discharge	several	mine effluent	Flows up to ~180 gpm (EPA, 2007).	10	~1.7 mile tunnel that extends from Idaho Springs to the north.
							Virginia Canyon	Perpetual discharge from groundwater collection system	Idaho Springs area waste piles and related sources	groundwater collection system discharge	Flows between ~10 and 90 gpm (EPA, 2007).	10	Ground water impacted from waste piles and other mine related features in Virginia Canyon in the Idaho Springs Mining District.
							North Clear Creek WTP	Perpetual discharge from mine and groundwater collection system	National Tunnel, Gregory Incline, Gregory Gulch groundwater	mine effluent/groundwater collection discharge	Between 2020 and 2021, ~115 gpm was treated (EPA 2024).	10	Groundwater and mine effluent from an area between Black Hawk and Central City.
Leadville	lead, zinc, copper, silver, gold, iron, manganese, bismuth	pyrite, sphalerite, galena, chalcopyrite, tetrahedrite	Central Colorado Mineral Belt carbonate-replacement deposits	Porphyry Cu-Mo-Au/Polymetallic sulfide S-R-V-IS	bismuth, manganese, zinc, antimony, arsenic, gallium, germanium, indium, manganese, tellurium, tungsten	copper, gold, iron, lead, silver	Leadville Mine Drainage Tunnel WTP	Perpetual inactive mine discharge	several	mine effluent	Before 2005, discharge was >~1,000 gpm and up to ~1,500 gpm. In March 2008, the flow was ~1,120 gpm (Wellman and others, 2011).	10	Location includes Climax-type and central Colorado sediment hosted copper critical mineral focus area. ~2.1 mile long tunnel that extends to the south and drains several mines in the district.
Battle Mountain	zinc, lead, silver, copper, gold, Mn-rich iron	sphalerite, pyrite, galena, chalcopyrite, tetrahedrite, siderite	Central Colorado Mineral Belt carbonate-replacement deposits	Porphyry Cu-Mo-Au/Polymetallic sulfide S-R-V-IS	zinc, bismuth, manganese, zinc, antimony, arsenic, gallium, germanium, indium, manganese, tellurium, tungsten	copper, gold, iron, lead, silver	Eagle Mine WTP	Perpetual inactive mine discharge	Eagle Mine	mine effluent	Average annual flow from the mine is ~210 gpm (EPA, 2018).	10	Location also includes the central Colorado sediment hosted copper USGS critical mineral focus area. Mine effluent from the Eagle Mine is captured through a ~2-mile long pipeline from portals.
							Eagle Mine North Groundwater Trench	Intermittant tailings groundwater collection trench	tailings from the Eagle Mine	tailings groundwater discharge	Groundwater collection that is intermittently pumped to the treatment plant.	10	Collects impacted groundwater from the consolidated tailings pile just south of Minturn.
Creede	silver, gold, copper, lead, zinc	galena, sphalerite, pyrite, chalcopyrite, silver, gold	Central Colorado epithermal Au-Ag	Alkalic porphyry/low sulfidation, high sulfidation	zinc, fluorspar, arsenic, antimony, bismuth, tellurium, tungsten, vanadium	copper, gold, lead, silver	Nelson Tunnel	Perpetual inactive mine discharge	several	mine effluent	Average flow from the tunnel is 365 gpm based on 17 years of data (EPA, 2020).	10	Drains several historic mines that likely include the Amethyst, Commodore, Happy Thought, Last Chance, and Park Regent mines.
Summitville	gold, silver, copper, lead	Pyrite, enargite, galena, sphalerite, chalcopyrite	Summitville	Climax-type/lithocap alunite, polymetallic sulfide S-R-V-IS; Central Colorado epithermal Au-Ag/low sulfidation, high sulfidation	aluminum, antimony, arsenic, antimony, bismuth, gallium, germanium, fluorspar, indium, manganese, potash, REE, tellurium, tin, tungsten, vanadium, zinc	gold, silver	Reynolds Adit, Summitville Dam Impoundment	Perpetual inactive mine discharge	Summitville Mine, Summitville Dam Impoundment	mine effluent	Treatment rates ranged between 1,317 and 2000 gpm between 2015 and 2019 (EPA, 2020).	5	The Reynolds Adit drains several levels of the historic mine.The dam impoundment collects water from adits and impacted surface water and groundwater at the site.Dam influent sampled 3 times, Reynolds adit sampled 2, influent from dam sampled once.
Eureka	gold, silver, lead, copper, zinc	pyrite, galena, sphalerite, chalcopyrite, tetrahedrite	Central Colorado epithermal Au-Ag	Alkalic porphyry/Low sulfidation, high sulfidation, polymetallic sulfide S-R-V-IS (tungsten veins would include S-R-V tungsten)	zinc, fluorspar, arsenic, antimony, bismuth, tellurium, tungsten, vanadium.	copper, gold, lead, silver	Gladstone Interim WTP	Perpetual inactive mine discharge	several, Gold King/Sunnyside Mines	mine effluent	From 2015 to 2016, flows into the treatment plant ranged from ~400 to 960 gpm (CDM Smith, 2016).	10	Location may include the San Juan tungsten veins critical mineral focus area. Mine effluent from several interconnected mines.
Rico	silver, gold, zinc, lead, copper	Pyrite, sphalerite, galena, chalcopyrite, molybdenite (unmined at depth)	Silver Cr.-Calico Peak	Climax-type (at depth)/lithocap alunite; polymetallic sulfide S-R-V-IS; porphyry molybdenum	aluminum (alunite), antimony, arsenic, bismuth, gallium, germanium, indium, manganese, rhenium, scandium, tin, tungsten, vanadium, zinc	copper, gold, lead, molybdenum, silver	St. Louis Tunnel	Perpetual inactive mine discharge	several	mine effluent	Flow rates generally range from 440 to 1,400 gpm (Dean and others, 2022).	5	~1 mile long tunnel that extends to the east from the Dolores River and likely drains water from several mines.

NOTES:
¹ - Based on Dicken and others (2022) and Hofstra and Kreiner (2020) .
Ore minerals also include native gold and silver in many of these deposits.
IS - intermediate sulfidation
na - not applicable

R - replacement
REE - rare earth elements
S - skarn
USGS - U.S. Geological Survey
V - vein

Table 4 - Summary of the Eagle Mine WTP results.

SampleID	EM-WTP-001	EM-WTP-01-23-001	EM-WTP-02-23-001	EMWTP-03-23-001	EM-WTP-04-23-001	EM-WTP-01-24-001	EM-WTP-02-24-001	EM-WTP-03-24-001	EM-WTP-04-24-001	EM-WTP-05-24-001
Date Sampled	10/28/2022	4/20/2023	5/25/2023	8/2/2023	9/29/2023	5/7/2024	5/30/2024	6/13/2024	6/28/2024	7/26/2024
pH	6.05	5.93	5.14	5.48	5.87	5.26	5.92	5.88	6.1	5.84
Temperature (°C)	12.4	15.1	17.4	18	na	14	17.6	19.1	6.9	19.7
DO (mg/L)	4.04	1.79	2.85	2.61	1.53	1.81	2.13	1.48	1.74	2.08
Conductivity (uS/cm)	2,540	2,830	2,660	2,928	3,040	2,500	2,940	2,890	2,005	2,750
Flow (gpm)	180	158	160	165	132	145	225	230	195	146
Flow (L/min)	681	598	606	625	500	549	852	871	738	553
Alkalinity (mg/L CaCO ₃)	102 E	102 E	< 10 E	23.8 E	36.6 E	< 10	44.9	60.9	na	41
Al (ppb)	290	249	848	356	244	470	331	334	284	262
As (ppb)	275	137	70.1	129	152	67.5	134	185	176	91.5
Ba (ppb)	10.5	10.9	11.3	11.5	11.1	11.5	10.5	11	10.8	8.68
Be (ppb)	0.568	0.307	1.04	0.718	0.638	0.721	0.573	0.603	0.61	0.534
Bi (ppb)	0.05	0.02	0.21	0.03	0.02	0.02	0.03	0.04	0.03	0.03
Co (ppb)	10.7	9.14	20.2	17	15.5	13.9	15.9	15.4	17.2	15.4
Cr (ppb)	1.06	0.4	3.53	0.33	0.22	0.27	0.17	0.17	0.2	0.22
Cs (ppb)	6.0	5.3	6.0	5.8	6.4	6.7	6.6	6.9	6.9	7.1
Cu (ppb)	272	252	920	263	234	423	257	311	311	226
Ga (ppb)	0.8	1.0	1.9	0.7	0.3	1.6	1.1	1.0	0.8	0.9
Ge (ppb)	0.9	0.8	1.6	1.4	1.4	1.4	1.2	1.2	1.3	1.1
Hf (ppb)	< 0.1	0.2	< 0.1	< 0.1	0.1	0.2	< 0.1	< 0.1	< 0.1	< 0.1
In (ppb)	< 0.1	0.3	1	0.4	0.3	0.5	0.4	0.5	0.32	0.4
Li (ppb)	19.4	23.4	24.8	26	19.6	20.1	24.4	24.8	28	18.8
Mg (ppb)	201,000	179,000	214,000	204,000	164,000	185,000	210,000	218,000	231,000	185,000
Mn (ppb)	18,900	15,600	29,900	32,500	23,700	23,000	25,800	26,600	27,100	23,300
Nb (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	< 0.1
Ni (ppb)	38.8	34	79	58.8	51.8	54.4	56.1	55.6	61.6	46.8
Rb (ppb)	36.4	27.6	30.9	34.7	46.8	32.1	33	35.3	35.4	35.8
S (ppb)	627,000	575,000	630,000	653,000	528,000	537,000	586,000	564,000	776,000	577,000
Sb (ppb)	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Sn (ppb)	0.06	0.24	8.5	< 0.06	0.08	< 0.06	< 0.06	0.07	< 0.06	< 0.06
Ta (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Te (ppb)	0.9	0.5	1.7	0.9	1.1	0.7	0.5	0.7	0.6	1.1
Ti (ppb)	0.25	0.48	0.18	0.44	0.4	0.11	0.24	0.27	0.19	0.1
V (ppb)	0.16	0.14	0.37	0.16	0.1	0.09	0.16	0.18	0.14	0.1
W (ppb)	0.03	< 0.02	< 0.02	< 0.02	200	3.26	0.11	11.5	0.97	2.86
Zn (ppb)	22,800	25,600	89,400	53,100	39,900	96,200	62,400	56,200	50,300	36,900
Zr (ppb)	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Rare Earth Elements										
Sc (ppb)	0.2	0.7	2.4	1.2	0.4	0.5	0.4	0.4	0.4	0.5
Sc_d (ppb)	0.052	1	0.3	1.1	0.2	0.3	0.4	0.3	0.3	0.4
Y (ppb)	2.63	1.39	5.34	2.91	2.81	3.48	2.4	2.62	2.44	2.38
Y_d (ppb)	0.3	0.47	4.47	1.15	0.91	2.93	0.87	0.36	0.46	0.6
La (ppb)	0.5	0.4	1.5	0.6	0.5	0.7	0.4	0.5	0.56	0.6
La_d (ppb)	< 0.1	0.1	1.3	0.2	0.1	0.7	0.2	< 0.1	0.06	0.2
Ce (ppb)	1.42	1.04	5.13	2.32	1.3	1.81	1.23	1.43	1.35	1.56
Ce_d (ppb)	0.07	0.22	2.61	0.53	0.21	1.22	0.25	0.08	0.07	0.31
Pr (ppb)	0.2	0.1	0.4	0.2	0.2	0.2	0.2	0.2	0.17	0.2
Pr_d (ppb)	< 0.1	< 0.1	0.3	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.01	< 0.1
Nd (ppb)	0.9	0.6	2.0	1.0	0.8	0.9	0.8	0.9	0.8	1.0
Nd_d (ppb)	< 0.1	< 0.1	1.3	0.2	< 0.1	0.6	0.1	< 0.1	0.02	0.1
Sm (ppb)	0.3	0.2	0.6	0.3	0.3	0.3	0.2	0.3	0.25	0.3
Sm_d (ppb)	< 0.1	< 0.1	0.4	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.01	< 0.1
Eu (ppb)	0.1	< 0.1	0.3	0.2	0.2	0.1	0.1	0.2	0.1	0.2
Eu_d (ppb)	< 0.1	< 0.1	0.2	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.01	< 0.1
Gd (ppb)	0.48	0.29	1.03	0.55	0.48	0.51	0.41	0.5	0.43	0.56
Gd_d (ppb)	0.02	0.04	0.76	0.09	0.07	0.39	0.06	0.02	0.02	0.05
Tb (ppb)	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.06	< 0.1
Tb_d (ppb)	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	< 0.1
Dy (ppb)	0.4	0.2	0.8	0.4	0.4	0.4	0.3	0.4	0.32	0.4
Dy_d (ppb)	< 0.1	< 0.1	0.6	< 0.1	< 0.1	0.3	< 0.1	< 0.1	0.02	< 0.1
Ho (ppb)	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.06	< 0.1
Ho_d (ppb)	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	< 0.1
Er (ppb)	0.2	< 0.1	0.3	0.2	0.2	0.2	0.1	0.2	0.15	0.2
Er_d (ppb)	< 0.1	< 0.1	0.3	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.01	< 0.1
Tm (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.02	< 0.1
Tm_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	< 0.1
Yb (ppb)	0.1	< 0.1	0.2	0.1	0.1	0.1	< 0.1	0.1	0.08	0.1
Yb_d (ppb)	< 0.1	< 0.1	0.2	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.01	< 0.1
Lu (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Lu_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.6
Total REE (ppb)	7.63	5.27	20.4	10.18	7.89	9.4	6.79	7.95	7.24	8.2
Total LREE (ppb)	3.9	2.68	10.96	5.17	3.78	4.52	3.34	4.03	3.66	4.42
Total HREE (ppb)	3.53	1.89	7.04	3.81	3.71	4.38	3.05	3.52	3.18	3.28

Notes:

pH, temperature, dissolved oxygen (DO), and conductivity measured in the field.

Total REEs (includes REE + Sc), LREEs, and HREEs non-detects were included at half the reporting limit.

gpm - gallons per minute

HREE - heavy REEs (Tb,Dy, Ho, Er, Tm, Yb, Lu, Y)

L/min - liters per minute

E - estimated, informational purposes, holding time exceedence or other issue

LREE - light REEs (La, Ce, Pr, Nd, Sm, Eu, Gd)

mg/L - milligrams per liter

na - not available

ppm - parts per million

ppb - parts per billion

uS/cm - microsiemens per centimeter

Table 5 - Summary of the Eagle Mine North Groundwater Extraction Trench results.

SampleID	EM-GWN-001	EM-GWN-01-23-001	EM-GW-02-23-001	EMGWN03-23-001	EM-GWN-04-23-001	EM-GWN-01-24-001	EM-GWN-02-24-001	EM-GWN-03-24-001	EM-GWN-04-24-001	EM-GWN-05-24-001
Date Sampled	10/28/2022	4/20/2023	5/25/2023	8/2/2023	9/29/2023	5/7/2024	5/30/2024	6/13/2024	6/28/2024	7/26/2024
pH	6.63	6.39	6.54	6.52	6.56	6.33	6.52	6.45	6.41	6.21
Temperature (°C)	11.3	11.1	13.4	14.5	na	8.8	11.7	12.6	10.3	18.6
DO (mg/L)	2.52	2.95	2.21	2.91	5.21	2.48	2.42	4.75	5.58	5.36
Conductivity (uS/cm)	2,560	2,200	2,430	2,560	2,850	2,500	2,720	2,680	1,679	2,750
Flow (gpm)	na	na	na	na	na	na	na	na	na	na
Flow (L/min)	na	na	na	na	na	na	na	na	na	na
Alkalinity (mg/L CaCO ₃)	79	67 E	106 E	< 10 E	< 10 E	42.7	55.1	30.4	na	8
Al (ppb)	124	634	252	188	9	438	347	25	< 1	4
As (ppb)	364	238	302	328	41.6	295	289	44.6	1.9	5.6
Ba (ppb)	13.9	11.8	12	13	11.5	12.7	11.9	11	9.93	9.49
Be (ppb)	0.22	0.385	0.2	0.288	0.041	0.408	0.292	0.061	0.024	0.016
Bi (ppb)	0.01	0.06	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Co (ppb)	6.93	8.22	8.7	7.98	6.91	8.51	9.17	9.14	9.04	7.43
Cr (ppb)	0.35	0.22	0.2	0.11	< 0.08	0.15	< 0.08	< 0.08	< 0.08	< 0.08
Cs (ppb)	10.6	6.1	7.6	9.2	9.8	9.3	9.2	9.5	9.6	10.4
Cu (ppb)	2	3.7	2.5	2.2	1.5	2.8	3.8	5.2	1.8	1.4
Ga (ppb)	0.7	0.7	0.6	0.2	< 0.1	0.9	0.8	0.8	0.8	1
Ge (ppb)	4.7	1.1	3.8	4.2	1.9	2.9	3.4	1.7	1.3	1.2
Hf (ppb)	< 0.1	0.2	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
In (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	< 0.1
Li (ppb)	182	105	95.1	159	144	130	146	147	181	118
Mg (ppb)	188,000	151,000	157,000	187,000	151,000	183,000	184,000	192,000	181,000	164,000
Mn (ppb)	61,900	52,400	55,900	77,600	59,900	58,100	59,100	63,900	59,300	59,700
Nb (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	< 0.1
Ni (ppb)	15.8	17.9	17.2	18	15.2	18.5	24.6	19.1	17.3	14.9
Rb (ppb)	31.3	19.2	28	29.3	41.4	26.8	25.6	27.9	27.6	29.4
Sb (ppb)	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Sn (ppb)	0.11	0.08	< 0.06	0.06	0.11	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
Ta (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Te (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Ti (ppb)	0.56	0.17	0.12	0.2	0.3	0.25	0.24	0.32	0.08	< 0.05
V (ppb)	0.1	0.1	0.07	0.1	0.02	0.09	0.09	0.04	0.02	0.01
W (ppb)	0.07	0.07	0.03	0.06	2.03	0.05	0.76	2.6	< 0.02	0.03
Zn (ppb)	13,200	13,400	13,400	15,000	10,500	15,500	15,300	13,400	10,100	9,100
Zr (ppb)	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Rare Earth Elements										
Sc (ppb)	< 0.1	0.4	0.8	1.2	0.2	0.4	0.3	0.3	0.3	0.3
Y (ppb)	1.56	2.59	2.4	2.04	0.13	2.82	2.39	0.25	< 0.02	0.06
La (ppb)	3.3	5.3	4.2	3.4	0.2	5.2	4.4	0.3	0.02	< 0.1
Ce (ppb)	6.83	10	12.3	10.5	0.41	10.2	9.26	0.53	0.04	0.18
Pr (ppb)	0.5	0.9	0.7	0.6	< 0.1	0.9	0.8	< 0.1	< 0.01	< 0.1
Nd (ppb)	2	3.3	2.7	2.2	0.1	3.2	2.9	0.2	0.01	< 0.1
Sm (ppb)	0.3	0.5	0.4	0.4	< 0.1	0.5	0.5	< 0.1	< 0.01	< 0.1
Eu (ppb)	< 0.1	0.1	< 0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1	< 0.1
Gd (ppb)	0.34	0.57	0.5	0.39	0.02	0.61	0.52	0.04	< 0.01	0.01
Tb (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	< 0.1
Dy (ppb)	0.2	0.3	0.3	0.2	< 0.1	0.3	0.3	< 0.1	< 0.01	< 0.1
Ho (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	< 0.1
Er (ppb)	< 0.1	0.2	0.1	0.1	< 0.1	0.2	0.1	< 0.1	< 0.01	< 0.1
Tm (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	< 0.1
Yb (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	< 0.1
Lu (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Total REE (ppb)	15.43	24.41	24.7	21.33	1.56	24.68	21.77	2.12	0.525	1.15
Total LREE (ppb)	13.32	20.67	20.85	17.54	0.88	20.71	18.43	1.22	0.135	0.44
Total HREE (ppb)	2.06	3.34	3.05	2.59	0.48	3.57	3.04	0.6	0.09	0.41

Notes:

pH, temperature, dissolved oxygen (DO), and conductivity measured in the field.

Total REEs (includes REE + Sc), LREEs, and HREEs non-detects were included at half the reporting limit.

gpm - gallons per minute

HREE - heavy REEs (Tb,Dy, Ho, Er, Tm, Yb, Lu, Y)

E - estimated, informational purposes, holding time exceedence or other issue

LREE - light REEs (La, Ce, Pr, Nd, Sm, Eu, Gd)

mg/L - milligrams per liter

na - not available

ppm - parts per million

ppb - parts per billion

uS/cm - microsiemens per centimeter

Table 6 - Summary of the Leadville Mine Drainage Tunnel WTP results.

SampleID	LDT-WTP-001	LDT-WTP-01-23001	LDT-02-23-001	LDTWTP03-23-001	LDT-WTP-04-23001	LDT-01-24-001	LDT-02-24-001	LDT-03-24-001	LDT-04-24-001	LDT-05-24-001
Date Sampled	10/28/2022	4/20/2023	5/25/2023	8/2/2023	9/29/2023	5/7/2024	5/30/2024	6/13/2024	6/28/2024	7/26/2024
pH	7.05	7.08	6.96	7.23	7.4	6.61	6.1	7.01	6.7	7.18
Temperature (°C)	11.3	na	10.9	6.7	na	8.5	6.7	8.5	10.6	13.3
DO (mg/L)	7.34	7.71	7.83	7.91	7.23	7.63	7.32	6.29	8.8	7.97
Conductivity (uS/cm)	402	551	569	570	347	461	531	368	366	440
Flow (gpm)	1,212	1,160	820	1,190	1,355	1,025	900	969	1,122	1,100
Flow (L/min)	4,588	4,391	3,104	4,505	5,129	3,880	3,407	3,668	4,247	4,164
Alkalinity (mg/L CaCO ₃)	127	140 E	125 E	129 E	163 E	127	39.4	103	na	120
Al (ppb)	130	160	776	381	294	917	2960	982	551	143
As (ppb)	1.2	1.3	1.4	1	1.6	1.4	3.3	1.2	0.9	0.4
Ba (ppb)	76.7	74.7	74.5	75.2	82.5	75.1	73.7	75.6	80.5	70.1
Be (ppb)	0.025	0.039	0.111	0.084	0.052	0.116	0.502	0.17	0.115	0.024
Bi (ppb)	< 0.01	< 0.01	< 0.01	0.08	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Co (ppb)	0.388	0.625	1.92	0.741	0.321	1.42	3.88	1.73	1.33	0.548
Cr (ppb)	0.33	0.3	0.46	0.18	0.21	0.36	1.15	0.36	0.36	0.22
Cs (ppb)	0.2	< 0.1	0.1	< 0.1	< 0.1	0.1	0.1	0.1	0.1	< 0.1
Cu (ppb)	5.3	6.8	58.2	17.1	14.1	51.4	203	57	29	8.8
Ga (ppb)	< 0.1	< 0.1	0.1	< 0.1	< 0.1	0.1	0.4	0.1	0.1	< 0.1
Ge (ppb)	< 0.1	3.3	0.2	< 0.1	0.2	0.2	0.5	0.2	0.2	< 0.1
Hf (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
In (ppb)	< 0.1	0.2	1.2	0.4	0.4	1.3	6.3	1.3	0.78	0.2
Li (ppb)	1.8	2.1	1.8	2.6	1.3	3	6	3.4	3.7	1.7
Mg (ppb)	21,100	29,000	28,300	23,500	17,200	26,900	33,500	28,600	29,100	20,400
Mn (ppb)	728	1,460	3,580	1,780	634	2,960	6,850	3,250	2,480	998
Nb (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	< 0.1
Ni (ppb)	0.9	1.7	3.8	3.2	1	2.6	9.7	3.8	3.4	1.6
Rb (ppb)	0.8	0.8	0.9	0.9	1	0.8	0.7	0.8	0.8	0.6
Sb (ppb)	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Sn (ppb)	< 0.06	< 0.06	0.07	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
Sr (ppb)	106	124	129	96.9	92	109	106	116	116	82.7
Ta (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Te (ppb)	< 0.1	< 0.1	< 0.1	0.3	< 0.1	< 0.1	0.5	< 0.1	< 0.1	< 0.1
Ti (ppb)	0.08	0.16	0.14	0.08	0.1	0.16	0.22	0.17	0.15	< 0.05
V (ppb)	0.06	0.07	0.09	0.1	0.08	0.1	0.22	0.1	0.07	0.04
W (ppb)	< 0.02	< 0.02	< 0.02	< 0.02	3.72	1.4	0.94	6.54	0.12	1.45
Zn (ppb)	1,410	2,310	7,800	3,890	1,480	6,350	19,700	8,160	5,360	2,600
Zr (ppb)	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Rare Earth Elements										
Sc (ppb)	< 0.1	0.2	0.6	0.8	0.3	0.4	0.8	0.4	0.3	0.2
Y (ppb)	0.4	0.49	2.22	1.31	1.11	1.93	5.66	2.13	1.58	0.55
La (ppb)	0.2	0.2	1.5	0.5	0.4	1.2	3.8	1.4	0.92	0.3
Ce (ppb)	0.44	0.5	4.89	1.95	1.04	2.86	8.86	3.37	2.21	0.7
Pr (ppb)	< 0.1	< 0.1	0.4	0.2	0.2	0.4	1.2	0.5	0.3	0.1
Nd (ppb)	0.3	0.3	1.8	0.9	0.6	1.6	5.3	2	1.29	0.4
Sm (ppb)	< 0.1	< 0.1	0.5	0.2	0.2	0.4	1.2	0.5	0.34	0.1
Eu (ppb)	< 0.1	< 0.1	0.1	< 0.1	< 0.1	0.1	0.4	0.2	0.1	< 0.1
Gd (ppb)	0.09	0.11	0.51	0.27	0.23	0.46	1.48	0.53	0.37	0.15
Tb (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.2	< 0.1	0.05	< 0.1
Dy (ppb)	< 0.1	< 0.1	0.4	0.2	0.2	0.3	1.2	0.4	0.29	0.1
Ho (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.2	< 0.1	0.05	< 0.1
Er (ppb)	< 0.1	< 0.1	0.2	0.1	< 0.1	0.2	0.5	0.2	0.13	< 0.1
Tm (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.02	< 0.1
Yb (ppb)	< 0.1	< 0.1	0.1	< 0.1	< 0.1	0.1	0.4	0.1	0.1	< 0.1
Lu (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Total REE (ppb)	1.98	2.3	13.42	6.73	4.63	10.15	31.3	11.93	8.1	2.95
Total LREE (ppb)	1.18	1.26	9.7	4.07	2.72	7.02	22.24	8.5	5.53	1.8
Total HREE (ppb)	0.75	0.84	3.12	1.86	1.61	2.73	8.26	3.03	2.27	0.95

Notes:

pH, temperature, dissolved oxygen (DO), and conductivity measured in the field.

Total REEs (includes REE + Sc), LREEs, and HREEs non-detects were included at half the reporting limit.

gpm - gallons per minute

HREE - heavy REEs (Tb,Dy, Ho, Er, Tm, Yb, Lu, Y)

L/min - liters per minute

E - estimated, informational purposes, holding time exceedence or other issue

LREE - light REEs (La, Ce, Pr, Nd, Sm, Eu, Gd)

mg/L - milligrams per liter

na - not available

ppm - parts per million

ppb - parts per billion

uS/cm - microsiemens per centimeter

Table 7 - Summary of the St. Louis Tunnel results.

SampleID	SLT-01-22-001	SLT-01-23-001	SLT-02-23-001	SLT-03-23-001	SLT-04-23-001
Date Sampled	11/19/2022	4/24/2023	5/31/2023	7/27/2023	9/30/2023
pH	6.64	6.9	6.33	6.38	6.6
Temperature (°C)	16.1	19.3	na	19.2	18.8
DO (mg/L)	3.54	5.06	4.88	4.01	4.39
Conductivity (uS/cm)	1,140	1,112	1,027	1,122	1,155
Flow (gpm)	168	562	870	1,000	873
Flow (L/min)	636	2,127	3,293	3,785	3,305
Alkalinity (mg/L CaCO ₃)	97 E	110 E	35.7 E	87.3 E	118 E
Al (ppb)	1,050	254	2,080	1,610	1,090
As (ppb)	2.3	0.7	0.6	1.6	2.3
Ba (ppb)	19.4	23.8	21.1	16.9	18.6
Be (ppb)	0.98	0.422	0.648	0.978	0.921
Bi (ppb)	0.76	0.11	0.08	0.3	0.56
Co (ppb)	2.26	2.58	8.03	5	3.31
Cr (ppb)	0.86	0.87	10.9	0.98	0.81
Cs (ppb)	0.5	0.5	0.6	0.5	0.5
Cu (ppb)	255	59.2	1,400	370	258
Ga (ppb)	0.7	0.2	0.6	0.7	1
Ge (ppb)	0.4	< 0.1	0.3	0.4	0.5
Hf (ppb)	< 0.1	0.3	0.1	< 0.1	< 0.1
In (ppb)	< 0.1	< 0.1	0.3	0.5	0.6
Li (ppb)	24.4	22	13.4	24.6	15.6
Mg (ppb)	20,000	20,200	19,100	18,400	13,400
Mn (ppb)	1,920	1,740	4,580	3,420	2,020
Nb (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Ni (ppb)	4.2	4.8	85.6	8.7	5.8
Rb (ppb)	5.6	4.7	10.3	5.8	6.7
Sb (ppb)	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Sn (ppb)	0.09	0.08	1.87	< 0.06	0.2
Ta (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Te (ppb)	0.4	0.5	0.1	< 0.1	0.4
Ti (ppb)	0.39	0.46	0.25	0.2	0.3
V (ppb)	0.34	0.16	0.06	0.23	0.34
W (ppb)	1.32	0.27	0.12	0.8	1.25
Zn (ppb)	4,330	5,120	19,700	6,110	3,930
Zr (ppb)	< 2	< 2	< 2	< 2	< 2
Rare Earth Elements					
Sc (ppb)	0.2	0.3	0.4	1.4	0.4
Y (ppb)	2.22	0.85	5.6	3.68	3.23
La (ppb)	2	0.8	6.2	3.3	2.4
Ce (ppb)	4.6	1.28	14.9	10.5	5.42
Pr (ppb)	0.6	0.2	1.2	0.9	0.7
Nd (ppb)	2.3	0.6	4.5	3.5	2.7
Sm (ppb)	0.5	0.1	0.9	0.7	0.6
Eu (ppb)	0.1	< 0.1	0.2	0.2	0.1
Gd (ppb)	0.57	0.15	1.16	0.78	0.68
Tb (ppb)	< 0.1	< 0.1	0.2	0.1	0.1
Dy (ppb)	0.5	0.1	0.8	0.6	0.5
Ho (ppb)	< 0.1	< 0.1	0.2	0.1	< 0.1
Er (ppb)	0.2	< 0.1	0.4	0.3	0.3
Tm (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Yb (ppb)	0.2	< 0.1	0.2	0.2	0.2
Lu (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Total REE (ppb)	14.2	4.7	37.0	26.4	17.5
Total LREE (ppb)	10.7	3.2	29.1	19.9	12.6
Total HREE (ppb)	3.3	1.3	7.5	5.1	4.5

Notes:

pH, temperature, dissolved oxygen (DO), and conductivity measured in the field.

Total REEs (includes REE + Sc), LREEs, and HREEs non-detects were included at half the reporting limit.

gpm - gallons per minute

HREE - heavy REEs (Tb,Dy, Ho, Er, Tm, Yb, Lu, Y)

L/min - liters per minute

E - estimated, informational purposes, holding time exceedence or other issue

LREE - light REEs

mg/L - milligram:

na - not available

ppm - parts per r

ppb - parts per b

uS/cm - microsie

Table 8 - Summary of the Argo Tunnel results.

SampleID	AT-01-22-001	AT-01-23-001	AT-02-23-001	AT-03-23-001	AT-04-23-001 FA	AT-01-24-001	AT-02-24-001	AT-03-24-001	AT-04-24-001	AT-05-24-001
Date Sampled	11/12/2022	4/20/2023	5/25/2023	8/2/2023	9/29/2023	5/13/2024	5/30/2024	6/13/2024	7/1/2024	7/25/2024
pH	2.75	2.84	2.89	2.75	2.89	2.75	2.48	2.66	2.67	2.81
Temperature (°C)	13	13.9	17.6	16	na	15.9	7.6	11.6	15.2	18.5
DO (mg/L)	5.69	5.43	5.47	4.4	4.74	3.64	6.73	6.36	7.63	5.04
Conductivity (uS/cm)	2,840	2,660	2,910	2,980	3,270	3,210	3,240	3,650	2,470	3,280
Flow (gpm)	190	144	198	213	197	197.4	217	187	227.5	218
Flow (L/min)	719	545	750	806	746	747	821	708	861	825
Alkalinity (mg/L CaCO ₃)	< 10	< 10 E	< 10 E	< 10 E	< 10 E	< 10	< 10	< 25	na	< 1
Al (ppb)	18,100	17,000	13,500	18,500	15,500	20,400	25,600	27,100	26,100	17,100
As (ppb)	48	51.3	52.4	50.1	41.7	76.5	85.8	86.8	70.6	56.4
Ba (ppb)	1.65	3.29	1.64	1.73	2.42	1.99	1.84	1.96	2.08	1.96
Be (ppb)	8.07	9.24	5.64	13.5	8.61	11.6	15.8	14.7	12.5	9.58
Bi (ppb)	0.04	0.02	0.03	0.04	0.03	0.02	0.04	0.06	0.05	0.04
Co (ppb)	103	125	120	109	105	118	129	135	123	115
Cr (ppb)	6.51	20.7	8.12	8.52	6.05	6.87	9.24	11.2	9.35	7.26
Cs (ppb)	5.5	6.1	5.4	5.7	5.7	8.1	8.3	9	8.5	7.9
Cu (ppb)	3,260	3,220	3,500	3,808	3,180	4,440	5,690	6,920	5,320	3,740
Ga (ppb)	12.6	7.8	9.3	2.5	5	6	6.5	7.1	6	5.2
Ge (ppb)	5.7	1	6.4	7.6	5.7	5.8	7.2	7.6	6.7	6.6
Hf (ppb)	< 0.1	0.3	< 0.1	< 0.1	0.2	0.1	< 0.1	< 0.1	0.3	0.1
In (ppb)	0.1	0.8	1.2	1.5	1.1	1.7	2.2	2.8	2.18	1.6
Li (ppb)	26.2	34.5	16.2	41.8	24	29.1	43.5	38.6	33	26
Mg (ppb)	80,400	108,000	82,400	89,600	77,400	93,600	99,900	98,400	93,600	89,700
Mn (ppb)	62,500	83,100	78,000	72,100	59,500	90,100	86,400	83,500	79,700	62,200
Nb (ppb)	< 0.1	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.12	< 0.1
Ni (ppb)	170	192	195	172	164	172	200	221	196	167
Rb (ppb)	23.5	23.7	44.4	22.8	33.7	26.9	25.7	25.2	25.3	25.3
Sb (ppb)	1.5	1.4	1.6	1.5	1.8	1.6	1.5	1.6	1.5	1.5
Sn (ppb)	< 0.06	1.49	21.7	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
Sr (ppb)	1,360	1,462	1,460	1,150	1,220	1,490	1,380	1,390	1,210	1,120
Ta (ppb)	< 0.1	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Te (ppb)	0.8	0.5	0.8	0.9	0.8	1	1.1	1.3	1	0.7
Ti (ppb)	0.79	1.92	0.58	0.79	4.4	0.66	1.04	1.12	0.97	0.72
V (ppb)	5.14	6.41	6.69	4.85	4.92	7.26	6.92	6.86	6.22	5.34
W (ppb)	0.04	0.1	< 0.02	< 0.02	0.29	0.17	0.77	0.12	0.12	12.3
Zn (ppb)	27,100	39,500	36,500	31,400	32,400	44,000	41,900	42,900	43,300	31,600
Zr (ppb)	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Rare Earth Elements										
Sc (ppb)	6.3	4.6	8.5	12.2	5.2	8.1	10	12.1	10.1	8.5
Y (ppb)	157	144	162	160	151	170	183	206	170	151
La (ppb)	165	130	141	150	118	162	198	230	193	150
Ce (ppb)	353	282	351	398	257	369	445	516	424	337
Pr (ppb)	48	38.7	40	43.4	34.7	45.8	54.8	63.8	53.8	43
Nd (ppb)	188	154	164	176	139	189	223	261	223	178
Sm (ppb)	38.9	32.7	35	37.6	30.4	40.6	48.3	55.2	47.7	38.8
Eu (ppb)	7.3	6.2	6.8	6.9	5.5	7.8	9.2	10.4	9	7.2
Gd (ppb)	44	35.8	39.9	40.5	33	46.3	54.7	61.4	52.4	43.2
Tb (ppb)	6.1	5.2	6	6.4	4.9	6.4	7.7	8.6	7.49	6.1
Dy (ppb)	33.2	27.9	30.5	32.1	25.5	35.3	41.4	46.9	40.5	33.3
Ho (ppb)	6.4	5.3	5.7	6	4.9	6.8	7.6	8.7	7.56	6.5
Er (ppb)	17.1	13.9	15.2	15.9	13.3	17.9	20.5	23.3	19.9	16.5
Tm (ppb)	2.1	1.7	2	2.2	1.7	2.3	2.6	3	2.52	2.1
Yb (ppb)	12.6	10.5	11.5	12.1	10.1	13.8	15.4	17.8	15.2	12.4
Lu (ppb)	1.8	1.5	1.7	1.7	1.4	2	2.3	2.6	2.2	1.8
Lu_d (ppb)	2.1	1.6	1.7	1.7	1.4	1.9	2.3	2.5	2.1	2.3
Total REE (ppb)	1,086.8	894.0	1,020.8	1,101.0	835.6	1,123.1	1,323.5	1,526.8	1,278.4	1,035.4
Total LREE (ppb)	844.2	679.4	777.7	852.4	617.6	860.5	1,033.0	1,197.8	1,002.9	797.2
Total HREE (ppb)	236.3	210.0	234.6	236.4	212.8	254.5	280.5	316.9	265.4	229.7

Notes:

pH, temperature, dissolved oxygen (DO), and conductivity measured in the field.

Total REEs (includes REE + Sc), LREEs, and HREEs non-detects were included at half the reporting limit.

gpm - gallons per minute

HREE - heavy REEs (Tb,Dy, Ho, Er, Tm, Yb, Lu, Y)

L/min - liters per minute

E - estimated, informational purposes, holding time exceedence or other issue

LREE - light REEs (La, Ce, Pr, Nd, Sm, Eu, Gd)

mg/L - milligrams per liter

na - not available

ppm - parts per million

ppb - parts per billion

uS/cm - microsiemens per centimeter

Table 9 - Summary of the Virginia Canyon results.

SampleID	VC-01-22-001	VC-01-23-001	VC-02-23-001	VC-03-23-001	VC-04-23-001 FA	VC-01-24-001	VC-02-24-001	VC-03-24-001	VC-04-24-001	VC-05-24-001
Date Sampled	11/12/2022	4/20/2023	5/25/2023	8/2/2023	9/29/2023	5/13/2024	5/30/2024	6/13/2024	7/1/2024	7/25/2024
pH	3.35	3.49	3.4	3.3	3.41	3.46	3.24	3.32	3.32	3.36
Temperature (°C)	13	na	14.3	17	na	12	6.1	9.2	9.8	18
DO (mg/L)	7.6	9.1	7.78	7.2	6.28	7.12	7.09	7.14	8.38	6.37
Conductivity (uS/cm)	2,220	1,927	1,934	2,173	2,450	1,738	1,808	2,001	1,519	2,320
Flow (gpm)	7.8	11.1	38.3	8.4	16.6	19.3	11	10.1	9.4	10.7
Flow (L/min)	30	42	145	32	63	73	42	38	36	41
Alkalinity (mg/L CaCO ₃)	< 10	< 10 E	< 10 E	< 10 E	< 10 E	< 10	< 10	< 25	na	< 1
Al (ppb)	66,100	49,200	45,800	43,900	46,300	31,800	43,900	46,300	50,200	40,600
As (ppb)	5	4.7	3	13.8	3.1	1.5	2.1	2.3	2.2	2.6
Ba (ppb)	6.74	6.45	8.1	38.8	9.68	8.84	10.5	10.8	11.1	12.5
Be (ppb)	10.1	8.13	9.73	15.4	8.97	7.08	11.5	12.2	11	9.06
Bi (ppb)	< 0.01	< 0.01	< 0.01	0.09	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Co (ppb)	233	213	196	199	214	108	144	160	173	198
Cr (ppb)	12.5	10.3	16.3	15.7	11.1	9.42	11.6	13.3	14.5	14
Cs (ppb)	0.2	0.2	0.1	0.5	0.2	0.2	0.3	0.3	0.3	0.4
Cu (ppb)	6,640	5,719	7,600	5,559	6,280	4,600	5,980	6,600	6,310	5,730
Ga (ppb)	18.9	9.6	12.9	2.6	5.9	2.9	4	4.6	5.1	4.8
Ge (ppb)	6.7	< 0.1	6.7	6.9	5.2	2.9	4.4	4.9	4.9	5.6
Hf (ppb)	0.1	0.2	0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1	0.1	0.1
In (ppb)	< 0.1	0.3	0.6	0.6	0.3	0.3	0.4	0.5	0.55	0.5
Li (ppb)	56.8	54.5	49.6	78.3	54	38.6	65.7	63.3	57	48.7
Mg (ppb)	82,500	87,000	64,600	70,600	67,200	60,800	65,800	67,100	65,600	71,100
Mn (ppb)	60,900	58,500	43,800	57,400	52,000	26,800	35,100	41,100	48,100	46,100
Nb (ppb)	0.1	0.1	0.1	0.2	< 0.1	< 0.1	< 0.1	< 0.1	0.03	< 0.1
Ni (ppb)	507	469	448	390	453	278	340	363	384	389
Rb (ppb)	10	6.9	12.4	20.5	18.6	8.5	10.3	11.6	13.9	14.9
Sb (ppb)	< 0.9	< 0.9	< 0.9	1.7	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Sn (ppb)	0.07	< 0.06	0.1	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
Ta (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Te (ppb)	< 0.1	< 0.1	0.2	0.2	< 0.1	0.2	< 0.1	< 0.1	< 0.1	< 0.1
Ti (ppb)	1.65	1.09	1.51	112	3.9	1.05	1.45	1.61	1.86	1.84
V (ppb)	0.05	0.05	0.07	3.93	0.12	0.04	0.06	0.06	0.08	0.06
W (ppb)	0.09	0.07	< 0.02	0.07	0.2	0.29	0.07	0.03	0.08	1.13
Zn (ppb)	56,900	55,000	53,500	46,200	55,200	35,900	44,200	48,600	52,000	44,800
Zr (ppb)	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Rare Earth Elements										
Sc (ppb)	7.3	6	12.5	17.1	5.3	5.3	7.3	8.9	10.6	11.1
Y (ppb)	293	216	248	204	236	142	170	190	194	201
La (ppb)	260	177	213	177	164	118	154	178	197	187
Ce (ppb)	583	395	474	493	373	268	356	422	472	440
Pr (ppb)	81.9	57.5	64.3	59.8	52.7	35.5	45.8	55.1	61.4	60.8
Nd (ppb)	335	238	270	244	209	148	189	229	255	259
Sm (ppb)	72.5	52.5	60.7	52.9	47.3	32.6	42.5	51.2	58.2	59.1
Eu (ppb)	15.8	11.3	12.6	10.8	10	6.9	8.9	10.8	12.1	12
Gd (ppb)	84.3	58.3	65.9	55.2	52.3	36.5	47.6	55.8	61.9	62.6
Tb (ppb)	12.5	8.8	10.5	9.2	7.8	5.4	6.9	8	8.9	8.8
Dy (ppb)	69.7	48.1	51.9	43.9	41.7	29.3	36.7	43.6	47.4	48.7
Ho (ppb)	13.1	9.4	9.8	8.1	7.9	5.4	6.9	8.1	8.6	9.1
Er (ppb)	35.7	24.7	26	21.9	21	14.7	18.8	21.8	23.5	23.8
Tm (ppb)	4.5	3.1	3.6	3.2	2.7	1.9	2.5	2.9	3.08	3.1
Yb (ppb)	27.7	19.6	20.6	17.4	16.7	11.9	15.2	17.7	18.8	18.5
Lu (ppb)	4.1	2.9	3	2.4	2.4	1.7	2.2	2.5	2.7	2.8
Total REE (ppb)	1,900.1	1,328.2	1,546.4	1,419.9	1,249.8	863.1	1,110.3	1,305.4	1,435.2	1,407.4
Total LREE (ppb)	1,432.5	989.6	1,160.5	1,092.7	908.3	645.5	843.8	1,001.9	1,117.6	1,080.5
Total HREE (ppb)	460.3	332.6	373.4	310.1	336.2	212.3	259.2	294.6	307.0	315.8

Notes:

pH, temperature, dissolved oxygen (DO), and conductivity measured in the field.

Total REEs (includes REE + Sc), LREEs, and HREEs non-detects were included at half the reporting limit.

gpm - gallons per minute

HREE - heavy REEs (Tb,Dy, Ho, Er, Tm, Yb, Lu, Y)

L/min - liters per minute

E - estimated, informational purposes, holding time exceedence or other issue

LREE - light REEs (La, Ce, Pr, Nd, Sm, Eu, Gd)

mg/L - milligrams per liter

na - not available

ppm - parts per million

ppb - parts per billion

uS/cm - microsiemens per centimeter

Table 10 - Summary of the Big Five Tunnel results.

SampleID	B5-01-22-001	B5-01-23-001	B5-02-23-001	B5-03-23-001	B5-04-23-001	B5-01-24-001	B5-02-24-001	B5-03-24-001	B5-04-24-001	B5-05-24-001
Date Sampled	11/12/2022	4/20/2023	5/25/2023	8/2/2023	9/29/2023	5/13/2024	5/30/2024	6/13/2024	7/1/2024	7/25/2024
pH	5.85	5.75	5.88	5.63	5.57	5.46	5.28	5.36	5.28	5.44
Temperature (°C)	13	13.9	13.5	18	na	14.5	12.4	9	15.1	14.5
DO (mg/L)	6.58	4.97	6.13	3.09	5.17	4.3	4.71	5.33	6.39	4.25
Conductivity (uS/cm)	2,340	2,400	2,430	2,500	2,840	2,570	2,520	2,650	1,943	2,770
Flow (gpm)	15	14.4	16	22	21	23.5	28.7	27.9	20	14.5
Flow (L/min)	57	55	61	83	79	89	109	106	76	55
Alkalinity (mg/L CaCO ₃)	< 10	< 10 E	< 10 E	< 10 E	< 10 E	< 10	< 10	< 25	na	< 1
Al (ppb)	640	604	2,540	1,160	811	1,430	1,570	2,970	1,920	1,110
As (ppb)	5	3.9	20.7	6.4	3.7	6.4	6.4	14.3	7.4	3.3
Ba (ppb)	10.4	10.5	11.2	11.1	11.7	11.5	11.3	11.6	11.7	10.2
Be (ppb)	1.19	1.04	2.96	2.15	1.53	2	2.17	3.04	2.66	1.66
Bi (ppb)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Co (ppb)	91.9	99.3	97.9	94.4	90.2	104	103	107	112	93.8
Cr (ppb)	0.15	0.21	0.53	0.15	0.15	0.19	0.2	0.39	0.24	0.25
Cs (ppb)	7.9	7.1	7.2	7.9	8.8	9.1	8.9	9.2	9.6	9.5
Cu (ppb)	89.2	93.7	420	125	125	200	202	347	214	166
Ga (ppb)	0.6	0.5	2	0.2	0.3	0.6	0.6	0.8	0.6	0.6
Ge (ppb)	1.4	1	5.3	2.6	2.2	2	2.1	3	2.3	2
Hf (ppb)	< 0.1	0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1
In (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	< 0.1
Li (ppb)	53.1	53.7	49	70.9	54.8	56.3	61.7	70.2	75	48.1
Mg (ppb)	115,000	124,000	110,000	125,000	101,000	130,000	130,000	138,000	138,000	115,000
Mn (ppb)	27,400	27,100	26,500	29,400	24,100	28,800	26,900	26,800	29,000	24,000
Na (ppb)	62,400	62,800	59,900	65,200	52,700	66,500	65,100	68,100	68,100	55,300
Nb (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.01	< 0.1
Ni (ppb)	180	195	197	179	180	217	212	217	230	179
Rb (ppb)	44.9	35	48.4	44.7	62.1	44.5	42.4	43.9	46.2	43.1
Sb (ppb)	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Sn (ppb)	0.08	< 0.06	0.09	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	0.18
Ta (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Te (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Ti (ppb)	0.21	0.15	0.19	0.11	0.2	0.17	0.15	0.17	0.2	0.12
V (ppb)	0.02	0.05	0.04	0.04	0.01	0.04	0.04	0.07	0.04	0.03
W (ppb)	0.06	0.49	0.11	0.15	17	0.1	0.06	0.04	0.12	2.06
Zn (ppb)	4,930	5,420	6,420	5,760	5,390	7,450	7,020	7,470	6,750	5,280
Zr (ppb)	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Rare Earth Elements										
Sc (ppb)	0.2	0.6	1.3	2.6	0.4	0.9	0.9	1.1	1	0.8
Y (ppb)	13.6	11.7	61.8	21	15.2	20.5	20.4	31.1	21.3	16.4
La (ppb)	6.6	5.7	27.8	8.8	5.8	8.2	8.9	13.1	8.88	8.3
Ce (ppb)	14.3	12.3	87.3	32.8	13.1	19.3	20	34.2	21.3	18.7
Pr (ppb)	2	1.8	10.1	3.2	1.9	2.9	3	5.4	3.31	2.7
Nd (ppb)	9.2	7.9	46.7	14.4	8.7	13.3	13.7	25.4	15.5	12.4
Sm (ppb)	2	1.7	10.3	3.3	2	3	3.1	5.6	3.56	3
Eu (ppb)	0.6	0.5	3	0.9	0.6	0.9	0.9	1.7	1	0.9
Gd (ppb)	2.78	2.27	13.9	4.02	2.51	4.01	4.14	7.23	4.52	3.82
Tb (ppb)	0.4	0.3	2	0.6	0.4	0.5	0.6	1	0.65	0.5
Dy (ppb)	2	1.7	10	3.1	1.8	2.9	3	5.3	3.36	3
Ho (ppb)	0.4	0.3	1.9	0.6	0.4	0.5	0.6	1	0.63	0.6
Er (ppb)	1	0.8	4.7	1.4	0.9	1.4	1.4	2.5	1.58	1.4
Tm (ppb)	0.1	< 0.1	0.6	0.2	0.1	0.2	0.2	0.3	0.19	0.2
Yb (ppb)	0.6	0.5	3.1	1	0.6	0.9	1	1.8	1.09	0.9
Lu (ppb)	< 0.1	< 0.1	0.5	0.2	< 0.1	0.1	0.1	0.3	0.2	0.1
Total REE (ppb)	55.83	48.17	285	98.12	54.46	79.51	81.94	137.03	88.07	73.72
Total LREE (ppb)	37.48	32.17	199.1	67.42	34.61	51.61	53.74	92.63	58.07	49.82
Total HREE (ppb)	18.15	15.4	84.6	28.1	19.45	27	27.3	43.3	29	23.1

Notes:

pH, temperature, dissolved oxygen (DO), and conductivity measured in the field.

Total REEs (includes REE + Sc), LREEs, and HREEs non-detects were included at half the reporting limit.

gpm - gallons per minute

HREE - heavy REEs (Tb,Dy, Ho, Er, Tm, Yb, Lu, Y)

L/minute - liters per minute

E - estimated, informational purposes, holding time exceedence or other issue

LREE - light REEs (La, Ce, Pr, Nd, Sm, Eu, Gd)

mg/L - milligrams per liter

na - not available

ppm - parts per million

ppb - parts per billion

uS/cm - microsiemens per centimeter

Table 11 - Summary of the North Clear Creek WTP results.

SampleID	BH-WTP-001	BH-WTP-01-23-001	BH-02-23-001	BHWTP-03-23-001	BH-WTP-04-23-001	BH-01-24-001	BH-02-24-001	BH-03-24-001	BH-04-24-001	BH-05-24-001
Date Sampled	11/1/2022	4/20/2023	5/25/2023	8/2/2023	9/29/2023	5/13/2024	5/30/2024	6/13/2024	7/1/2024	7/25/2024
pH	4.42	4.87	4.94	4.84	5.46	5.12	5.08	4.89	4.7	4.84
Temperature (°C)	na	13.7	14.6	16.4	na	12.1	8.3	15	14.9	15.6
DO (mg/L)	7.15	7.78	7.54	7.6	6.79	7.59	7.18	7.44	7.84	7.48
Conductivity (uS/cm)	2,036	1,955	2,057	1,940	2,420	2,063	2,050	2,094	1,616	2,290
Flow (gpm)	140	135	140	152	167	139.9	180	160	160	177.67
Flow (L/min)	530	511	530	575	632	530	681	606	606	673
Alkalinity (mg/L CaCO ₃)	< 10	< 10 E	< 10 E	< 10 E	< 10 E	< 10	< 25	na	na	< 1
Al (ppb)	2,190	1,610	1,080	1,480	1,050	1,980	1,720	1,990	2,320	1,610
As (ppb)	4.5	4.7	3.2	4.7	4	4.9	3.3	4	4.9	3.9
Ba (ppb)	7.09	6.76	6.76	6.85	7.6	7.26	7.48	8.04	7.88	6.77
Be (ppb)	3.46	2.88	2.25	4.46	2.78	4.08	3.45	3.94	4.8	3.13
Bi (ppb)	< 0.01	< 0.01	< 0.01	< 0.01	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Co (ppb)	108	130	120	115	108	109	100	105	112	94.8
Cr (ppb)	0.19	0.16	0.13	< 0.08	0.16	< 0.08	0.1	0.18	0.19	0.1
Cs (ppb)	7.6	6.9	7.3	7.6	7.7	10.1	9.6	9.4	10.2	10.3
Cu (ppb)	446	341	290	283	261	441	409	499	635	452
Ga (ppb)	5.6	3.6	3.6	0.6	1.5	2	1.6	1.7	2	1.7
Ge (ppb)	3.6	7.1	5	5.1	4.2	3.5	3.5	3.8	4.2	3.6
Hf (ppb)	< 0.1	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
In (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.01	< 0.1
Li (ppb)	23.7	29.9	17.9	38.3	22.9	28.2	28.1	32	33.6	22.5
Mg (ppb)	66,800	79,800	62,700	79,900	60,900	74,400	74,000	78,900	79,300	65,100
Mn (ppb)	24,100	25,700	24,300	27,700	22,000	23,100	21,700	22,800	24,200	18,900
Nb (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	< 0.1
Ni (ppb)	172	198	188	176	176	184	166	174	183	146
Rb (ppb)	39.6	34.4	43.3	40.6	52.4	39.8	38.4	38.1	41.5	37.1
Sb (ppb)	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Sn (ppb)	0.07	0.13	0.07	< 0.06	< 0.06	< 0.06	0.28	< 0.06	< 0.06	0.12
Ta (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Te (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Ti (ppb)	0.2	0.15	0.15	0.16	0.5	0.19	0.34	2.09	0.25	0.15
V (ppb)	0.04	0.05	0.05	0.1	0.09	0.05	0.06	0.12	0.06	0.05
W (ppb)	0.03	0.04	< 0.02	< 0.02	0.24	< 0.02	< 0.02	0.03	0.04	0.06
Zn (ppb)	4,380	5,080	5,080	5,190	4,990	6,030	5,250	5,680	5,670	4,330
Zr (ppb)	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Rare Earth Elements										
Sc (ppb)	0.7	0.9	0.8	2.8	0.5	1.2	1	1.1	1.3	1.1
Y (ppb)	115	108	118	112	94.6	119	92.6	98.8	115	92.2
La (ppb)	71.7	68.5	64.8	63.5	48.3	72.1	55.9	58.9	68.5	67.3
Ce (ppb)	160	152	183	186	106	178	138	143	170	153
Pr (ppb)	21.1	21.2	19.6	19.7	13.9	21.9	16.9	17.4	21.3	20.1
Nd (ppb)	88.2	86.2	79.6	80.7	57.3	91	69.9	72.9	89.4	85.8
Sm (ppb)	18.9	18.9	17.7	17.3	12.4	19.5	15.1	15.7	19.9	18.9
Eu (ppb)	3.5	3.4	3.3	3.3	2.3	3.5	2.8	2.8	3.5	3.4
Gd (ppb)	23.5	22.7	21.7	21.2	15.4	24.1	18.8	19.9	24.1	24.1
Tb (ppb)	3.5	3.4	3.4	3.2	2.4	3.4	2.7	2.9	3.53	3.3
Dy (ppb)	19.5	19.2	18.7	18.3	13	19.8	15.3	16	19.7	19.4
Ho (ppb)	3.9	3.9	3.7	3.6	2.6	3.9	3.1	3.2	3.82	3.9
Er (ppb)	10.5	10.2	9.9	9.9	7.1	10.6	8.2	8.5	10.4	10.3
Tm (ppb)	1.3	1.3	1.3	1.2	0.8	1.4	1	1.1	1.32	1.3
Yb (ppb)	7.5	7.3	6.9	6.8	5	7.8	5.9	6.2	7.69	7.4
Lu (ppb)	1.1	1.1	1	1	0.7	1.1	0.9	0.9	1.1	1.1
Total REE (ppb)	549.9	528.2	553.4	550.5	382.3	578.3	448.1	469.3	560.6	512.6
Total LREE (ppb)	386.9	372.9	389.7	391.7	255.6	410.1	317.4	330.6	396.7	372.6
Total HREE_d (ppb)	182.4	156	161.6	152	124.4	165	132.7	129.9	156.0	130.7

Notes:

pH, temperature, dissolved oxygen (DO), and conductivity measured in the field.

Total REEs (includes REE + Sc), LREEs, and HREEs non-detects were included at half the reporting limit.

gpm - gallons per minute

HREE - heavy REEs (Tb,Dy, Ho, Er, Tm, Yb, Lu, Y)

L/min - liters per minute

E - estimated, informational purposes, holding time exceedence or other issue

LREE - light REEs (La, Ce, Pr, Nd, Sm, Eu, Gd)

mg/L - milligrams per liter

na - not available

ppm - parts per million

ppb - parts per billion

uS/cm - microsiemens per centimeter

Table 12 - Summary of the Nelson Tunnel results.

SampleID	NT-01-22-001	NT-01-23-001	NT-02-23-001	NT-03-23-001	NT-04-23-001 FA	NT-01-24-001	NT-02-24-001	NT-03-24-001	NT-04-24-001	NT-05-24-001
Date Sampled	11/18/2022	4/23/2023	5/30/2023	7/26/2023	9/29/2023	5/8/2024	5/30/2024	6/14/2024	6/27/2024	7/17/2024
pH	5.18	4.63	5.17	4.28	4.28	4.73	4.7	4.67	4.58	4.52
Temperature (°C)	18	8.8	7.4	12.2	11.5	16.9	18.1	na	19.6	23
DO (mg/L)	6.41	6.38	6.31	6.24	6.3	6.71	6.56	6.33	6.25	5.98
Conductivity (uS/cm)	1,119	1,096	822	787	917	1,033	990	1,152	1,128	813
Flow (gpm)	346	333	339	327	315	315	333	315	315	315
Flow (L/min)	1,310	1,261	1,283	1,238	1,192	1,192	1,261	1,192	1,192	1,192
Alkalinity (mg/L CaCO ₃)	< 10 E	< 10 E	< 10 E	< 10 E	< 10 E	< 10	< 25	< 25	na	< 1
Al (ppb)	308	270	1400	714	349	663	1800	720	576	399
As (ppb)	8.7	7.5	6.8	5.8	2.8	8.4	7.4	7.4	8.4	6.8
Ba (ppb)	15.6	16.7	18.6	15.9	15.1	18	20.1	18.2	16.2	13.9
Be (ppb)	3.22	3.04	1.74	3.63	2.41	3.06	3.09	3.68	3.64	2.74
Bi (ppb)	< 0.01	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Cd (ppb)	81.8	79.8	472	126	92.1	133	247	133	116	83.5
Co (ppb)	26.2	25.9	28.3	19.3	17.3	25.8	27.6	28.6	27.2	23.7
Cr (ppb)	0.14	0.13	0.16	< 0.08	0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08
Cs (ppb)	18.6	15.4	12.8	15.4	16	18	16.6	19.1	19.9	20.2
Cu (ppb)	27.7	28.5	560	104	34	120	378	118	83	57
Ga (ppb)	4.2	2.9	2.1	0.4	1.1	1.4	1.3	1.6	1.5	1.5
Ge (ppb)	2	2.3	1.1	1.5	0.9	1.2	1.3	1.5	1.3	1.3
Hf (ppb)	< 0.1	0.7	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
In (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	< 0.1
Li (ppb)	185	149	74.2	125	116	147	144	180	156	120
Mg (ppb)	10,600	10,400	6,150	7,550	5,830	9,500	8,920	10,300	9,940	8,520
Mn (ppb)	16,000	15,400	10,800	9,250	7,230	14,500	12,700	14,700	16,200	12,800
Nb (ppb)	< 0.1	0.3	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.01	< 0.1
Ni (ppb)	10.9	11.2	11.1	7.1	6.3	10.8	11.9	14	11.6	9.3
Rb (ppb)	21.4	17.5	22.5	19.7	25.5	20.9	21.5	20.9	21.5	21.2
Sb (ppb)	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Sn (ppb)	< 0.06	0.18	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
Ta (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Te (ppb)	< 0.1	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Ti (ppb)	0.4	0.24	0.39	0.68	0.2	0.47	0.7	0.33	0.14	0.15
V (ppb)	0.03	0.02	0.04	0.04	0.01	0.05	0.05	0.01	< 0.01	< 0.01
W (ppb)	< 0.02	0.07	< 0.02	0.03	0.1	0.15	120	0.03	0.36	< 0.02
Zn (ppb)	34,400	31,600	39,900	31,100	26,700	38,400	39,800	41,400	38,300	28,800
Zr (ppb)	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Rare Earth Elements										
Sc (ppb)	0.1	0.3	0.2	2.9	0.3	0.6	0.7	0.6	0.7	0.5
Y (ppb)	20	18.6	19.4	14	13	20.5	20.9	21.2	21.2	18
La (ppb)	97.9	78.7	49.4	54.9	47.8	72.1	60.4	79.1	84.2	82.9
Ce (ppb)	183	145	128	157	91.1	145	126	152	163	157
Pr (ppb)	19.1	16.1	10.3	12.3	10.2	14.4	12.4	14.7	16.3	16.6
Nd (ppb)	65.3	54.4	35.2	40.2	34.6	49.2	43.1	50.5	56.3	57.4
Sm (ppb)	9.7	8.2	5.7	6.3	5.3	7.3	6.6	7.6	8.29	9
Eu (ppb)	1.5	1.3	1	0.9	0.7	1.1	1.1	1.2	1.3	1.4
Gd (ppb)	9.75	7.86	5.8	5.58	4.95	7.47	6.92	8.03	8.71	9.13
Tb (ppb)	1	0.8	0.7	0.6	0.5	0.8	0.7	0.8	0.88	0.9
Dy (ppb)	4.3	3.5	3.2	2.6	2.1	3.3	3.4	3.4	3.83	4
Ho (ppb)	0.7	0.6	0.5	0.4	0.3	0.6	0.6	0.5	0.59	0.6
Er (ppb)	1.6	1.2	1.3	1	0.8	1.2	1.3	1.2	1.35	1.4
Tm (ppb)	0.2	0.1	0.2	< 0.1	< 0.1	0.1	0.1	0.1	0.13	0.1
Yb (ppb)	0.7	0.6	0.8	0.4	0.3	0.6	0.8	0.6	0.64	0.7
Lu (ppb)	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Total REE (ppb)	414.9	337.31	261.8	299.18	212.05	324.32	285.07	341.58	367.47	359.68
Total LREE (ppb)	386.25	311.56	235.4	277.18	194.65	296.57	256.52	313.13	338.1	333.43
Total HREE (ppb)	28.55	25.45	26.2	19.1	17.1	27.15	27.85	27.85	28.67	25.75

Notes:

pH, temperature, dissolved oxygen (DO), and conductivity measured in the field.

Total REEs (includes REE + Sc), LREEs, and HREEs non-detects were included at half the reporting limit.

gpm - gallons per minute

HREE - heavy REEs (Tb,Dy, Ho, Er, Tm, Yb, Lu, Y)

L/min - liters per minute

E - estimated, informational purposes, holding time exceedence or other issue

LREE - light REEs (La, Ce, Pr, Nd, Sm, Eu, Gd)

mg/L - milligrams per liter

na - not available

ppm - parts per million

ppb - parts per billion

uS/cm - microsiemens per centimeter

Table 13 - Summary of the Gladstone WTP results.

SampleID	G-WTP-01-22-001	G-WTP-01-23-001	G-WTP-02-23-001	GWTP-03-23-001	G-WTP-04-23-001	G-WTP-01-24-001	G-WTP-02-24-001	G-WTP-03-24-001	G-WTP-04-24-001	G-WTP-05-24-001
Date Sampled	11/18/2022	4/24/2023	5/31/2023	7/27/2023	9/30/2023	5/13/2024	5/30/2024	6/14/2024	7/12/2024	7/19/2024
pH	3.67	5.2	2.8	3.04	3.44	5.5	3	2.76	3	3.2
Temperature (°C)	8.9	na	na	na	8.4	5.5	6.7	8.3	8.9	11.5
DO (mg/L)	7.61	7.33	6.87	na	8.22	8.25	7.52	5.84	6.71	7.7
Conductivity (uS/cm)	1,639	1,564	na	2,360	2,146	1,740	2,020	2,760	2,230	2,390
Flow (gpm)	346	460	430	255	435	300	300	200	265	280
Flow (L/min)	1,310	1,741	1,628	965	1,647	1,136	1,136	757	1,003	1,060
Alkalinity (mg/L CaCO ₃)	< 10 E	< 10 E	< 10 E	< 10 E	< 10 E	< 10	< 25	< 25	na	< 1
Al (ppb)	21,200	9,130	13,100	31,800	22,100	9,360	21,200	46,100	29,100	27,000
As (ppb)	18.3	11.7	66.5	43.2	33.5	13	46.2	82.9	28.5	40.6
Ba (ppb)	9.28	8.55	7.4	8.34	8.74	9.38	9.16	16.7	9.63	8.68
Be (ppb)	6.65	2.81	4.24	7.54	7.88	3.37	4.76	6.55	5.84	5.67
Bi (ppb)	3.92	1.36	2.88	8.39	9.03	2.14	2.65	3.44	2.11	8.74
Co (ppb)	71.4	47.7	41.8	82.5	91.3	41.9	54.3	92.5	72.9	75.8
Cr (ppb)	2.21	1.19	45.5	5.7	3.41	1.36	4.04	10.7	5.35	5.65
Cs (ppb)	5.7	2.9	8.3	7.5	5.6	3.7	5.3	10.3	6.9	9.5
Cu (ppb)	5,010	2,591	3,200	5,672	5,250	2,580	4,040	8,580	4,920	5,650
Ga (ppb)	3.4	1.6	19.9	6.4	4	1.6	4.3	13	5.3	6
Ge (ppb)	2	1	2.5	3.5	2.9	0.9	2.1	4.6	2.6	3
Hf (ppb)	0.2	1	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1	< 0.1	0.6
In (ppb)	1.1	2.5	40.4	17.3	9.4	3.1	11.5	42.6	14.6	16.8
Li (ppb)	35.3	24	40.8	45.1	28.5	24.3	33.7	61.9	43.9	33.1
Mg (ppb)	19,300	14,300	8,350	23,100	18,800	14,800	17,100	29,600	21,700	21,300
Mn (ppb)	26,100	19,300	7,540	26,700	30,200	17,500	17,300	22,000	21,400	19,500
Nb (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	0.2
Ni (ppb)	41.3	26.8	29.2	48.9	50.5	23.6	33.2	64.7	46.9	42.9
Rb (ppb)	15.1	8.5	8.2	20.2	18.5	10.3	10.5	14	13.9	17.4
Sb (ppb)	1.6	< 0.9	1.5	2.3	3.6	< 0.9	1.5	1.6	< 0.9	2.8
Sn (ppb)	0.48	0.12	0.12	0.83	1.72	0.13	0.22	0.32	0.15	1.03
Ta (ppb)	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Te (ppb)	11.8	3.8	12.3	31.7	30.3	4.1	10	19.4	9.7	29.3
Ti (ppb)	0.39	0.53	2.68	2.4	1.5	0.54	2.1	3.92	1.38	1.8
V (ppb)	10.4	8.1	18.8	21.2	22.4	9.09	18.2	26.8	12	18.9
W (ppb)	0.05	0.1	0.16	0.1	0.2	0.08	2.11	1.18	0.25	0.19
Zn (ppb)	19,200	10,400	12,200	19,400	22,400	11,200	15,200	30,500	18,700	16,700
Zr (ppb)	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Rare Earth Elements										
Sc (ppb)	0.8	0.6	7.9	4.1	0.9	0.6	1.7	5.2	2.3	2.2
Y (ppb)	41.3	21.2	22.3	50.2	55.3	22.4	30.2	53.4	43.9	43.6
La (ppb)	19.8	8.1	46	24	18.2	7.4	16.4	44.7	22.7	21.9
Ce (ppb)	46.8	17.9	160	82	41.6	17.1	44.9	136	60.4	57.6
Pr (ppb)	6.4	2.6	7.8	8.9	5.8	2.4	7	18.8	9	8.6
Nd (ppb)	29.2	11.4	35.4	41.5	26.1	11.2	31.7	85.6	41.1	40.3
Sm (ppb)	8.8	3.5	8.5	11.8	7.8	3.5	8.3	20.7	10.7	12
Eu (ppb)	4.1	1.7	2.7	4.8	3.4	1.6	3.1	6.8	4.1	4.8
Gd (ppb)	15.7	6.4	9.28	16.8	12.6	6.46	11.3	24.7	15.1	17.3
Tb (ppb)	2.3	1	3.3	2.7	2	0.9	1.6	3.4	2.17	2.4
Dy (ppb)	11.7	4.7	6	12.6	9.5	4.7	7.8	16.4	10.5	12.3
Ho (ppb)	1.9	0.8	1	2	1.6	0.8	1.2	2.6	1.67	2
Er (ppb)	4.4	1.7	2.2	4.5	3.6	1.7	2.9	6.1	3.8	4.4
Tm (ppb)	0.5	0.2	0.7	0.5	0.4	0.2	0.3	0.7	0.44	0.5
Yb (ppb)	2.6	1	1.4	2.8	2.2	1	1.8	3.9	2.39	2.7
Lu (ppb)	0.3	0.1	0.1	0.3	0.3	0.1	0.2	0.5	0.3	0.3
Total REE (ppb)	196.6	82.9	314.6	269.5	191.3	82.06	170.4	429.5	230.6	232.9
Total LREE (ppb)	130.8	51.6	269.7	189.8	115.5	49.66	122.7	337.3	163.1	162.5
Total HREE (ppb)	65	30.7	37	75.6	74.9	31.8	46	87	65.17	68.2

Notes:

pH, temperature, dissolved oxygen (DO), and conductivity measured in the field.

Total REEs (includes REE + Sc), LREEs, and HREEs non-detects were included at half the reporting limit.

gpm - gallons per minute

HREE - heavy REEs (Tb,Dy, Ho, Er, Tm, Yb, Lu, Y)

L/min - liters per minute

E - estimated, informational purposes, holding time exceedence or other issue

LREE - light REEs (La, Ce, Pr, Nd, Sm, Eu, Gd)

mg/L - milligrams per liter

na - not available

ppm - parts per million

ppb - parts per billion

uS/cm - microsiemens per centimeter

Table 14 - Summary of Summitville Dam Impoundment and Reynolds Adit results.

General Location	Reynolds Adit	Reynolds Adit	Summitville Dam Impoundment Effluent	Summitville Dam Impoundment Effluent	Summitville Dam Impoundment Effluent	Summitville Dam Impoundment Effluent
SampleID	SV-01-24-001	SV-04-24-001	SV-02-24-001	SV-03-24-001	SV-05-24-001	SV-04-24-003
Date Sampled	5/7/2024	6/28/2024	5/30/2024	6/14/2024	7/18/2024	6/28/2024
pH	2.91	2.65	3.63	3.04	2.94	2.86
Temperature (°C)	14.4	9.3	16.5	na	15.4	12.6
DO (mg/L)	4.77	1.8	7.58	6	4.35	7.7
Conductivity (uS/cm)	2,360	4,160	827	1,166	1,261	2,660
Flow (gpm)	31.9	145	1,800	na	1,208	1,254
Flow (L/min)	121	549	6,814	na	4,573	4,747
Alkalinity (mg/L CaCO ₃)	< 10	na	< 25	< 25	< 1	na
Al (ppb)	132,000	181,000	14,000	28,500	49,500	111,000
As (ppb)	344	947	6.6	53.5	79.2	531
Ba (ppb)	11.1	7.07	12.9	15.1	7.24	10.8
Be (ppb)	17.1	35	2.49	5.96	10.1	21.3
Bi (ppb)	0.34	1.86	0.02	0.11	0.18	1.35
Co (ppb)	319	592	58.7	98.2	221	349
Cr (ppb)	21.2	43.3	1.43	4.58	9.64	25.2
Cs (ppb)	1	0.9	0.1	0.2	0.3	0.6
Cu (ppb)	21,300	47,100	2,380	6,040	13,000	29,300
Ga (ppb)	8.6	26.7	0.5	2.1	5.2	14.6
Ge (ppb)	6.3	12.1	0.7	1.5	3.4	7.7
Hf (ppb)	< 0.1	0.1	< 0.1	< 0.1	< 0.1	< 0.1
Hg (ppb)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
In (ppb)	8.9	22.5	0.2	1.5	4.1	11.4
Li (ppb)	25.3	45.3	6.4	11.8	16	28.9
Mg (ppb)	37,800	48,900	16,400	16,600	26,100	33,400
Mn (ppb)	16,700	22,600	3,910	5,200	9,720	14,500
Nb (ppb)	< 0.1	< 0.01	< 0.1	< 0.1	< 0.1	< 0.01
Ni (ppb)	411	701	75.7	125	245	440
Rb (ppb)	16.4	14.7	3.3	4.4	7.7	11.2
Sb (ppb)	4.5	12.3	< 0.9	< 0.9	1.3	7.5
Sn (ppb)	< 0.06	0.16	< 0.06	< 0.06	< 0.06	0.08
Ta (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Te (ppb)	1.9	9.1	< 0.1	0.5	1.2	5.1
Ti (ppb)	0.27	0.56	0.33	0.44	0.37	0.52
V (ppb)	37.5	76.5	0.32	2.1	5.44	41.6
W (ppb)	0.17	0.24	57.7	0.08	0.05	0.14
Zn (ppb)	14,800	22,000	1,500	3,190	5,910	13,100
Zr (ppb)	< 2	< 2	< 2	< 2	< 2	< 2
Rare Earth Elements						
Sc (ppb)	5.3	15.2	1.1	2.3	4.4	9.3
Y (ppb)	92.1	139	16	25.7	53.7	86.8
La (ppb)	63.6	154	15.2	25.5	51.5	83.5
Ce (ppb)	153	327	34.5	56.6	120	194
Pr (ppb)	18.6	37.9	4.5	7.2	14.3	23.5
Nd (ppb)	82.4	162	18.9	30.5	59.7	98.5
Sm (ppb)	18	35.4	3.6	6.1	12.1	20.6
Eu (ppb)	5.4	9.9	1	1.6	3.4	5.8
Gd (ppb)	24.2	43.8	4.22	7.07	15.5	25.1
Tb (ppb)	3.5	6.12	0.5	0.9	2	3.47
Dy (ppb)	18.7	30.9	2.8	4.7	10	18.2
Ho (ppb)	3.4	5.6	0.5	0.8	1.9	3.26
Er (ppb)	8.8	14.7	1.2	2.1	4.8	8.26
Tm (ppb)	1.1	1.83	0.2	0.3	0.6	1.04
Yb (ppb)	6.6	10.9	0.9	1.6	3.5	6.25
Lu (ppb)	1	1.6	0.1	0.2	0.5	0.9
Total REE (ppb)	505.7	995.9	105.2	173.2	357.9	588.5
Total LREE (ppb)	365.2	770.0	81.9	134.6	276.5	451.0
Total HREE (ppb)	135.2	210.7	22.2	36.3	77.0	128.2

Notes:

pH, temperature, dissolved oxygen (DO), and conductivity measured in the field.

Total REEs (includes REE + Sc), LREEs, and HREEs non-detects were included at half the reporting limit.

gpm - gallons per minute

HREE - heavy REEs (Tb,Dy, Ho, Er, Tm, Yb, Lu, Y)

L/min - liters per minute

LREE - light REEs (La, Ce, Pr, Nd, Sm, Eu, Gd)

mg/L - milligrams per liter

na - not available

ppm - parts per million

ppb - parts per billion

uS/cm - microsiemens per centimeter

Table 15 - Summary of water treatment plant residual solids.

Sample location	Argo WTP	NCC WTP	LMDT WTP	LMDT WTP ¹	Eagle Mine WTP	Gladstone WTP	St. Louis Tunnel			
Sample name	23-ARG-WTP-GRAB	23-BHK-WTP-GRAB	23-LVL-WTP-GRAB	23-LVL-WTP-GRAB-DUP	23-EGL-WTP-GRAB	23-GLN-WTP-GRAB	23-SLT-WTP-GRAB			
<i>Al₂O₃</i> (%)	4.2	0.65	2.31	2.32	1.3	11.55	10.91			
<i>BaO</i> (%)	<0.01	<0.01	0.06	0.06	<0.001	<0.01	0.05			
CaO (%)	13.35	18.35	7.19	7.24	0.32	5.0	1.38			
<i>Cr₂O₃</i> (%)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01			
Fe ₂ O ₃ (%)	17.57	28.92	13.67	13.66	62.45	26.69	21.41			
K ₂ O (%)	0.03	0.03	0.1	0.11	0.03	<0.01	2.64			
<i>MgO</i> (%)	9.76	5.75	9.17	9.25	0.16	2.36	1.69			
<i>MnO</i> (%)	8.57	5.45	6.4	6.41	0.06	7.13	2.35			
Na ₂ O (%)	0.06	0.03	0.13	0.18	<0.01	0.04	0.62			
P ₂ O ₅ (%)	0.04	0.03	0.09	0.09	0.03	0.57	0.15			
SiO ₂ (%)	6.42	7.09	14.35	14.55	2.62	6.29	41.94			
SrO (%)	0.02	0.04	0.02	0.01	<0.001	0.04	0.04			
<i>TiO₂</i> (%)	<0.01	0.01	0.02	0.01	<0.01	<0.01	0.39	Avg. bulk continental crust ²	5x Avg. bulk continental crust ²	10x Avg. bulk continental crust ²
<i>V₂O₅</i> (%)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01			
LOI (%)	5.60	17.30	30.41	2.35	na	7.29	26.93			
<i>Pd</i> (ppb)	<1	<1	<1	<1	<1	<1	1	1	5	10
<i>Pt</i> (ppb)	<10	<10	<10	<10	<10	<10	<10	na	na	na
<i>As</i> (ppm)	50	6	33	32	6,748	51	26	1	5	10
<i>Ba</i> (ppm)	23	35	520	524	<10	<10	528	250	1250	2500
<i>Be</i> (ppm)	12	6	<5	<5	8	22	9	1.5	7.5	15
<i>Bi</i> (ppm)	<0.1	<0.1	<0.1	<0.1	0.3	13.7	5	0.06	0.3	0.6
<i>Co</i> (ppm)	127	193	23.3	23.3	1.7	207	44.2	29	145	290
<i>Cr</i> (ppm)	13	<10	35	36	<10	<10	37	185	925	1850
<i>Cs</i> (ppm)	<0.1	0.1	0.6	0.5	0.4	0.4	6.8	1.5	7.5	15
<i>Cu</i> (ppm)	4,097	557	451	455	5,692	>10,000	3736	75	375	750
<i>Ga</i> (ppm)	12	10	11	11	10	16	26	18	90	180
<i>Ge</i> (ppm)	<1	<1	<1	<1	4	<1	1	1.6	8	16
<i>Hf</i> (ppm)	<1	<1	<1	<1	<1	<1	5	3	15	30
<i>In</i> (ppm)	1	<0.2	10.2	10.2	1.7	19	3.7	0.05	0.25	0.5
<i>Li</i> (ppm)	<10	<10	<10	<10	<10	<10	25	13	65	130
<i>Mn</i> (ppm)	64,382	41,553	48,243	48,914	541	55,013	18,895	1,400	7000	14000
<i>Nb</i> (ppm)	<1	<1	<1	<1	<1	<1	12	11	55	110
<i>Ni</i> (ppm)	242	344	96	97	10	138	32	128	640	1280
<i>Rb</i> (ppm)	1.1	1.5	4.9	4.9	1.6	0.8	88.8	37	185	370
<i>Sb</i> (ppm)	1.2	0.3	0.4	0.5	6.1	4.5	4.3	0.2	1	2
<i>Sn</i> (ppm)	<1	<1	<1	<1	<1	2.0	2.0	2.5	12.5	25
<i>Ta</i> (ppm)	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.7	1	5	10
<i>Te</i> (ppm)	0.51	<0.05	0.1	0.1	7.73	39.4	1.08	na	na	na
<i>V</i> (ppm)	<5	<5	<5	<5	na	46	49	230	1150	2300
<i>W</i> (ppm)	<1	<1	<1	<1	<1	<1	15	1	5	10
<i>Zn</i> (ppm)	>10,000	9,219	>10,000	>10,000	>10,000	>10,000	>10,000	80	400	800
<i>Zr</i> (ppm)	7.2	9.5	6.5	4.3	12.8	4.7	170	100	500	1000
Rare Earth Elements										
<i>Sc</i> (ppm)	6.0	<5	<5	<5	<5	<5	9.0	30	150	300
<i>La</i> (ppm)	138	95.3	14.3	14.4	7.5	48.9	56.4	16	80	160
<i>Ce</i> (ppm)	309	208	33.9	34	19.3	111	120	33	165	330
<i>Pr</i> (ppm)	41.28	28.48	5.21	5.25	2.49	15.88	14.63	3.9	19.5	39
<i>Nd</i> (ppm)	158	113	21.6	21.6	10.9	68.7	53.3	16	80	160
<i>Sm</i> (ppm)	34.3	24.2	5.9	5.8	3.5	21.2	10.9	3.5	17.5	35
<i>Eu</i> (ppm)	6.41	4.46	1.83	1.88	1.74	9.51	2.06	1.1	5.5	11
<i>Gd</i> (ppm)	38.13	30.96	7.22	7.1	6.17	38.66	11.02	3.3	16.5	33
<i>Tb</i> (ppm)	5.12	4.29	0.95	0.97	0.83	5.19	1.58	0.6	3	6
<i>Dy</i> (ppm)	28.98	25.02	5.2	5.18	4.32	26.4	9.24	3.7	18.5	37
<i>Ho</i> (ppm)	5.35	5.0	0.94	0.96	0.83	4.32	1.85	0.78	3.9	7.8
<i>Er</i> (ppm)	14.11	13.09	2.5	2.46	2.1	9.52	5.01	2.2	11	22
<i>Tm</i> (ppm)	1.82	1.61	0.3	0.31	0.24	1.09	0.7	0.32	1.6	3.2
<i>Yb</i> (ppm)	10.7	9.1	1.7	1.8	1.3	5.6	4.2	2.2	11	22
<i>Lu</i> (ppm)	1.56	1.34	0.26	0.25	0.19	0.66	0.61	0.3	1.5	3
<i>Y</i> (ppm)	175	175	31.6	31.2	35.2	134	58.3	20	100	200
Total REEs	973.76	738.85	133.41	133.16	96.61	500.63	358.8			
TotalLREEs	725.12	504.4	89.96	90.03	51.6	313.85	268.31			
TotalHREEs	242.64	234.45	43.45	43.13	45.01	186.78	81.49			

Notes:

- 1 - duplicate sample. All results from lab job number MRP-20751.
- 2 - Average upper and bulk continental crust from Taylor and McClenнан (2003).
- Bold italic elements/compounds associated with USGS or DOE (e.g. Cu) critical minerals.
- Bold resutls over 10x average buk continental crust, italics over 5x.
- HREE - heavy REEs, Tb, Dy, Ho, Er, Tm, Yb, Lu, Y
- LMDT - Leadville Mine Drainage Tunnel

- LREE - light REEs, La, Ce, Pr, Nd, Sm, Eu, Gd
- na - not available
- NCC - North Clear Creek
- Total REEs = REEs + Sc + Y
- WTP - water treatment plant

Table 16 - Ranges of field parameters, discharge, and critical mineral concentrations at all the sites.

	Eagle WTP (n = 10)						Eagle Mine North Groundwater Extraction Trench (n=10)						Leadville Mine Drainage Tunnel WTP (n=10)						Argo Tunnel (n=10)						
	Min	Max	Median	Mean	25th	75th	Min	Max	Median	Mean	25th	75th	Min	Max	Median	Mean	25th	75th	Min	Max	Median	Mean	25th	75th	
pH	5.14	6.1	5.88	5.75	5.57	5.93	6.21	6.63	6.49	6.46	6.40	6.54	6.1	7.4	7.03	6.93	6.77	7.16	2.48	2.89	2.75	2.75	2.69	2.83	
Temperature (°C)	6.9	19.7	17.4	15.6	14.0	18.0	8.8	18.6	11.7	12.5	11.1	13.4	6.7	13.3	9.55	9.6	8.1	11.0	7.6	18.5	15.2	14.4	13.0	16.0	
DO (mg/L)	1.48	4.04	1.95	2.21	1.75	2.49	2.21	5.58	2.93	3.639	2.49	5.10	6.29	8.8	7.67	7.60	7.33	7.89	3.64	7.63	5.45	5.51	4.82	6.19	
Conductivity (uS/cm)	2,005	3,040	2,790	2,708	2,570	2,919	1,679	2,850	2,560	2,493	2,448	2,710	347	570	451	461	377	546	2,470	3,650	3,095	3,051	2,858	3,263	
Flow (gpm)	132	230	163	174	149	191	na	na	na	na	na	na	820	1,355	1,111	1,085	983	1,183	144	228	198	199	192	216	
Flow (L/min)	500	871	615	657	564	724	na	na	na	na	na	na	3,104	5,129	4,206	4,108	3,721	4,476	545	861	748	753	726	818	
Alkalinity (mg/L as CaCO ₃)	10	102	41	46.8	23.8	60.9	< 8	106	42.7	44.2	8.0	67.0	39.4	163	127	119.3	120	129	< 1	< 25	5	5.3	5	5	
Al (ppb)	244	848	310.5	366.8	267.5	350.5	< 1	634	156	202.2	13	323.3	130	2,960	466	729.4	193.5	881.8	13,500	27,100	18,300	19,890	17,025	24,300	
As (ppb)	67.5	275	135.5	141.71	100.9	170.0	1.9	364.0	263.5	191.0	42.4	300.3	0.4	3.3	1.3	1.4	1.1	1.4	41.7	86.8	54.4	62.0	50.4	75.0	
Ba (ppb)	8.7	11.5	11.0	10.8	10.6	11.3	9.5	13.9	11.9	11.7	11.1	12.5	70.1	82.5	75.2	75.9	74.6	76.4	1.6	3.3	2.0	2.1	1.8	2.1	
Be (ppb)	0.31	1.04	0.61	0.63	0.57	0.70	0.02	0.41	0.21	0.19	0.05	0.29	0.02	0.50	0.10	0.12	0.04	0.12	5.64	15.80	10.59	10.92	8.77	13.25	
Bi (ppb)	0.02	0.21	0.03	0.05	0.02	0.04	< 0.01	0.06	0.01	0.01	0.01	0.01	< 0.01	0.08	0.01	0.01	0.01	0.01	0.02	0.06	0.04	0.04	0.03	0.04	
Co (ppb)	9.1	20.2	15.5	15.0	14.3	16.7	6.9	9.2	8.4	8.2	7.6	9.0	0.3	3.9	1.0	1.3	0.6	1.7	103.0	135.0	119.0	118.2	110.5	124.5	
Cr (ppb)	0.17	3.53	0.25	0.66	0.21	0.38	< 0.08	0.35	0.08	0.12	0.04	0.19	0.18	1.15	0.35	0.39	0.24	0.36	6.05	20.70	8.32	9.38	6.97	9.32	
Cs (ppb)	5.3	7.1	6.5	6.4	6.0	6.9	6.1	10.6	9.4	9.1	9.2	9.8	< 0.1	0.2	0.1	0.1	0.1	0.1	5.4	9.0	7.0	7.0	5.7	8.3	
Cu (ppb)	226.0	920.0	267.5	346.9	253.3	311.0	1.4	5.2	2.4	2.7	1.9	3.5	5.3	203.0	23.1	45.1	10.1	55.6	3,180	6,920	3,774	4,308	3,320	5,100	
Ga (ppb)	0.30	1.90	0.95	1.01	0.80	1.08	< 0.10	1.00	0.75	0.66	0.63	0.80	< 0.10	0.40	0.08	0.11	0.05	0.10	2.50	12.60	6.25	6.80	5.40	7.63	
Ge (ppb)	0.80	1.60	1.25	1.23	1.13	1.40	1.10	4.70	2.40	2.62	1.40	3.70	< 0.10	3.30	0.20	0.50	0.09	0.20	1.00	7.60	6.50	6.03	5.73	7.08	
Hf (ppb)	< 0.10	0.20	0.05	0.09	0.05	0.09	< 0.10	0.20	0.05	0.07	0.05	0.05	< 0.10	< 0.10	0.05	0.05	0.05	0.05	< 0.10	0.30	0.08	0.13	0.05	0.18	
In (ppb)	< 0.10	1.00	0.40	0.42	0.31	0.48	< 0.01	< 0.10	0.05	0.05	0.05	0.05	< 0.10	6.30	0.59	1.21	0.25	1.28	0.10	2.80	1.55	1.52	1.13	2.06	
Li (ppb)	18.80	28.00	23.90	22.93	19.73	24.80	95.10	182.00	145.00	140.71	121.00	156.00	1.30	6.00	2.35	2.74	1.80	3.30	16.20	43.50	31.05	31.29	26.05	37.58	
Mg (ppb)	164,000	231,000	202,500	199,100	185,000	213,000	151,000	192,000	182,000	173,800	158,750	186,250	17,200	33,500	27,600	25,760	21,700	28,900	77,400	108,000	91,650	91,300	84,200	97,200	
Mn (ppb)	15,600	32,500	24,750	24,640	23,075	26,975	52,400	77,600	59,500	60,780	58,350	61,400	634	6,850	2,130	2,472	1,114	3,178	59,500	90,100	78,850	75,710	64,900	83,400	
Nb (ppb)	< 0.01	< 0.10	0.050	0.046	0.05	0.05	< 0.01	< 0.10	0.050	0.046	0.05	0.05	< 0.01	< 0.10	0.05	0.046	0.05	0.05	< 0.10	0.12	0.050	0.062	0.05	0.05	
Ni (ppb)	34.0	79.0	55.0	53.7	48.1	58.1	14.9	24.6	17.6	17.9	16.2	18.4	0.9	9.7	2.9	3.2	1.6	3.7	164.0	221.0	182.0	184.9	170.5	195.8	
Rb (ppb)	27.60	46.80	35.00	34.80	32.33	35.70	19.20	41.40	27.95	28.65	27.00	29.38	0.60	1.00	0.80	0.81	0.80	0.88	22.80	44.40	25.30	27.65	24.08	26.60	
Sb (ppb)	< 0.90	< 0.90	0.45	0.45	0.45	0.45	< 0.90	< 0.90	0.45	0.45	0.45	0.45	< 0.90	< 0.90	0.45	0.45	0.45	0.45	1.40	1.80	1.50	1.55	1.50	1.60	
Sn (ppb)	0.060	8.5	0.045	0.910	0.030	0.078	< 0.060	0.110	0.030	0.054	0.030	0.075	< 0.060	0.070	0.030	0.034	0.030	0.030	< 0.060	21.700	0.030	2.343	0.030	0.030	
Ta (ppb)	< 0.1	< 0.1	0.05	0.05	0.05	0.05	< 0.1	< 0.1	0.05	0.05	0.05	0.05	< 0.1	< 0.1	0.05	0.05	0.05	0.05	< 0.1	0.1	0.05	0.055	0.05	0.05	
Te (ppb)	0.50	1.70	0.80	0.87	0.63	1.05	< 0.10	< 0.10	0.05	0.05	0.05	0.05	< 0.10	0.50	0.05	0.12	0.05	0.05	0.50	1.30	0.85	0.89	0.80	1.00	
Ti (ppb)	0.10	0.48	0.25	0.27	0.18	0.37	< 0.05	0.56	0.22	0.23	0.13	0.29	< 0.05	0.22	0.15	0.13	0.09	0.16	0.58	4.40	0.88	1.30	0.74	1.10	
V (ppb)	0.090	0.370	0.150	0.160	0.110	0.160	0.010	0.100	0.080	0.064	0.025	0.098	0.040	0.220	0.085	0.093	0.070	0.100	4.850	7.260	6.315	6.061	5.190	6.818	
W (ppb)	0.02	200.00	0.54	21.88	0.02	3.16	< 0.02	2.60	0.07	0.57	0.04	0.59	< 0.02	6.54	0.53	1.42	0.01	1.44	< 0.02	12.30	0.12	1.39	0.06	0.26	
Zn (ppb)	22,800	96,200	51,700	53,280	37,650	60,850	9,100	15,500	13,400	12,890	11,175	14,600	1,410	19,700	4,625	5,906	2,383	7,438	27,100	44,000	38,000	37,060	31,800	42,650	
Zr (ppb)	< 2	< 2	1	1	1	1	< 2	< 2	1	1	1	1	< 2	< 2	1	1	1	1	< 2	< 2	1	1	1	1	
Rare Earth Elements																									
Sc (ppb)	0.2	td																							

Table 16 (cont.) - Ranges of field parameters, discharge, and critical mineral concentrations at all the sites.

	Virginia Canyon (n=10)						Big Five Tunnel (n=10)						North Clear Creek WTP (n=10)						Nelson Tunnel (n=10)					
	Min	Max	Median	Mean	25th	75th	Min	Max	Median	Mean	25th	75th	Min	Max	Median	Mean	25th	75th	Min	Max	Median	Mean	25th	75th
pH	3.24	3.49	3.36	3.37	3.32	3.41	5.28	5.88	5.52	5.55	5.38	5.72	4.42	5.46	4.88	4.92	4.84	5.05	4.28	5.18	4.65	4.67	4.54	4.72
Temperature (°C)	6.1	18	12.5	12.4	9.7	15.0	9	18	13.9	13.8	13	14.5	8.3	16.4	14.8	13.8	13.3	15.2	7.4	23	16.9	15.1	11.5	18.1
DO (mg/L)	6.28	9.1	7.17	7.41	7.10	7.74	3.09	6.58	5.07	5.09	4.40	5.93	6.79	7.84	7.51	7.44	7.25	7.60	5.98	6.71	6.32	6.35	6.26	6.40
Conductivity (uS/cm)	1,519	2,450	1,968	2,009	1,838	2,208	1943	2840	2510	2496.3	2407.5	2630	1616	2420	2053.5	2052.1	1975.25	2086.25	787	1152	1011.5	985.7	845.75	1113.25
Flow (gpm)	8	38	11	14	10	15	14	29	21	20	15	23	135	180	156	155	140	165	315	346	321	325	315	333
Flow (L/min)	30	145	41	54	36	58	55	109	78	77	58	88	511	681	591	587	530	626	1,192	1,310	1,215	1,231	1,192	1,261
Alkalinity (mg/L as CaCO ₃)	< 1	< 25	5	5.3	5	5	< 1	< 25	5	5.3	5	5	< 1	< 25	5	5.4	5	5	< 1	< 25	5	6.2	5	5
Al (ppb)	31,800	66,100	46,050	46,410	43,900	48,475	604	2,970	1,295	1,476	885.8	1,833	1,050	2320	1,665	1,703	1,513	1,988	270	1,800	619.5	719.9	361.5	718.5
As (ppb)	1.5	13.8	2.8	4.0	2.2	4.3	3.3	20.7	6.4	7.8	4.2	7.2	3.2	4.9	4.3	4.2	3.9	4.7	2.8	8.7	7.4	7.0	6.8	8.2
Ba (ppb)	6.5	38.8	10.1	12.4	8.3	11.0	10.2	11.7	11.3	11.1	10.7	11.6	6.8	8.0	7.2	7.2	6.8	7.6	13.9	20.1	16.5	16.8	15.7	18.2
Be (ppb)	7.08	15.40	9.92	10.32	8.99	11.38	1.04	3.04	2.08	2.04	1.56	2.54	2.25	4.80	3.46	3.52	2.94	4.05	1.74	3.68	3.08	3.03	2.82	3.53
Bi (ppb)	< 0.01	0.09	0.01	0.01	0.01	0.01	< 0.01	< 0.01	0.01	0.01	0.01	0.01	< 0.01	0.01	0.01	0.01	0.01	0.01	< 0.01	0.01	0.01	0.01	0.01	0.01
Co (ppb)	108.0	233.0	197.0	183.8	163.3	209.5	90.2	112.0	98.6	99.4	94.0	103.8	94.8	130.0	108.5	110.2	105.8	114.3	17.3	28.6	26.1	25.0	24.2	27.5
Cr (ppb)	9.42	16.30	12.90	12.87	11.23	14.38	0.15	0.53	0.21	0.25	0.16	0.25	< 0.08	0.19	0.15	0.13	0.10	0.18	< 0.08	0.16	0.04	0.08	0.04	0.12
Cs (ppb)	0.1	0.5	0.3	0.3	0.2	0.3	7.1	9.6	8.9	8.5	7.9	9.2	6.9	10.3	8.6	8.7	7.6	10.0	12.8	20.2	17.3	17.2	15.6	19.0
Cu (ppb)	4,600	7,600	6,130	6,102	5,722	6,528	89.2	420.0	183.0	198.2	125.0	211.0	261.0	635.0	425.0	405.7	302.8	450.5	27.7	560.0	93.5	151.0	39.8	119.5
Ga (ppb)	2.60	18.90	4.95	7.13	4.15	8.68	0.20	2.00	0.60	0.68	0.53	0.60	0.60	5.60	1.85	2.39	1.63	3.20	0.40	4.20	1.50	1.80	1.33	1.98
Ge (ppb)	< 0.10	6.90	5.05	4.83	4.53	6.43	1.00	5.30	2.15	2.39	2.00	2.53	3.50	7.10	4.00	4.36	3.60	4.80	0.90	2.30	1.30	1.44	1.23	1.50
Hf (ppb)	< 0.10	0.20	0.10	0.10	0.05	0.10	< 0.10	0.20	0.05	0.07	0.05	0.05	< 0.10	0.10	0.05	0.06	0.05	0.05	< 0.10	0.70	0.05	0.12	0.05	0.05
In (ppb)	< 0.10	0.60	0.45	0.41	0.30	0.54	< 0.01	< 0.10	0.05	0.05	0.05	0.05	< 0.01	0.10	0.05	0.05	0.05	0.05	< 0.01	< 0.10	0.05	0.05	0.05	0.05
Li (ppb)	38.60	78.30	55.65	56.65	50.70	61.73	48.10	75.00	55.55	59.28	53.25	68.08	17.90	38.30	28.15	27.71	23.10	31.48	74.20	185.00	145.50	139.62	121.25	154.25
Mg (ppb)	60,800	87,000	67,150	70,230	65,650	70,975	101,000	138,000	124,500	122,600	115,000	130,000	60,900	79,900	74,200	72,180	65,525	79,200	5,830	10,600	9,210	8,771	7,793	10,210
Mn (ppb)	26,800	60,900	47,100	46,980	41,775	56,050	24,000	29,400	27,000	27,000	26,575	28,450	18,900	27,700	23,600	23,450	22,200	24,275	7,230	16,200	13,650	12,958	11,275	15,225
Nb (ppb)	< 0.030	0.20	0.05	0.078	0.05	0.10	< 0.010	0.100	0.05	0.051	0.05	0.05	< 0.010	< 0.10	0.05	0.046	0.05	0.05	< 0.01	0.30	0.05	0.071	0.05	0.05
Ni (ppb)	278.0	507.0	389.5	402.1	368.3	451.8	179.0	230.0	196.0	198.6	180.0	215.8	146.0	198.0	176.0	176.3	172.5	183.8	6.3	14.0	11.0	10.4	9.7	11.5
Rb (ppb)	6.90	20.50	12.00	12.76	10.08	14.65	35.00	62.10	44.60	45.52	43.30	45.88	34.40	52.40	39.70	40.52	38.18	41.28	17.50	25.50	21.30	21.26	20.90	21.50
Sb (ppb)	< 0.90	1.70	0.45	0.58	0.45	0.45	< 0.90	< 0.90	0.45	0.45	0.45	0.45	< 0.90	< 0.90	0.45	0.45	0.45	0.45	< 0.90	< 0.90	0.45	0.45	0.45	0.45
Sn (ppb)	< 0.060	0.100	0.030	0.041	0.030	0.030	< 0.060	0.180	0.030	0.056	0.030	0.068	< 0.060	0.280	0.050	0.082	0.030	0.108	< 0.060	0.180	0.030	0.045	0.030	0.03
Ta (ppb)	< 0.1	< 0.1	0.05	0.05	0.05	0.05	< 0.1	< 0.1	0.05	0.05	0.05	0.05	< 0.1	< 0.1	0.05	0.05	0.05	0.05	< 0.1	< 0.1	0.05	0.05	0.05	0.05
Te (ppb)	< 0.10	0.20	0.05	0.10	0.05	0.16	< 0.10	< 0.10	0.05	0.05	0.05	0.05	< 0.10	< 0.10	0.05	0.05	0.05	0.05	< 0.10	0.10	0.05	0.06	0.05	0.05
Ti (ppb)	1.05	112.00	1.63	12.80	1.47	1.86	0.11	0.21	0.17	0.17	0.15	0.20	0.15	2.09	0.20	0.42	0.15	0.32	0.14	0.70	0.36	0.37	0.21	0.45
V (ppb)	0.040	3.930	0.060	0.452	0.053	0.078	0.010	0.070	0.040	0.038	0.033	0.040	0.04	0.12	0.055	0.067	0.050	0.083	< 0.010	0.050	0.025	0.026	0.010	0.040
W (ppb)	< 0.02	1.13	0.08	0.20	0.07	0.17	0.04	17.00	0.12	2.02	0.07	0.41	< 0.02	0.24	0.03	0.05	0.01	0.04	< 0.02	120.00	0.05	12.08	0.02	0.14
Zn (ppb)	35,900	56,900	50,300	49,230	45,150	54,625	4,930	7,470	6,090	6,189	5,398	6,953	4,330	6,030	5,135	5,168	5,013	5,565	26,700	41,400	36,350	35,040	31,225	39,450
Zr (ppb)	< 2	< 2	1	1	1	1	< 2	< 2	1	1	1	1	< 2	< 2	1	1	1	1	< 2	< 2	1	1	1	1
Rare Earth Elements																								
Sc (ppb)	5.30	17.10	8.10	9.14	6.33	10.98	0.20	2.6																

Table 16 (cont.) - Ranges of field parameters, discharge, and critical mineral concentrations at all the sites.

	Gladstone WTP (n=10)						St. Louis Tunnel (n=10)						Reynolds Adit (n=2)						Summitville Dam Impoundment Effluent (n=3)					
	Min	Max	Median	Mean	25th	75th	Min	Max	Median	Mean	25th	75th	Min	Max	Median	Mean	25th	75th	Min	Max	Median	Mean	25th	75th
pH	2.76	5.5	3.12	3.56	3.00	3.61	6.33	6.9	6.6	6.57	6.38	6.64	2.65	2.91	2.78	2.78	2.72	2.85	2.94	3.63	3.04	3.20	2.99	3.34
Temperature (°C)	5.5	11.5	8.4	8.3	7.5	8.9	16.1	19.3	19	18.4	18.1	19.2	9.3	14.4	11.9	11.9	10.6	13.1	15.4	16.5	16.0	16.0	15.7	16.2
DO (mg/L)	5.84	8.25	7.52	7.34	6.87	7.7	3.54	5.06	4.39	4.38	4.01	4.88	1.8	4.77	3.29	3.29	2.54	4.03	4.35	7.58	6	5.98	5.18	6.79
Conductivity (uS/cm)	1564	2760	2146	2094.333	1740	2360	1027	1155	1122	1111.2	1112	1140	2360	4160	3260	3260	2810	3710	827	1261	1166	1084.7	996.5	1213.5
Flow (gpm)	200	460	300	327	269	409	168	1,000	870	695	562	873	32	145	88	88	60	117	1,208	1,800	1,504	1,504	1,356	1,652
Flow (L/min)	757	1,741	1,136	1,238	1,017	1,548	636	3,785	3,293	2,629	2,127	3,305	121	549	335	335	228	442	4,573	6,814	5,693	5,693	5,133	6,253
Alkalinity (mg/L as CaCO ₃)	< 1	< 25	5	6.2	5	5	35.7	118	97	89.6	87.3	110	< 10	10	5	5	5	5	< 1	< 25	12.5	8.5	6.5	12.5
Al (ppb)	9,130	46,100	21,650	23,009	15,125	28,575	254	2,080	1,090	1,217	1,050	1,610	132,000	181,000	156,500	156,500	144,250	168,750	14,000	49,500	28,500	30,667	21,250	39,000
As (ppb)	11.7	82.9	37.1	38.4	20.9	45.5	0.6	2.3	1.6	1.5	0.7	2.3	344.0	947.0	645.5	645.5	494.8	796.3	6.6	79.2	53.5	46.4	30.1	66.4
Ba (ppb)	7.4	16.7	9.0	9.6	8.6	9.4	16.9	23.8	19.4	20.0	18.6	21.1	7.1	11.1	9.1	9.1	8.1	10.1	7.2	15.1	12.9	11.7	10.1	14.0
Be (ppb)	2.81	7.88	5.76	5.53	4.37	6.63	0.42	0.98	0.92	0.79	0.65	0.98	17.10	35.00	26.05	26.05	21.58	30.53	2.49	10.10	5.96	6.18	4.23	8.03
Bi (ppb)	1.36	9.03	3.16	4.47	2.27	7.27	0.08	0.76	0.30	0.36	0.11	0.56	0.34	1.86	1.10	1.10	0.72	1.48	0.02	0.18	0.11	0.10	0.07	0.15
Co (ppb)	41.8	92.5	72.2	67.2	49.4	80.8	2.3	8.0	3.3	4.2	2.6	5.0	319.0	592.0	455.5	455.5	387.3	523.8	58.7	221.0	98.2	126.0	78.5	159.6
Cr (ppb)	1.19	45.50	4.70	8.51	2.51	5.69	0.81	10.90	0.87	2.88	0.86	0.98	21.20	43.30	32.25	32.25	26.73	37.78	1.43	9.64	4.58	5.22	3.01	7.11
Cs (ppb)	2.9	10.3	6.3	6.6	5.4	8.1	0.5	0.6	0.5	0.5	0.5	0.5	0.9	1.0	1.0	1.0	0.9	1.0	0.1	0.3	0.2	0.2	0.2	0.3
Cu (ppb)	2,580	8,580	4,965	4,749	3,410	5,550	59.2	1,400	258.0	468.4	255.0	370.0	21,300	47,100	34,200	34,200	27,750	40,650	2,380	13,000	6,040	7,140	4,210	9,520
Ga (ppb)	1.60	19.90	4.80	6.55	3.55	6.30	0.20	1.00	0.70	0.64	0.60	0.70	8.60	26.70	17.65	17.65	13.13	22.18	0.50	5.20	2.10	2.60	1.30	3.65
Ge (ppb)	0.90	4.60	2.55	2.51	2.03	2.98	< 0.10	0.50	0.40	0.33	0.30	0.40	6.30	12.10	9.20	9.20	7.75	10.65	0.70	3.40	1.50	1.87	1.10	2.45
Hf (ppb)	< 0.10	1.00	0.05	0.23	0.05	0.20	< 0.10	0.30	0.05	0.11	0.05	0.10	< 0.10	0.10	0.08	0.08	0.06	0.09	< 0.10	< 0.10	0.05	0.05	0.05	0.05
In (ppb)	1.10	42.60	13.05	15.93	4.68	17.18	< 0.10	0.60	0.30	0.30	0.05	0.50	8.90	22.50	15.70	15.70	12.30	19.10	0.20	4.10	1.50	1.93	0.85	2.80
Li (ppb)	24.00	61.90	34.50	37.06	29.65	43.13	13.40	24.60	22.00	20.00	15.60	24.40	25.30	45.30	35.30	35.30	30.30	40.30	6.40	16.00	11.80	11.40	9.10	13.90
Mg (ppb)	8,350	29,600	19,050	18,835	15,375	21,600	13,400	20,200	19,100	18,220	18,400	20,000	37,800	48,900	43,350	43,350	40,575	46,125	16,400	26,100	16,600	19,700	16,500	21,350
Mn (ppb)	7,540	30,200	20,450	20,754	17,950	25,075	1,740	4,580	2,020	2,736	1,920	3,420	16,700	22,600	19,650	19,650	18,175	21,125	3,910	9,720	5,200	6,277	4,555	7,460
Nb (ppb)	< 0.01	0.20	0.05	0.061	0.05	0.05	< 0.10	< 0.10	0.05	0.05	0.05	0.05	< 0.01	< 0.10	0.028	0.028	0.016	0.039	< 0.10	< 0.10	0.05	0.05	0.05	0.05
Ni (ppb)	23.6	64.7	42.1	40.8	30.2	48.4	4.2	85.6	5.8	21.8	4.8	8.7	411.0	701.0	556.0	556.0	483.5	628.5	75.7	245.0	125.0	148.6	100.4	185.0
Rb (ppb)	8.20	20.20	13.95	13.66	10.35	16.83	4.70	10.30	5.80	6.62	5.60	6.70	14.70	16.40	15.55	15.55	15.13	15.98	3.30	7.70	4.40	5.13	3.85	6.05
Sb (ppb)	< 0.90	3.60	1.55	1.63	0.71	2.13	< 0.90	< 0.90	0.45	0.45	0.45	0.45	4.50	12.30	8.40	8.40	6.45	10.35	< 0.90	1.30	0.45	0.73	0.45	0.88
Sn (ppb)	0.120	1.720	0.270	0.512	0.135	0.743	< 0.060	1.870	0.090	0.454	0.080	0.200	< 0.060	0.160	0.095	0.095	0.063	0.128	< 0.060	< 0.060	0.030	0.030	0.030	0.030
Ta (ppb)	< 0.1	0.1	0.05	0.055	0.05	0.05	< 0.1	< 0.1	0.05	0.05	0.05	0.05	< 0.1	< 0.1	0.05	0.05	0.05	0.05	< 0.1	< 0.1	0.05	0.05	0.05	0.05
Te (ppb)	3.80	31.70	12.05	16.24	9.78	26.83	< 0.10	0.50	0.40	0.29	0.10	0.40	1.90	9.10	5.50	5.50	3.70	7.30	< 0.10	1.20	0.50	0.58	0.28	0.85
Ti (ppb)	0.39	3.92	1.65	1.72	0.75	2.33	0.20	0.46	0.30	0.32	0.25	0.39	0.27	0.56	0.42	0.42	0.34	0.49	0.33	0.44	0.37	0.38	0.35	0.41
V (ppb)	8.100	26.800	18.500	16.589	10.800	20.625	0.060	0.340	0.230	0.226	0.160	0.340	37.5	76.5	57.0	57.0	47.250	66.750	0.320	5.440	2.100	2.620	1.210	3.770
W (ppb)	0.05	2.11	0.18	0.44	0.10	0.24	0.12	1.32	0.80	0.75	0.27	1.25	0.17	0.24	0.21	0.21	0.19	0.22	0.05	57.70	0.08	19.28	0.07	28.89
Zn (ppb)	10,400	30,500	17,700	17,590	12,950	19,350	3,930	19,700	5,120	7,838	4,330	6,110	14,800	22,000	18,400	18,400	16,600	20,200	1,500	5,910	3,190	3,533	2,345	4,550
Zr (ppb)	< 2	< 2	1	1	1	1	< 2	< 2	1	1	1	1	< 2	< 2	1	1	1	1	< 2	< 2	1	1	1	1
Rare Earth Elements																								
Sc (ppb)	0.60	7.90	1.95	2.63																				

Table 17 - Summary of estimated loads for select critical minerals.

Site	Date Sampled	pH	Flow rate (L/min)	Al (kg/d)	Co (kg/d)	Cu (kg/d)	Mg (kg/d)	Mn (kg/d)	Ni (kg/d)	Zn (kg/d)	Total REE (kg/d)	Total LREE (kg/d)	Total HREE (kg/d)
Eagle Mine WTP	10/28/2022	6.05	681	0.28	0.01	0.27	197.22	18.54	0.04	22.37	0.01	0.004	0.003
	4/20/2023	5.93	598	0.21	0.01	0.22	154.16	13.44	0.03	22.05	0.00	0.002	0.002
	5/25/2023	5.14	606	0.74	0.02	0.80	186.64	26.08	0.07	77.97	0.02	0.01	0.01
	8/2/2023	5.48	625	0.32	0.02	0.24	183.48	29.23	0.05	47.76	0.01	0.005	0.003
	9/29/2023	5.87	500	0.18	0.01	0.17	118.00	17.05	0.04	28.71	0.01	0.003	0.003
	5/7/2024	5.26	549	0.37	0.01	0.33	146.22	18.18	0.04	76.04	0.01	0.004	0.003
	5/30/2024	5.92	852	0.41	0.02	0.32	257.56	31.64	0.07	76.53	0.01	0.004	0.004
	6/13/2024	5.88	871	0.42	0.02	0.39	273.31	33.35	0.07	70.46	0.01	0.01	0.004
	6/28/2024	6.10	738	0.30	0.02	0.33	245.54	28.81	0.07	53.47	0.01	0.004	0.003
	7/26/2024	5.84	553	0.21	0.01	0.18	147.23	18.54	0.04	29.37	0.01	0.004	0.003
Average daily estimated load (kg/d)				0.34	0.01	0.32	190.94	23.49	0.05	50.47	0.01	0.004	0.003
Leadville Mine Drainage Tunnel WTP	10/28/2022	7.05	4,588	0.86	0.003	0.04	139.40	4.81	0.01	9.32	0.01	0.01	0.005
	4/20/2023	7.08	4,391	1.01	0.004	0.04	183.37	9.23	0.01	14.61	0.01	0.01	0.01
	5/25/2023	6.96	3,104	3.47	0.009	0.26	126.50	16.00	0.02	34.86	0.06	0.04	0.01
	8/2/2023	7.23	4,505	2.47	0.005	0.11	152.44	11.55	0.02	25.23	0.04	0.03	0.01
	9/29/2023	7.40	5,129	2.17	0.002	0.10	127.04	4.68	0.01	10.93	0.03	0.02	0.01
	5/7/2024	6.61	3,880	5.12	0.01	0.29	150.30	16.54	0.01	35.48	0.06	0.04	0.02
	5/30/2024	6.10	3,407	14.52	0.02	1.00	164.35	33.61	0.05	96.65	0.15	0.11	0.04
	6/13/2024	7.01	3,668	5.19	0.01	0.30	151.07	17.17	0.02	43.10	0.06	0.04	0.02
	6/28/2024	6.70	4,247	3.37	0.01	0.18	177.98	15.17	0.02	32.78	0.05	0.03	0.01
	7/26/2024	7.18	4,164	0.86	0.003	0.05	122.32	5.98	0.01	15.59	0.02	0.01	0.01
Average daily estimated load (kg/d)				3.90	0.01	0.24	149.48	13.47	0.02	31.85	0.05	0.03	0.01
Argo Tunnel	11/12/2022	2.75	719	18.75	0.11	3.38	83.27	64.73	0.18	28.07	1.13	0.87	0.24
	4/20/2023	2.84	545	13.34	0.10	2.53	84.77	65.23	0.15	31.01	0.70	0.53	0.16
	5/25/2023	2.89	750	14.57	0.13	3.78	88.93	84.19	0.21	39.39	1.10	0.84	0.25
	8/2/2023	2.75	806	21.48	0.13	4.42	104.03	83.71	0.20	36.46	1.28	0.99	0.27
	9/29/2023	2.89	746	16.64	0.11	3.41	83.12	63.89	0.18	34.79	0.90	0.66	0.23
	5/13/2024	2.75	747	21.95	0.13	4.78	100.72	96.95	0.19	47.35	1.21	0.93	0.27
	5/30/2024	2.48	821	30.28	0.15	6.73	118.17	102.20	0.24	49.56	1.57	1.22	0.33
	6/13/2024	2.66	708	27.62	0.14	7.05	100.30	85.11	0.23	43.73	1.56	1.22	0.32
	7/1/2024	2.67	861	32.37	0.15	6.60	116.07	98.84	0.24	53.70	1.59	1.24	0.33
	7/25/2024	2.81	825	20.32	0.14	4.44	106.59	73.91	0.20	37.55	1.23	0.95	0.27
Average daily estimated load (kg/d)				21.73	0.13	4.71	98.60	81.88	0.20	40.16	1.23	0.95	0.27
Virginia Canyon	11/12/2022	3.35	30	2.81	0.01	0.28	3.51	2.59	0.02	2.42	0.08	0.06	0.02
	4/20/2023	3.49	42	2.98	0.01	0.35	5.26	3.54	0.03	3.33	0.08	0.06	0.02
	5/25/2023	3.40	145	9.56	0.04	1.59	13.49	9.14	0.09	11.17	0.32	0.24	0.08
	8/2/2023	3.30	32	2.01	0.01	0.25	3.23	2.63	0.02	2.12	0.07	0.05	0.01
	9/29/2023	3.41	63	4.19	0.02	0.57	6.08	4.71	0.04	4.99	0.11	0.08	0.03
	5/13/2024	3.46	73	3.35	0.01	0.48	6.40	2.82	0.03	3.78	0.09	0.07	0.02
	5/30/2024	3.24	42	2.63	0.01	0.36	3.95	2.10	0.02	2.65	0.07	0.05	0.02
	6/13/2024	3.32	38	2.55	0.01	0.36	3.69	2.26	0.02	2.68	0.07	0.06	0.02
	7/1/2024	3.32	36	2.57	0.01	0.32	3.36	2.46	0.02	2.66	0.07	0.06	0.02
	7/25/2024	3.36	41	2.37	0.01	0.33	4.15	2.69	0.02	2.61	0.08	0.06	0.02
Average daily estimated load (kg/d)				3.50	0.01	0.49	5.31	3.49	0.03	3.84	0.10	0.08	0.03
Big Five Tunnel	11/12/2022	5.85	57	0.05	0.01	0.01	9.40	2.24	0.01	0.40	0.005	0.003	0.001
	4/20/2023	5.75	55	0.05	0.01	0.01	9.73	2.13	0.02	0.43	0.004	0.003	0.001
	5/25/2023	5.88	61	0.22	0.01	0.04	9.59	2.31	0.02	0.56	0.02	0.02	0.01
	8/2/2023	5.63	83	0.14	0.01	0.01	14.99	3.53	0.02	0.69	0.01	0.01	0.003
	9/29/2023	5.57	79	0.09	0.01	0.01	11.56	2.76	0.02	0.62	0.01	0.004	0.002
	5/13/2024	5.46	89	0.18	0.01	0.03	16.65	3.69	0.03	0.95	0.01	0.01	0.003
	5/30/2024	5.28	109	0.25	0.02	0.03	20.34	4.21	0.03	1.10	0.01	0.01	0.004
	6/13/2024	5.36	106	0.45	0.02	0.05	20.99	4.08	0.03	1.14	0.02	0.01	0.01
	7/1/2024	5.28	76	0.21	0.01	0.02	15.04	3.16	0.03	0.74	0.01	0.01	0.003
	7/25/2024	5.44	55	0.09	0.01	0.01	9.09	1.90	0.01	0.42	0.01	0.004	0.002
Average daily estimated load (kg/d)				0.17	0.01	0.02	13.74	3.00	0.02	0.70	0.01	0.01	0.003
North Clear Creek WTP	11/1/2022	4.42	530	1.67	0.08	0.34	50.98	18.39	0.13	3.34	0.42	0.30	0.14
	4/20/2023	4.87	511	1.18	0.10	0.25	58.72	18.91	0.15	3.74	0.39	0.27	0.11
	5/25/2023	4.94	530	0.82	0.09	0.22	47.85	18.54	0.14	3.88	0.42	0.30	0.12
	8/2/2023	4.84	575	1.23	0.10	0.23	66.20	22.95	0.15	4.30	0.46	0.32	0.13
	9/29/2023	5.46	632	0.96	0.10	0.24	55.44	20.03	0.16	4.54	0.35	0.23	0.11
	5/13/2024	5.12	530	1.51	0.08	0.34	56.74	17.62	0.14	4.60	0.44	0.31	0.13
	5/30/2024	5.08	681	1.69	0.10	0.40	72.61	21.29	0.16	5.15	0.44	0.31	0.13
	6/13/2024	4.89	606	1.74	0.09	0.44	68.81	19.89	0.15	4.95	0.41	0.29	0.11
	7/1/2024	4.70	606	2.02	0.10	0.55	69.16	21.11	0.16	4.95	0.49	0.35	0.14
	7/25/2024	4.84	673	1.56	0.09	0.44	63.05	18.30	0.14	4.19	0.50	0.36	0.13
Average daily estimated load (kg/d)				1.44	0.09	0.34	60.96	19.70	0.15	4.36	0.43	0.30	0.12
Nelson Tunnel	11/18/2022	5.18	1,310	0.58	0.05	0.05	19.99	30.18	0.02	64.88	0.78	0.73	0.05
	4/23/2023	4.63	1,261	0.49	0.05	0.05	18.88	27.95	0.02	57.36	0.61	0.57	0.05
	5/30/2023	5.17	1,283	2.59	0.05	1.03	11.36	19.96	0.02	73.73	0.48	0.43	

APPENDICES

APPENDIX A

Appendix A

Additional Background - Site Geologic Information

The following sections give a summary of the geology associated with the sites sampled during this investigation. See **Table 3** in the report for a summary. See table at the end of this summary for a list of mineral chemical formulas referenced here. References are included in the reference section of the report.

Argo Tunnel, Big Five Tunnel, and Virginia Canyon

This area is included in the Central City-Idaho Springs polymetallic veins critical mineral focus area (Dicken and others, 2022). Most of the mineralization in both mining districts is in veins and/or stockwork within faults and fissures associated with the Precambrian rocks and related to the younger Laramide-age porphyritic intrusive rocks (Lovering and Goddard, 1950). The Idaho Springs Mining District, which the Virginia Canyon groundwater system drains water from, produced gold, silver, copper, lead, and zinc. The principal vein ore minerals include pyrite, sphalerite, galena, chalcopryite, and tennantite with quartz and carbonate mineral gangue (see the acronym list at the beginning of this document for the formulas for all the minerals referred to in this text). The vein deposits were classified generally as pyrite, pyritic copper, pyritic lead-zinc, and lead-zinc veins (Moench and Drake, 1966).

The Central City Mining District has several main types of ore and the bulk of it occurs within veins that follow minor fault zones with some bodies occurring in stockwork chimney-like zones of brecciation (Lovering and Goddard, 1950). This district primarily produced gold and silver with less amounts of copper, lead, zinc, and uranium. Generally, there are four main types of ore (Bastin and Hill, 1917 as summarized by Lovering and Goddard, 1950; see pages 173 to 175):

- Pyritic ore – predominately pyrite and gangue with lesser amounts of chalcopyrite, tennantite, gold, enargite (in places), and other metallic minerals. The gangue is predominately quartz but siderite and fluorite may be abundant in places. Gold and silver in these ores are associates with chalcopyrite and tennantite. Galena, sphalerite, molybdenite, and native bismuth are also present in various places.
- Galena-sphalerite ores – mostly galena, sphalerite, and pyrite with lesser amounts of chalcopyrite with minor tennantite and bornite. Enargite, native bismuth, and molybdenite also occur locally in minor amounts. Common gangue minerals include quartz, calcite, siderite, with minor rhodochrosite and barite in a few areas.
- Composite ores – includes a composite of the pyritic and galena-sphalerite ores. Some ores contain mostly pyrite with some chalcopyrite that have been brecciated with the fragments cemented by quartz, galena, sphalerite, and chalcopyrite.
- Telluride ores – Reported from some mines and consist of gold and silver tellurides in a gangue of quartz with minor amounts of fluorite, iron-bearing calcite, and pyrite. Reportedly, no tellurides of gold and silver occur in the pyritic or galena-sphalerite ores.
- Uranium ores – pitchblende occurs in areas of the district and generally occurs as a minor component of the pyritic ores.
- Secondary enrichment – Enrichment of gold, silver, and copper occurs between 50 and 150 feet below the surface but extends to 700 feet in some areas and includes several supergene minerals.

North Clear Creek WTP

This area is included in the Central City-Idaho Springs polymetallic veins critical mineral focus area (Dicken and others, 2022). Production from this area included gold, silver, copper, lead, and zinc. Gold was discovered in Gregory Gulch in 1859 (the first gold lode discovered in Colorado) and is located between Black Hawk and Central City, Gilpin County. The Gregory Incline slopes downward for 1,709 feet at ~25 degrees and intersects the Gregory vein at 700 feet. Production from this area included gold, silver, copper, lead, and zinc. The area in and around Gregory Gulch contains several mines including the well-known Bates-Hunter Mine. The

National Tunnel trends southwest ~3,130 feet and daylights near the junction of Running Gulch with North Clear Creek. Most of the mineralization is associated with veins and/or stockwork within faults and fissures associated with the Precambrian rocks and related to the younger Laramide-age porphyritic intrusive rocks (Lovering and Goddard, 1950). Between 1905 and 1937, the tunnel produced ore from veins that contained gold, silver, copper, lead, and zinc. Ore minerals included pyrite, gold, silver, tennantite, enargite, chalcopyrite, with minor galena and sphalerite, and quartz gangue (Sims and others, 1963).

Leadville Mine Drainage Tunnel

The Leadville Mining District is within the Central Colorado Mineral Belt carbonate-replacement deposit and Climax-Sweet Home critical mineral focus areas. The area contains several mineral deposit types (Dicken and others, 2022). The Leadville Mining District historically produced about: 8,400 tons of silver; 101 tons of gold; 1,200,000 tons of lead; 53,000 tons of copper; 1,235,000 tons of zinc; and 0.9 to 2.6 million tons of iron-manganese ore. Also, bismuth, a critical mineral, was produced as a byproduct of smelting in the district. Ore deposit types in the district include carbonate-replacement deposits (zinc-lead-silver-gold mantos and their oxidized equivalents), quartz-base-metal veins, magnetite-serpentine-gold replacement bodies, quartz-pyrite-gold-silver veins, and disseminated pyrite-gold in porphyry (Emmons and others, 1927; Cappa and Bartos, 2007). Much of the ore is associated with the carbonate-replacement deposits hosted in the Mississippian Leadville Dolomite. Minerals deposited in the district include pyrite, sphalerite, galena, chalcopyrite, tetrahedrite, pyrrhotite, marcasite, manganiferous siderite, rhodochrosite, electrum, and late-stage veinlets with elevated silver, gold, bismuth, and tellurium (Thomson and Arehart, 1990).

Analyses of the ores from the sulfide zones indicate that nearly all the galena in Leadville contains antimony, a critical mineral. Galena, or lead sulfide solid solution minerals, from the Leadville district contain up to 6,200 ppm antimony, up to 2,000 ppm tellurium, up to 1,200 ppm arsenic, and 5.5 to 11 weight % bismuth (Chapman and Stevens, 1933; Foord and Shawe, 1989). Bismuthinite, associated with argentite in inclusions within galena, is common at

Leadville in both primary and secondary ores (Eckel, 1961; Streufert and Cappa, 1994). Secondary oxides could also host germanium.

Eagle Mine WTP and North Groundwater Extraction Trench

The Eagle Mine is located within the Central Colorado Mineral Belt carbonate-replacement and Central Colorado sediment-hosted copper deposits critical mineral focus areas (Dicken and others, 2022). Between 1880 and 1972, the Eagle Mine, which closed in the late-1970s/early-1980s, produced zinc (~857,000 short tons), lead (~148,444 short tons), silver (over 66 million troy ounces), copper (~104,801 short tons), and gold (~393,491 troy ounces). The mine also historically produced manganiferous iron ore. The ore deposits are principally carbonate replacement deposits in the Mississippian Leadville Limestone (dolomite in this area), but some deposits occur in other formations including the Devonian Dyer Dolomite. Pyrite, siderite (containing about 10% manganese), and sphalerite constitute over ~90% of the total volume of the ore deposit which also contains galena, chalcopyrite, tetrahedrite, telluride, and other minerals (Lovering and others, 1978). Historical data indicates that arsenic, antimony, bismuth, and tellurium (all critical minerals) occur in some ores from the mining district. Silver and gold were also produced from other subordinate pyritic deposits that occur in the Cambrian Sawatch Quartzite where siderite, pyrite, marcasite and small amounts of sphalerite, chalcopyrite, galena, barite occur (Lovering and others, 1978). Silver and gold telluride minerals occur in veinlets within the quartzite and underlying Precambrian rocks (Lovering and others, 1978).

Nelson Tunnel

This area is included in Creede Mining District and the Central Colorado epithermal Au-Ag critical mineral focus area (Dicken and others, 2022). Mine production from the district through 1966 was 58 million ounces of silver; 150,000 ounces of gold; 2,300 tons of copper; 125,000 tons of lead, and 40,000 tons of zinc from 2 million tons of ore (Neubert and Wood, 2000). The Nelson Tunnel drains the Amethyst Mine which was one of the largest producers in the mining district. Many of these mines, including the Amethyst Mine, mined the deposits in the Amethyst vein and related veins emplaced along fault zones associated with the Creede graben

and Oligocene Bachelor Mountain Rhyolite. Vein minerals include barite, galena, sphalerite, pyrite, chalcopyrite, cerussite, anglesite, manganese oxides, silver, gold, and cerargyrite (Neubert and Wood, 2000).

Summitville Mine

The historic Summitville Mine is located ~40 miles directly west of Alamosa in the southern San Juan Mountains, Rio Grande County. It is within the Summitville critical mineral focus area (Dicken and others, 2022). Placer gold was first discovered in 1870, and subsequent mining operations targeted the near surface and deeper epithermal acid sulfate Au-Ag-Cu deposit hosted in a quartz latite volcanic dome (Gray and Coolbaugh, 1994). The mine primarily produced gold along with silver, copper, and lead (Steven and Ratte, 1960). As reported by Gray and Coolbaugh (1994, page 1912), *“The Summitville acid sulfate deposit occupies the midlevel portion of a larger magmatic hydrothermal system that includes a porphyry intrusion at depth and a hot spring environment at the surface.”*

The altered quartz latite contains highly silicified ore zones generally controlled by structures where mapped ore zones are similar in orientation to regional faults and a radial fracture pattern likely related to a deeper intrusive body (Gray and Coolbaugh, 1994). Alteration includes vuggy silica, quartz-alunite, quartz-kaolinite, and clay zones (Gray and Coolbaugh, 1994; Ketellapper and others, 1996). A deeper quartz monzonite porphyry, below the acid sulfate deposit, postdates the quartz latite and contains stockwork pyrite veins with traces of chalcopyrite and molybdenite along with disseminated pyrite like those observed in copper porphyry systems (Gray and Coolbaugh, 1994). Primary hypogene minerals include pyrite and enargite (Gray and Coolbaugh, 1994). Other minerals include covellite, luzonite, tennantite, native sulfur, barite, galena, sphalerite, marcasite, chalcopyrite, native gold, chalcocite, and several other minerals and iron oxides. Elevated concentrations of gold, silver, copper, arsenic, and tellurium were also observed in the vuggy silica altered zones while concentrations of bismuth and lead were highest in the quartz-alunite zone (Gray and Coolbaugh, 1994). As with

many of the deposits briefly described in this investigation, many other secondary minerals occur at Summitville (Flohr and others, 1995) and only the major ones are provided here.

Gladstone WTP

The Gladstone WTP drains several mines within the Central Colorado epithermal Au-Ag and San Juan tungsten veins critical mineral focus areas and contains several mineral/deposit types (Dicken and others, 2022). The mines in this area (Cement Creek-Bonita Peak) primarily produced gold, silver, lead, and copper. Ore included mainly banded quartz and pyrite, but some ores contained galena, sphalerite, chalcopyrite and unidentified silver minerals (Burbank and Luedke, 1969). Several mines in this area are part of the Sunnyside Mine Group including the Gold King, American Tunnel, and Mogul Mine. The Sunnyside Mine includes eight separate ore shoots and has produced ~60% of the gold, silver, lead, copper, and zinc production from San Juan County (Blood, 1968). Some of the mines in the area produced zinc while zinc from the Gold King Mine (one of the largest gold producers) was not recovered (Burbank and Luedke, 1969). Metals are generally contained in galena, sphalerite, chalcopyrite, and tetrahedrite with an approximate 1.5 lead/zinc ratio in the ores. Gangue minerals include manganese-bearing rhodonite and rhodochrosite (Blood, 1968). The Silver Ledge and Gold Thread mine in the area reportedly produced some tungsten ore (hubnerite) from narrow veins (Blood, 1968).

St. Louis Tunnel

The Rico-Argentine mines are within the Silver Creek-Calico Peak critical mineral focus area. This area contains polymetallic sulfide and porphyry molybdenum deposit types (Dicken and others, 2022). As reported by McKnight (1974), the Rico-Argentine mines area historically produced lead, zinc, silver, copper and gold from: carbonate replacement deposits in the Pennsylvanian Hermosa Group; contact-metamorphic deposits of sulfides and iron oxides in limestones (Devonian Ouray and Mississippian Leadville Limestones, but also the Hermosa Group); veins on fractures and small faults in the Hermosa Group sandstones and arkoses; and replacement deposits in residual debris from the solution of gypsum in the lower Hermosa Group. Production from 1879 to 1968 included: 82,717 short tons of zinc, 83,847 short tons of

lead, 5,637 short tons of copper, over 14.5 million ounces of silver, and 83,045 ounces of gold (McKnight, 1974). Common sulfide minerals include pyrite, sphalerite, galena, and chalcopyrite. Other minerals include arsenic and stibnite sulfosalt minerals and gangue minerals rhodochrosite and rhodonite (McKnight, 1974). One characteristic of the sulfide ore bodies described by McKnight (1974) was the pervasiveness of manganese. At least one germanium-bearing sulfide was reported from the area (McKnight, 1974).

In the 1980s, additional exploration in the area identified a Climax-type molybdenum deposit at depth between 1 to 2 kilometers deep along the Last Chance Fault and within the Proterozoic Uncompahgre Formation and overlying Paleozoic Hermosa Group. An indicated resource at Silver Creek includes 40 million short tons of 0.31% molybdenum but projections indicate that it may exceed 200 million short tons (Cameron and others, 1985).

Mineral List

alunite	$\text{KAl}_3(\text{SO}_4)_2(\text{OH})_6$
anglesite	PbSO_4
argentite	Ag_2S
barite	BaSO_4
bismuthinite	Bi_2S_3
bornite	Cu_5FeS_4
calcite	CaCO_3
cerargyrite ¹	AgCl
cerussite	PbCO_3
chalcopyrite	CuFeS_2
covellite	CuS
electrum	(Au,Ag)
enargite	Cu_3AsS_4
fluorite	CaF_2
galena	PbS
hubnerite	MnWO_4
iron-bearing calcite	(Ca,Fe) CO_3
kaolinite	$\text{Al}_2(\text{Si}_2\text{O}_5)(\text{OH})_4$

luzonite	Cu_3AsS_4
marcasite	FeS_2
molybdenite	MoS_2
pitchblende	UO_2
pyrite	FeS_2
pyrrhotite	Fe_{1-x}S
quartz	SiO_2
rhodochrosite	MnCO_3
rhodonite	$\text{CaMn}_3\text{Mn}[\text{Si}_5\text{O}_{15}]$
siderite	FeCO_3
sphalerite	ZnS
stibnite	Sb_2S_3
tennantite ²	$\text{Cu}_6(\text{Cu}_4\text{C}^{2+}_2)\text{As}_4\text{S}_{12}\text{S}$
tetrahedrite ³	$\text{Cu}_6(\text{Cu}_4\text{C}^{2+}_2)\text{Sb}_4\text{S}_{12}\text{S}$

Notes:

1 - Also known as chlorargyrite.

2 - $\text{C}^{2+} = \text{Fe}^{2+}, \text{Zn}, \text{Cu}, \text{Hg}$ and/or other species.

3 - $\text{C}^{2+} = \text{Fe}^{2+}, \text{Zn}, \text{Cd}, \text{Hg}$ and/or other species.

APPENDIX B

Eagle Mine WTP Water Data Summary

SampleID	EM-WTP-001	EM-WTP-01-23-001	EM-WTP-02-23-001	EMWTP-03-23-001	EM-WTP-04-23-001	EM-WTP-01-24-001	EM-WTP-02-24-001	EM-WTP-03-24-001	EM-WTP-04-24-001	EM-WTP-05-24-001
Date Sampled	10/28/2022	4/20/2023	5/25/2023	8/2/2023	9/29/2023	5/7/2024	5/30/2024	6/13/2024	6/28/2024	7/26/2024
pH	6.05	5.93	5.14	5.48	5.87	5.26	5.92	5.88	6.1	5.84
Temperature (°C)	12.4	15.1	17.4	18	na	14	17.6	19.1	6.9	19.7
DO (mg/L)	4.04	1.79	2.85	2.61	1.53	1.81	2.13	1.48	1.74	2.08
Conductivity (uS/cm)	2,540	2,830	2,660	2,928	3,040	2,500	2,940	2,890	2,005	2,750
Flow (gpm)	180	158	160	165	132	145	225	230	195	146
Flow (L/min)	681	598	606	625	500	549	852	871	738	553
Alkalinity (mg/L as CaCO ₃)	102.0	102 E	< 10 E	23.8 E	36.6 E	< 10	44.9	60.9	na	41
Au (ppb)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Au_d (ppb)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Ag (ppb)	0.07	0.17	0.57	0.27	0.07	1.01	0.30	0.26	0.14	0.06
Ag_d (ppb)	0.70	< 0.05	0.18	< 0.05	< 0.05	0.37	0.16	0.40	< 0.05	0.26
Al (ppb)	290	249	848	356	244	470	331	334	284	262
Al_d (ppb)	26	29	468	47	24	223	47	21	32	14
As (ppb)	275	137	70.1	129	152	67.5	134	185	176	91.5
As_d (ppb)	18.2	37.2	20.9	53.0	58.1	21.0	27.0	49.0	16.2	15.0
B (ppb)	30	32	34	28	26	27	28	30	33	25
B_d (ppb)	28	32	30	29	24	24	26	28	33	27
Ba (ppb)	10.5	10.9	11.3	11.5	11.1	11.5	10.5	11	10.8	8.68
Ba_d (ppb)	15.4	11.4	10.4	10.3	11.9	10.9	10.4	10.2	9.72	8.76
Be (ppb)	0.568	0.307	1.04	0.718	0.638	0.721	0.573	0.603	0.61	0.534
Be_d (ppb)	0.90	0.22	0.91	0.457	0.424	0.582	0.34	0.293	0.357	0.254
Bi (ppb)	0.05	0.02	0.21	0.03	0.02	0.02	0.03	0.04	0.03	0.03
Bi_d (ppb)	0.3	< 0.01	0.01	< 0.01	< 0.01	0.03	0.03	< 0.01	< 0.01	< 0.01
Ca (ppb)	332,000	328,000	293,000	354,000	266,000	310,000	366,000	369,000	382,000	327,000
Ca_d (ppb)	365,000	356,000	321,000	360,000	258,000	281,000	346,000	349,000	371,000	342,000
Cd (ppb)	41.2	64.4	354	105	65.5	334	132	95.5	84.9	56.6
Cd_d (ppb)	42	67	288	107	68.9	340	141	101	85.6	59.2
Co (ppb)	10.7	9.14	20.2	17	15.5	13.9	15.9	15.4	17.2	15.4
Co_d (ppb)	10.0	9.2	19.8	17	14.2	13.4	15.6	15.7	15.6	16.9
Cr (ppb)	1.06	0.4	3.53	0.33	0.22	0.27	0.17	0.17	0.2	0.22
Cr_d (ppb)	1.4	< 0.08	< 0.08	< 0.08	0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08
Cs (ppb)	6	5.3	6	5.8	6.4	6.7	6.6	6.9	6.9	7.1
Cs_d (ppb)	6.84	6.3	5.7	5.7	6.7	5.6	6.1	6.0	6.1	5.8
Cu (ppb)	272	252	920	263	234	423	257	311	311	226
Cu_d (ppb)	95.1	135	801	165	145	365	130	62	118	83
Fe (ppb)	47,700	40,200	51,300	59,500	47,500	57,400	51,900	55,900	54,500	47,000
Fe_d (ppb)	23,500	30,900	36,700	49,300	37,800	42,400	35,200	40,000	32,500	32,500
Ga (ppb)	0.8	1.0	1.9	0.7	0.3	1.6	1.1	1.0	0.8	0.9
Ga_d (ppb)	0.1	0.2	0.3	< 0.1	< 0.1	0.3	0.4	0.3	0.4	0.6
Ge (ppb)	0.9	0.8	1.6	1.4	1.4	1.4	1.2	1.2	1.3	1.1
Ge_d (ppb)	< 0.1	0.9	1.1	1.1	0.7	1.0	0.8	0.9	0.6	0.8
Hf (ppb)	< 0.1	0.2	< 0.1	< 0.1	0.1	0.2	< 0.1	< 0.1	< 0.1	< 0.1
Hf_d (ppb)	< 0.1	0.2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.1	< 0.1
Hg (ppb)	< 0.1	< 0.01	0.05	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Hg_d (ppb)	< 0.01	< 0.1	< 0.1	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
In (ppb)	< 0.1	0.3	1.0	0.4	0.3	0.5	0.4	0.5	0.32	0.4
In_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.01	< 0.1
K (ppb)	9830	9640	7910	10100	7760	10600	11000	10900	11300	8900
K_d (ppb)	11800	10600	7890	9940	7000	9150	9610	9740	10800	9370
Li (ppb)	19.4	23.4	24.8	26.0	19.6	20.1	24.4	24.8	28	18.8
Li_d (ppb)	25.2	20.3	26.0	23.9	21.8	18.2	20.3	23.1	27.7	20.9
Mg (ppb)	201,000	179,000	214,000	204,000	164,000	185,000	210,000	218,000	231,000	185,000
Mg_d (ppb)	212,000	184,000	226,000	207,000	150,000	162,000	215,000	219,000	234,000	203,000
Mn (ppb)	18,900	15,600	29,900	32,500	23,700	23,000	25,800	26,600	27,100	23,300
Mn_d (ppb)	17,700	16,100	30,900	30,600	24,700	23,600	26,700	26,800	26,806	24,000
Mo (ppb)	1.44	0.74	0.52	0.48	1.09	0.18	0.55	0.92	0.7	0.66
Mo_d (ppb)	1.7	0.21	< 0.04	0.22	0.25	0.06	0.1	0.23	< 0.4	0.1
Na (ppb)	7,630	7,110	8,540	9,000	7,120	8,390	9,920	10,200	10,100	8,470
Na_d (ppb)	7,700	7,490	9,200	9,260	6,460	6,980	9,570	9,890	9,840	9,690
Nb (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	< 0.1
Nb_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.09	< 0.1
Ni (ppb)	38.8	34.0	79.0	58.8	51.8	54.4	56.1	55.6	61.6	46.8
Ni_d (ppb)	107.0	34.9	71.3	58.2	52.4	50.0	59.0	57.0	56.8	50
P (ppb)	26	17	63	21	10	14	16	18	11	28
P_d (ppb)	100	< 3	< 3	< 3	< 3	< 3	< 3	< 3	< 3	< 3
Pb (ppb)	14.1	12.4	33.2	37.7	18.8	43.5	31.8	29.5	19.9	15.9
Pb_d (ppb)	6.1	< 0.09	1.76	0.61	0.1	1.1	0.68	0.34	< 0.09	< 0.09
Rb (ppb)	36.4	27.6	30.9	34.7	46.8	32.1	33	35.3	35.4	35.8
Rb_d (ppb)	31.3	34.2	29.5	35.2	33.0	39.1	34.7	33.3	32.7	31.7
Re (ppb)	0.2	< 0.1	0.2	0.2	0.2	0.1	0.2	0.2	0.2	0.1
Re_d (ppb)	4.3	0.1	< 0.1	0.2	0.2	0.1	0.1	0.2	0.2	0.1
S (ppb)	627,000	575,000	630,000	653,000	528,000	537,000	586,000	564,000	776,000	577,000
S_d (ppb)	775,000	583,000	651,000	644,000	466,000	611,000	679,000	688,000	651,000	623,000
Sb (ppb)	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Sb_d (ppb)	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Se (ppb)	0.1	0.11	0.19	0.08	0.15	0.14	0.05	0.07	0.05	0.05
Se_d (ppb)	< 0.04	0.1	0.2	0.08	0.06	0.15	0.08	0.07	0.07	0.09
Si (ppb)	6,380	7,160	6,840	9,200	5,880	6,830	7,130	7,390	7,670	5,630
Si_d (ppb)	13,000	6,940	6,720	9,410	5,600	6,210	6,330	6,600	7,400	6,220
Sn (ppb)	0.06	0.24	8.5	< 0.06	0.08	< 0.06	< 0.06	0.07	< 0.06	< 0.06
Sn_d (ppb)	< 0.06	< 0.06	< 0.06	0.06	0.07	< 0.06	< 0.06	< 0.06	< 0.06	0.23

Eagle Mine WTP Water Data Summary

SampleID	EM-WTP-001	EM-WTP-01-23-001	EM-WTP-02-23-001	EMWTP-03-23-001	EM-WTP-04-23-001	EM-WTP-01-24-001	EM-WTP-02-24-001	EM-WTP-03-24-001	EM-WTP-04-24-001	EM-WTP-05-24-001
Date Sampled	10/28/2022	4/20/2023	5/25/2023	8/2/2023	9/29/2023	5/7/2024	5/30/2024	6/13/2024	6/28/2024	7/26/2024
Sr (ppb)	283	249	250	278	245	258	272	272	287	228
Sr_d (ppb)	240	282	241	266	259	254	279	278	263	247
Ta (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Ta_d (ppb)	0.5	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Te (ppb)	0.9	0.5	1.7	0.9	1.1	0.7	0.5	0.7	0.6	1.1
Te_d (ppb)	1.6	< 0.1	0.3	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Th (ppb)	0.7	0.5	1.0	0.3	0.6	0.3	0.1	0.2	0.1	0.2
Th_d (ppb)	< 0.1	0.3	< 0.1	< 0.1	0.5	< 0.1	< 0.1	< 0.1	< 0.1	0.1
Ti (ppb)	0.25	0.48	0.18	0.44	0.4	0.11	0.24	0.27	0.19	0.1
Ti_d (ppb)	0.6	0.09	0.12	< 0.07	0.08	0.12	0.11	0.08	< 0.1	0.14
Tl (ppb)	4.67	4.72	6.36	6.03	5.81	5.6	6.14	6.12	6.08	4.71
Tl_d (ppb)	2.8	4.84	5.65	6.0	6.63	5.72	6.47	6.44	5.32	4.89
U (ppb)	4.26	2.41	3.11	2.41	2.7	2.04	2.45	3.13	3.06	2.09
U_d (ppb)	1.4	1.28	1.53	1.24	1.15	0.965	0.68	0.793	0.787	0.449
V (ppb)	0.16	0.14	0.37	0.16	0.10	0.09	0.16	0.18	0.14	0.1
V_d (ppb)	< 0.01	< 0.01	0.02	0.02	< 0.01	0.01	0.02	0.04	0.01	0.02
W (ppb)	0.03	< 0.02	< 0.02	< 0.02	200	3.26	0.11	11.5	0.97	2.86
W_d (ppb)	0.09	< 0.02	< 0.02	< 0.02	5.01	0.64	< 0.02	0.29	0.06	0.06
Zn (ppb)	22,800	25,600	89,400	53,100	39,900	96,200	62,400	56,200	50,300	36,900
Zn_d (ppb)	25,200	26,800	87,200	54,100	44,600	88,100	58,300	52,300	50,800	38,700
Zr (ppb)	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Zr_d (ppb)	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Cl (ppm)*	10.3	15	16.3	14.4	14.1	18.0	< 5	20.5	20.6	15
F (ppm)*	0.39	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	6.84	< 2.5	< 2.5	na
NO ₃ (ppm)*	< 0.1	10.9	0.38	< 1	< 1	< 2.5	< 2.5	< 2.5	< 2.5	na
SO ₄ (ppm)*	2,119	1,864	1,987	1,848	1,875	1,787	118	1,871	2,084	2,000

Rare Earth Elements

Sc (ppb)	0.2	0.7	2.4	1.2	0.4	0.5	0.4	0.4	0.4	0.5
Sc_d (ppb)	0.052	1.0	0.3	1.1	0.2	0.3	0.4	0.3	0.3	0.4
Y (ppb)	2.63	1.39	5.34	2.91	2.81	3.48	2.4	2.62	2.44	2.38
Y_d (ppb)	0.3	0.47	4.47	1.15	0.91	2.93	0.87	0.36	0.46	0.6
La (ppb)	0.5	0.4	1.5	0.6	0.5	0.7	0.4	0.5	0.56	0.6
La_d (ppb)	< 0.1	0.1	1.3	0.2	0.1	0.7	0.2	< 0.1	0.06	0.2
Ce (ppb)	1.42	1.04	5.13	2.32	1.3	1.81	1.23	1.43	1.35	1.56
Ce_d (ppb)	0.07	0.22	2.61	0.53	0.21	1.22	0.25	0.08	0.07	0.31
Pr (ppb)	0.2	0.1	0.4	0.2	0.2	0.2	0.2	0.2	0.17	0.2
Pr_d (ppb)	< 0.1	< 0.1	0.3	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.01	< 0.1
Nd (ppb)	0.9	0.6	2.0	1.0	0.8	0.9	0.8	0.9	0.8	1.0
Nd_d (ppb)	< 0.1	< 0.1	1.3	0.2	< 0.1	0.6	0.1	< 0.1	0.02	0.1
Sm (ppb)	0.3	0.2	0.6	0.3	0.3	0.3	0.2	0.3	0.25	0.3
Sm_d (ppb)	< 0.1	< 0.1	0.4	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.01	< 0.1
Eu (ppb)	0.1	< 0.1	0.3	0.2	0.2	0.1	0.1	0.2	0.1	0.2
Eu_d (ppb)	< 0.1	< 0.1	0.2	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.01	< 0.1
Gd (ppb)	0.48	0.29	1.03	0.55	0.48	0.51	0.41	0.5	0.43	0.56
Gd_d (ppb)	0.02	0.04	0.76	0.09	0.07	0.39	0.06	0.02	0.02	0.05
Tb (ppb)	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.06	< 0.1
Tb_d (ppb)	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	< 0.1
Dy (ppb)	0.4	0.2	0.8	0.4	0.4	0.4	0.3	0.4	0.32	0.4
Dy_d (ppb)	< 0.1	< 0.1	0.6	< 0.1	< 0.1	0.3	< 0.1	< 0.1	0.02	< 0.1
Ho (ppb)	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.06	< 0.1
Ho_d (ppb)	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	< 0.1
Er (ppb)	0.2	< 0.1	0.3	0.2	0.2	0.2	0.1	0.2	0.15	0.2
Er_d (ppb)	< 0.1	< 0.1	0.3	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.01	< 0.1
Tm (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.02	< 0.1
Tm_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	< 0.1
Yb (ppb)	0.1	< 0.1	0.2	0.1	0.1	0.1	< 0.1	0.1	0.08	0.1
Yb_d (ppb)	< 0.1	< 0.1	0.2	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.01	< 0.1
Lu (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Lu_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.6
Total REE (ppb)	7.63	5.27	20.4	10.18	7.89	9.4	6.79	7.95	7.24	8.2
Total LREE (ppb)	3.9	2.68	10.96	5.17	3.78	4.52	3.34	4.03	3.66	4.42
Total HREE (ppb)	3.53	1.89	7.04	3.81	3.71	4.38	3.05	3.52	3.18	3.28
Total REE_d (ppb)	1.042	2.38	13.04	3.77	2.04	7.44	2.38	1.36	1.04	2.71
Total REE % dissolved	13.7	45.2	63.9	37.0	25.9	79.1	35.1	17.1	14.4	33.0
Total LREE_d (ppb)	0.34	0.56	6.87	1.17	0.58	3.41	0.76	0.35	0.185	0.81
Total LREE % dissolved	8.7	20.9	62.7	22.6	15.3	75.4	22.8	8.7	5.1	18.3
Total HREE_d (ppb)	0.65	0.82	5.87	1.5	1.26	3.73	1.22	0.71	0.555	1.5
Total HREE % dissolved	18.4	43.4	83.4	39.4	34.0	85.2	40.0	20.2	17.5	45.7

Notes:

Results designated with a "d" (e.g. Eu_d) are dissolved concentrations.

pH, temperature, dissolved oxygen (DO), and conductivity measured in the field.

Total REEs (includes REE + Sc), LREEs, and HREEs non-detects were included at half the reporting limit.

gpm - gallons per minute

HREE - heavy REEs (Tb,Dy, Ho, Er, Tm, Yb, Lu, Y)

L/min - liters per minute

LREE - light REEs (La, Ce, Pr, Nd, Sm, Eu, Gd)

mg/L - milligrams per liter

ppm - parts per million

ppb - parts per billion

uS/cm - microsiemens per centimeter

Eagle Mine North Groundwater Extraction Trench Water Data Summary

SampleID	EM-GWN-001	EM-GWN-01-23-001	EM-GW-02-23-001	EMGWN03-23-001	EM-GWN-04-23-001	EM-GWN-01-24-001	EM-GWN-02-24-001	EM-GWN-03-24-001	EM-GWN-04-24-001	EM-GWN-05-24-001
Date Sampled	10/28/2022	4/20/2023	5/25/2023	8/2/2023	9/29/2023	5/7/2024	5/30/2024	6/13/2024	6/28/2024	7/26/2024
pH	6.63	6.39	6.54	6.52	6.56	6.33	6.52	6.45	6.41	6.21
Temperature (°C)	11.3	11.1	13.4	14.5	na	8.8	11.7	12.6	10.3	18.6
DO (mg/L)	2.52	2.95	2.21	2.91	5.21	2.48	2.42	4.75	5.58	5.36
Conductivity (uS/cm)	2,560	2,200	2,430	2,560	2,850	2,500	2,720	2,680	1,679	2,750
Flow (gpm)	na	na	na	na	na	na	na	na	na	na
Flow (L/min)	na	na	na	na	na	na	na	na	na	na
Alkalinity (mg/L as CaCO ₃)	79	67 E	106 E	< 10 E	< 10 E	42.7	55.1	30.4	na	8
Au (ppb)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Au_d (ppb)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Ag (ppb)	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.41	< 0.05	< 0.05	< 0.05
Ag_d (ppb)	0.9	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.06	0.06	0.06	0.24
Al (ppb)	124	634	252	188	9	438	347	25	< 1	4
Al_d (ppb)	91	491	255	67	< 1	160	60	162	5	6
As (ppb)	364	238	302	328	41.6	295	289	44.6	1.9	5.6
As_d (ppb)	344	231	303	293	16	260	238	20	1.1	0.7
B (ppb)	169	105	92	141	128	119	125	123	142	109
B_d (ppb)	146	106	123	111	109	121	115	120	123	122
Ba (ppb)	13.9	11.8	12	13	11.5	12.7	11.9	11	9.93	9.49
Ba_d (ppb)	15.6	13	11.9	12.2	12.7	13.4	12.1	10.6	9.31	9.85
Be (ppb)	0.22	0.385	0.2	0.288	0.041	0.408	0.292	0.061	0.024	0.016
Be_d (ppb)	0.5	0.4	0.319	0.196	0.019	0.338	0.228	0.054	0.018	0.021
Bi (ppb)	0.01	0.06	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Bi_d (ppb)	0.3	< 0.01	< 0.01	< 0.01	< 0.01	0.02	< 0.01	< 0.01	< 0.01	< 0.01
Ca (ppb)	225,000	202,000	181,000	225,000	163,000	213,000	217,000	219,000	203,000	186,000
Ca_d (ppb)	213,000	216,000	210,000	220,000	157,000	197,000	203,000	201,000	185,000	195,000
Cd (ppb)	1.08	1.02	0.688	1.54	0.466	0.889	0.704	0.533	0.54	0.301
Cd_d (ppb)	1.3	0.999	0.576	0.876	0.485	0.818	0.775	1.08	0.47	0.38
Co (ppb)	6.93	8.22	8.7	7.98	6.91	8.51	9.17	9.14	9.04	7.43
Co_d (ppb)	6.2	8.17	8.43	8.16	6.34	8.72	8.97	9.3	7.97	7.8
Cr (ppb)	0.35	0.22	0.2	0.11	< 0.08	0.15	< 0.08	< 0.08	< 0.08	< 0.08
Cr_d (ppb)	0.5	< 0.08	< 0.08	< 0.08	0.74	0.08	< 0.08	0.09	< 0.08	< 0.08
Cs (ppb)	10.6	6.1	7.6	9.2	9.8	9.3	9.2	9.5	9.6	10.4
Cs_d (ppb)	12	7.4	8.1	8.9	10.4	8	8.3	8.7	8.3	8.5
Cu (ppb)	2	3.7	2.5	2.2	1.5	2.8	3.8	5.2	1.8	1.4
Cu_d (ppb)	23.8	2.9	1.9	2.2	1.2	16	13	42	7.4	7.4
Fe (ppb)	126,000	95,200	112,000	166,000	66,700	131,000	145,000	79,000	68,200	51,600
Fe_d (ppb)	133,000	95,600	118,000	168,000	58,700	118,000	129,000	65,200	61,500	46,000
Ga (ppb)	0.7	0.7	0.6	0.2	< 0.1	0.9	0.8	0.8	0.8	1
Ga_d (ppb)	0.5	0.7	0.5	0.2	0.2	0.8	0.8	0.8	0.8	1.4
Ge (ppb)	4.7	1.1	3.8	4.2	1.9	2.9	3.4	1.7	1.3	1.2
Ge_d (ppb)	< 0.1	3.2	3.6	4	1	3	3	2	1	1.1
Hf (ppb)	< 0.1	0.2	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Hf_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Hg (ppb)	< 0.1	< 0.01	0.07	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Hg_d (ppb)	< 0.01	< 0.1	< 0.1	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
In (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	< 0.1
In_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	< 0.1
K (ppb)	9920	8150	7750	10200	7840	9130	15000	10600	9830	8430
K_d (ppb)	11500	9060	8320	10000	7240	8760	13100	9160	8370	8890
Li (ppb)	182	105	95.1	159	144	130	146	147	181	118
Li_d (ppb)	172	96.3	138	114	132	141	135	145	154	134
Mg (ppb)	188,000	151,000	157,000	187,000	151,000	183,000	184,000	192,000	181,000	164,000
Mg_d (ppb)	195,000	155,000	182,000	190,000	137,000	178,000	180,000	189,000	171,000	179,000
Mn (ppb)	61,900	52,400	55,900	77,600	59,900	58,100	59,100	63,900	59,300	59,700
Mn_d (ppb)	64,800	54,600	60,100	74,700	61,300	61,700	63,100	65,800	58,356	61,800
Mo (ppb)	2.14	1.31	1.8	1.67	0.84	1.38	1.4	0.56	0.5	0.14
Mo_d (ppb)	1.8	1.26	1.64	1.73	0.59	1.89	1.42	0.52	0.5	0.1
Na (ppb)	96,600	65,200	72,500	89,800	74,200	81,300	86,500	88,300	91,000	75,300
Na_d (ppb)	98,100	65,800	85,300	90,300	67,300	84,300	82,800	85,000	80,600	81,900
Nb (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	< 0.1
Nb_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.03	< 0.1
Ni (ppb)	15.8	17.9	17.2	18	15.2	18.5	24.6	19.1	17.3	14.9
Ni_d (ppb)	83.5	17.7	17.1	18.2	14.8	19	20	20	15.2	15
P (ppb)	< 3	12	< 3	10	< 3	5	12	5	< 3	12
P_d (ppb)	600	< 3	< 3	4	< 3	< 3	< 3	< 3	< 3	< 3
Pb (ppb)	0.43	0.57	0.42	1.56	0.2	0.47	0.55	0.1	< 0.09	< 0.09
Pb_d (ppb)	5.5	0.17	0.11	0.12	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09
Rb (ppb)	31.3	19.2	28	29.3	41.4	26.8	25.6	27.9	27.6	29.4
Rb_d (ppb)	30.1	23.5	25	29.7	29.8	23.1	25	25.3	24.7	26
Re (ppb)	0.1	0.2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Re_d (ppb)	4.5	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
S (ppb)	564,000	472,000	429,000	573,000	479,000	451,000	507,000	510,000	595,000	499,000
S_d (ppb)	721,000	484,000	496,000	584,000	401,000	568,000	576,000	595,000	464,000	543,000
Sb (ppb)	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Sb_d (ppb)	2.4	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Se (ppb)	0.13	0.06	0.05	0.06	0.26	< 0.04	< 0.04	< 0.04	< 0.04	0.05
Se_d (ppb)	0.8	0.04	0.07	0.08	0.13	0.1	< 0.04	< 0.04	< 0.04	0.07
Si (ppb)	8,720	8,760	6,800	10,200	5,540	8,520	9,610	6,820	7,090	4,280
Si_d (ppb)	< 20	9,110	7,896	11,000	5,100	8,940	8,250	6,110	6,230	4,600
Sn (ppb)	0.11	0.08	< 0.06	0.06	0.11	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
Sn_d (ppb)	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	0.21
Sr (ppb)	580	518	549	572	525	578	567	589	534	452

Eagle Mine North Groundwater Extraction Trench Water Data Summary

SampleID	EM-GWN-001	EM-GWN-01-23-001	EM-GW-02-23-001	EMGWN03-23-001	EM-GWN-04-23-001	EM-GWN-01-24-001	EM-GWN-02-24-001	EM-GWN-03-24-001	EM-GWN-04-24-001	EM-GWN-05-24-001
Date Sampled	10/28/2022	4/20/2023	5/25/2023	8/2/2023	9/29/2023	5/7/2024	5/30/2024	6/13/2024	6/28/2024	7/26/2024
Sr_d (ppb)	538	562	510	572	518	556	579	594	493	463
Ta (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Ta_d (ppb)	0.4	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Te (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Te_d (ppb)	1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Th (ppb)	1	0.3	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Th_d (ppb)	< 0.1	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Ti (ppb)	0.56	0.17	0.12	0.2	0.3	0.25	0.24	0.32	0.08	< 0.05
Ti_d (ppb)	< 0.05	0.1	0.1	< 0.07	< 0.07	0.08	0.09	0.09	< 0.1	< 0.05
Tl (ppb)	4.28	3.75	3.74	4.27	4.18	4.37	3.88	3.82	3.07	3.34
Tl_d (ppb)	2.8	4.11	3.61	4.25	4.86	4.21	4.24	4.11	2.85	3.46
U (ppb)	2.46	1.61	2.07	2.21	1.11	1.92	2.13	0.991	0.955	0.176
U_d (ppb)	1.3	1.69	2.08	2.19	0.796	2.49	2.03	0.825	0.742	0.08
V (ppb)	0.1	0.1	0.07	0.1	0.02	0.09	0.09	0.04	0.02	0.01
V_d (ppb)	< 0.01	0.08	0.06	0.03	< 0.01	0.04	0.04	0.09	0.01	< 0.01
W (ppb)	0.07	0.07	0.03	0.06	2.03	0.05	0.76	2.6	< 0.02	0.03
W_d (ppb)	0.46	0.06	0.1	0.05	0.06	0.06	0.21	0.16	< 0.02	< 0.02
Zn (ppb)	13,200	13,400	13,400	15,000	10,500	15,500	15,300	13,400	10,100	9,100
Zn_d (ppb)	12,800	14,000	12,600	15,200	11,200	14,000	14,400	11,800	9,940	9,470
Zr (ppb)	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Zr_d (ppb)	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Cl (ppm)*	37	43.5	36.3	36.6	41.4	43.6	47.6	38	41.9	33
F (ppm)*	0.36	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	na
NO ₃ (ppm)*	< 0.1	< 1	0.12	< 1	< 1	< 2.5	< 2.5	< 2.5	< 2.5	na
SO ₄ (ppm)*	1,838	1,463	1,486	1,652	1,710	1,592	1,593	1,603	1,342	1,700
Rare Earth Elements										
Sc (ppb)	< 0.1	0.4	0.8	1.2	0.2	0.4	0.3	0.3	0.3	0.3
Sc_d (ppb)	0.042	0.6	0.1	1.3	0.2	0.4	0.4	0.3	0.2	0.2
Y (ppb)	1.56	2.59	2.4	2.04	0.13	2.82	2.39	0.25	< 0.02	0.06
Y_d (ppb)	1.6	2.5	2.1	1.1	0.02	1.79	0.78	0.44	0.16	0.23
La (ppb)	3.3	5.3	4.2	3.4	0.2	5.2	4.4	0.3	0.02	< 0.1
La_d (ppb)	2.6	4.6	3.8	1.4	1.4	2.6	0.9	0.3	0.37	0.7
Ce (ppb)	6.83	10	12.3	10.5	0.41	10.2	9.26	0.53	0.04	0.18
Ce_d (ppb)	4.67	11.2	7.06	3.03	1.26	3.4	1.18	0.61	0.54	0.82
Pr (ppb)	0.5	0.9	0.7	0.6	< 0.1	0.9	0.8	< 0.1	< 0.01	< 0.1
Pr_d (ppb)	0.4	0.7	0.6	0.2	< 0.1	0.3	< 0.1	< 0.1	0.03	< 0.1
Nd (ppb)	2	3.3	2.7	2.2	0.1	3.2	2.9	0.2	0.01	< 0.1
Nd_d (ppb)	1.2	2.5	2.2	0.5	0.2	0.8	0.3	0.2	0.11	0.2
Sm (ppb)	0.3	0.5	0.4	0.4	< 0.1	0.5	0.5	< 0.1	< 0.01	< 0.1
Sm_d (ppb)	0.2	0.4	0.3	< 0.1	< 0.1	0.2	< 0.1	< 0.1	0.02	< 0.1
Eu (ppb)	< 0.1	0.1	< 0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1	< 0.1
Eu_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	< 0.1
Gd (ppb)	0.34	0.57	0.5	0.39	0.02	0.61	0.52	0.04	< 0.01	0.01
Gd_d (ppb)	0.23	0.43	0.36	0.1	0.02	0.24	0.06	0.05	0.03	0.04
Tb (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	< 0.1
Tb_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	< 0.1
Dy (ppb)	0.2	0.3	0.3	0.2	< 0.1	0.3	0.3	< 0.1	< 0.01	< 0.1
Dy_d (ppb)	0.1	0.3	0.2	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.01	< 0.1
Ho (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	< 0.1
Ho_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	< 0.1
Er (ppb)	< 0.1	0.2	0.1	0.1	< 0.1	0.2	0.1	< 0.1	< 0.01	< 0.1
Er_d (ppb)	< 0.1	0.1	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.01	< 0.1
Tm (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	< 0.1
Tm_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	< 0.1
Yb (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	< 0.1
Yb_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.01	< 0.1
Lu (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Lu_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.6
Total REE (ppb)	15.43	24.41	24.7	21.33	1.56	24.68	21.77	2.12	0.525	1.15
Total LREE (ppb)	13.32	20.67	20.85	17.54	0.88	20.71	18.43	1.22	0.135	0.44
Total HREE (ppb)	2.06	3.34	3.05	2.59	0.48	3.57	3.04	0.6	0.09	0.41
Total REE_d (ppb)	11.392	23.63	17.12	8.08	3.6	10.38	4.12	2.4	1.545	3.24
Total REE % dissolved	73.8	96.8	69.3	37.9	230.8	42.1	18.9	113.2	294.3	281.7
Total LREE_d (ppb)	9.35	19.88	14.37	5.33	3.03	7.59	2.59	1.31	1.105	1.91
Total LREE % dissolved	70.2	96.2	68.9	30.4	344.3	36.6	14.1	107.4	818.5	434.1
Total HREE_d (ppb)	2	3.15	2.65	1.45	0.37	2.39	1.13	0.79	0.24	1.13
Total HREE % dissolved	97.1	94.3	86.9	56.0	77.1	66.9	37.2	131.7	266.7	275.6

Notes:

Results designated with a "d" (e.g. Eu_d) are dissolved concentrations.

pH, temperature, dissolved oxygen (DO), and conductivity measured in the field.

Total REEs (includes REE + Sc), LREEs, and HREEs non-detects were included at half the reporting limit.

gpm - gallons per minute

HREE - heavy REEs (Tb,Dy, Ho, Er, Tm, Yb, Lu, Y)

E - estimated, informational purposes, holding time exceedence or other issue

* - anion data is for information purposes (sample exceeded holding time or other) except for the late July 2024 results.

LREE - light REEs (La, Ce, Pr, Nd, Sm, Eu, Gd)

mg/L - milligrams per liter

ppm - parts per million

ppb - parts per billion

uS/cm - microsiemens per centimeter

Leadville Mine Drainage Tunnel WTP Water Data Summary

SampleID	LDT-WTP-001	LDT-WTP-01-23001	LDT-02-23-001	LDTWTP03-23-001	LDT-WTP-04-23001	LDT-01-24-001	LDT-02-24-001	LDT-03-24-001	LDT-04-24-001	LDT-05-24-001
Date Sampled	10/28/2022	4/20/2023	5/25/2023	8/2/2023	9/29/2023	5/7/2024	5/30/2024	6/13/2024	6/28/2024	7/26/2024
pH	7.05	7.08	6.96	7.23	7.4	6.61	6.1	7.01	6.7	7.18
Temperature (°C)	11.3	na	10.9	6.7	na	8.5	6.7	8.5	10.6	13.3
DO (mg/L)	7.34	7.71	7.83	7.91	7.23	7.63	7.32	6.29	8.8	7.97
Conductivity (uS/cm)	402	551	569	570	347	461	531	368	366	440
Flow (gpm)	1,212	1,160	820	1,190	1,355	1,025	900	969	1,122	1,100
Flow (L/min)	4,588	4,391	3,104	4,505	5,129	3,880	3,407	3,668	4,247	4,164
Alkalinity (mg/L as CaCO ₃)	127	140 E	125 E	129 E	163 E	127	39.4	103	na	120
Au (ppb)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Au_d (ppb)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Ag (ppb)	0.17	0.14	0.12	0.13	0.43	0.36	0.15	0.14	0.13	0.09
Ag_d (ppb)	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Al (ppb)	130	160	776	381	294	917	2960	982	551	143
Al_d (ppb)	4	5	21	12	9	8	48	6	3	11
As (ppb)	1.2	1.3	1.4	1	1.6	1.4	3.3	1.2	0.9	0.4
As_d (ppb)	0.3	0.5	0.2	< 0.2	< 0.2	0.5	< 0.2	< 0.2	< 0.2	< 0.2
B (ppb)	12	6	5	5	5	5	7	5	8	4
B_d (ppb)	5	10	5	4	4	6	4	5	6	5
Ba (ppb)	76.7	74.7	74.5	75.2	82.5	75.1	73.7	75.6	80.5	70.1
Ba_d (ppb)	93.6	78.6	73	74.5	80.5	74.6	74.9	70.6	73.9	70.5
Be (ppb)	0.025	0.039	0.111	0.084	0.052	0.116	0.502	0.17	0.115	0.024
Be_d (ppb)	<	0.007	0.026	0.022	<	0.011	0.071	0.02	<	0.007
Bi (ppb)	< 0.01	< 0.01	< 0.01	0.08	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Bi_d (ppb)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Ca (ppb)	50,400	70,700	61,400	56,700	40,000	51,400	52,400	57,500	60,600	46,400
Ca_d (ppb)	66,500	71,100	68,800	53,800	43,200	51,300	50,000	57,800	58,500	48,800
Cd (ppb)	7.55	11.1	48.5	26.6	10	37	131	45	33.2	16.9
Cd_d (ppb)	7.89	10.9	46.3	26.7	7.98	35.2	129	47.8	31.6	17.3
Co (ppb)	0.388	0.625	1.92	0.741	0.321	1.42	3.88	1.73	1.33	0.548
Co_d (ppb)	0.364	0.565	1.81	0.722	0.296	1.44	3.85	2.14	1.22	0.55
Cr (ppb)	0.33	0.3	0.46	0.18	0.21	0.36	1.15	0.36	0.36	0.22
Cr_d (ppb)	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08
Cs (ppb)	0.2	< 0.1	0.1	< 0.1	< 0.1	0.1	0.1	0.1	0.1	< 0.1
Cs_d (ppb)	0.125	0.1	0.1	< 0.1	0.1	0.1	0.2	0.2	0.1	0.1
Cu (ppb)	5.3	6.8	58.2	17.1	14.1	51.4	203	57	29	8.8
Cu_d (ppb)	0.6	1	12	3.7	1.1	6.3	47	16	4.8	2.5
Fe (ppb)	1,450	2,340	4,760	2,200	4,480	5,890	19,200	5,320	3,920	827
Fe_d (ppb)	156	671	798	61	21	178	851	76	8	49
Ga (ppb)	< 0.1	< 0.1	0.1	< 0.1	< 0.1	0.1	0.4	0.1	0.1	< 0.1
Ga_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1
Ge (ppb)	< 0.1	3.3	0.2	< 0.1	0.2	0.2	0.5	0.2	0.2	< 0.1
Ge_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Hf (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Hf_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Hg (ppb)	< 0.1	< 0.01	0.06	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Hg_d (ppb)	< 0.01	< 0.1	< 0.1	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
In (ppb)	< 0.1	0.2	1.2	0.4	0.4	1.3	6.3	1.3	0.78	0.2
In_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	< 0.1
K (ppb)	940	1220	1020	1240	711	1520	923	1080	1100	828
K_d (ppb)	1074	1210	1090	976	772	1550	833	1020	968	889
Li (ppb)	1.8	2.1	1.8	2.6	1.3	3	6	3.4	3.7	1.7
Li_d (ppb)	2	2.2	5.2	1.8	1.7	2.7	4	3.4	2.4	1.8
Mg (ppb)	21,100	29,000	28,300	23,500	17,200	26,900	33,500	28,600	29,100	20,400
Mg_d (ppb)	26,900	28,400	31,200	23,800	17,700	27,200	32,200	28,600	28,700	22,400
Mn (ppb)	728	1,460	3,580	1,780	634	2,960	6,850	3,250	2,480	998
Mn_d (ppb)	767	1,400	3,520	1,590	672	2,940	6,700	3,500	2,535	1,040
Mo (ppb)	0.15	0.18	0.16	0.14	0.23	0.11	0.08	0.1	< 0.4	0.15
Mo_d (ppb)	0.13	0.14	0.11	0.16	0.12	0.28	< 0.04	0.1	< 0.4	0.12
Na (ppb)	1,940	2,350	2,160	2,240	1,560	2,280	2,200	2,320	2,360	1,750
Na_d (ppb)	2,270	2,280	2,460	2,080	1,530	2,260	2,060	2,220	2,140	1,930
Nb (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	< 0.1
Nb_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	< 0.1
Ni (ppb)	0.9	1.7	3.8	3.2	1	2.6	9.7	3.8	3.4	1.6
Ni_d (ppb)	1	1.4	3.8	2.9	1	3	7	5	3.1	1.7
P (ppb)	10	12	11	11	8	16	74	21	14	13
P_d (ppb)	< 3	< 3	< 3	< 3	< 3	< 3	< 3	< 3	< 3	< 3
Pb (ppb)	3.19	3.33	3.08	7.36	6.68	1.92	8.6	3.48	2.68	2.59
Pb_d (ppb)	< 0.09	< 0.09	< 0.09	0.21	< 0.09	< 0.09	0.37	0.55	< 0.09	< 0.09
Rb (ppb)	0.8	0.8	0.9	0.9	1	0.8	0.7	0.8	0.8	0.6
Rb_d (ppb)	0.6	1	0.8	0.7	0.7	0.8	0.7	0.8	0.7	0.6
Re (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Re_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
S (ppb)	35,000	57,900	59,800	40,000	26,100	46,100	84,200	57,200	65,800	31,200
S_d (ppb)	34,700	60,800	66,500	40,300	23,600	58,300	95,100	67,600	52,800	34,300
Sb (ppb)	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Sb_d (ppb)	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Se (ppb)	0.17	0.06	0.13	0.12	0.12	0.14	0.16	0.13	0.14	0.11
Se_d (ppb)	0.16	0.11	0.18	0.12	0.08	0.16	0.18	0.18	0.12	0.12
Si (ppb)	4,240	4,860	4,610	6,140	4,130	4,820	5,800	5,570	5,640	3,780
Si_d (ppb)	5,740	4,590	4,996	5,930	4,040	4,840	4,740	4,830	5,060	4,160
Sn (ppb)	< 0.06	< 0.06	0.07	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
Sn_d (ppb)	< 0.06	< 0.06	< 0.06	< 0.06	0.18	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
Sr (ppb)	106	124	129	96.9	92	109	106	116	116	82.7

Leadville Mine Drainage Tunnel WTP Water Data Summary

SampleID	LDT-WTP-001	LDT-WTP-01-23001	LDT-02-23-001	LDTWTP03-23-001	LDT-WTP-04-23001	LDT-01-24-001	LDT-02-24-001	LDT-03-24-001	LDT-04-24-001	LDT-05-24-001
Date Sampled	10/28/2022	4/20/2023	5/25/2023	8/2/2023	9/29/2023	5/7/2024	5/30/2024	6/13/2024	6/28/2024	7/26/2024
Sr_d (ppb)	114	126	120	96.1	99.5	109	109	117	109	83.8
Ta (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Ta_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Te (ppb)	< 0.1	< 0.1	< 0.1	0.3	< 0.1	< 0.1	0.5	< 0.1	< 0.1	< 0.1
Te_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Th (ppb)	0.1	0.1	0.5	0.2	0.2	0.4	1.8	0.4	0.3	< 0.1
Th_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Ti (ppb)	0.08	0.16	0.14	0.08	0.1	0.16	0.22	0.17	0.15	< 0.05
Ti_d (ppb)	< 0.05	0.07	< 0.07	< 0.07	< 0.07	0.05	0.06	0.06	< 0.1	< 0.05
Tl (ppb)	0.021	0.018	0.024	0.015	0.024	0.031	0.07	0.026	0.05	0.05
Tl_d (ppb)	0.017	0.028	0.016	0.011	0.017	0.097	0.111	0.091	0.021	0.098
U (ppb)	2.37	2.64	3.17	2.58	3.26	3.12	4.88	3.1	2.85	1.71
U_d (ppb)	2.04	2.29	1.24	1.39	1.75	0.781	0.129	0.082	0.308	1.37
V (ppb)	0.06	0.07	0.09	0.1	0.08	0.1	0.22	0.1	0.07	0.04
V_d (ppb)	0.02	0.04	0.02	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
W (ppb)	< 0.02	< 0.02	< 0.02	< 0.02	3.72	1.4	0.94	6.54	0.12	1.45
W_d (ppb)	0.03	< 0.02	< 0.02	< 0.02	1.78	0.51	3.18	1.01	0.26	1.29
Zn (ppb)	1,410	2,310	7,800	3,890	1,480	6,350	19,700	8,160	5,360	2,600
Zn_d (ppb)	1,630	2,270	7,600	3,820	1,490	5,540	18,600	6,840	5,370	2,720
Zr (ppb)	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Zr_d (ppb)	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Cl (ppm)*	1.39	< 5	< 5	1.89	1.97	< 5	< 5	< 5	< 5	2
F (ppm)*	0.1	< 2.5	< 2.5	< 0.25	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	na
NO ₃ (ppm)*	1.74	2.15	1.98	2.25	2.65	2.61	2.82	2.53	< 2.5	na
SO ₄ (ppm)*	98	196	193	115	108	179	296	194	180	110
Rare Earth Elements										
Sc (ppb)	< 0.1	0.2	0.6	0.8	0.3	0.4	0.8	0.4	0.3	0.2
Sc_d (ppb)	0.005	0.1	< 0.1	0.8	0.2	0.2	0.2	0.2	0.2	0.2
Y (ppb)	0.4	0.49	2.22	1.31	1.11	1.93	5.66	2.13	1.58	0.55
Y_d (ppb)	0.04	0.05	0.28	0.13	0.02	0.22	0.99	0.13	0.06	0.08
La (ppb)	0.2	0.2	1.5	0.5	0.4	1.2	3.8	1.4	0.92	0.3
La_d (ppb)	< 0.1	< 0.1	0.2	0.1	< 0.1	< 0.1	0.7	0.1	0.02	< 0.1
Ce (ppb)	0.44	0.5	4.89	1.95	1.04	2.86	8.86	3.37	2.21	0.7
Ce_d (ppb)	< 0.01	0.02	0.23	0.31	0.02	0.21	0.87	0.13	0.02	0.04
Pr (ppb)	< 0.1	< 0.1	0.4	0.2	0.2	0.4	1.2	0.5	0.3	0.1
Pr_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	< 0.1
Nd (ppb)	0.3	0.3	1.8	0.9	0.6	1.6	5.3	2	1.29	0.4
Nd_d (ppb)	< 0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	0.3	< 0.1	< 0.01	< 0.1
Sm (ppb)	< 0.1	< 0.1	0.5	0.2	0.2	0.4	1.2	0.5	0.34	0.1
Sm_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	< 0.1
Eu (ppb)	< 0.1	< 0.1	0.1	< 0.1	< 0.1	0.1	0.4	0.2	0.1	< 0.1
Eu_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.01	< 0.1
Gd (ppb)	0.09	0.11	0.51	0.27	0.23	0.46	1.48	0.53	0.37	0.15
Gd_d (ppb)	< 0.01	< 0.01	0.02	0.03	< 0.01	0.01	0.11	0.01	< 0.01	< 0.01
Tb (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.2	< 0.1	0.05	< 0.1
Tb_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	< 0.1
Dy (ppb)	< 0.1	< 0.1	0.4	0.2	0.2	0.3	1.2	0.4	0.29	0.1
Dy_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	< 0.1
Ho (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.2	< 0.1	0.05	< 0.1
Ho_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	< 0.1
Er (ppb)	< 0.1	< 0.1	0.2	0.1	< 0.1	0.2	0.5	0.2	0.13	< 0.1
Er_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	< 0.1
Tm (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.02	< 0.1
Tm_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	< 0.1
Yb (ppb)	< 0.1	< 0.1	0.1	< 0.1	< 0.1	0.1	0.4	0.1	0.1	< 0.1
Yb_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	< 0.1
Lu (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Lu_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.6
Total REE (ppb)	1.98	2.3	13.42	6.73	4.63	10.15	31.3	11.93	8.1	2.95
Total LREE (ppb)	1.18	1.26	9.7	4.07	2.72	7.02	22.24	8.5	5.53	1.8
Total HREE (ppb)	0.75	0.84	3.12	1.86	1.61	2.73	8.26	3.03	2.27	0.95
Total REE_d (ppb)	0.655	0.775	1.33	1.97	0.845	1.24	3.67	1.12	0.41	1.475
Total REE % dissolved	33.1	33.7	9.9	29.3	18.3	12.2	11.7	9.4	5.1	50.0
Total LREE_d (ppb)	0.26	0.275	0.65	0.69	0.275	0.47	2.13	0.44	0.07	0.295
Total LREE % dissolved	22.0	21.8	6.7	17.0	10.1	6.7	9.6	5.2	1.3	16.4
Total HREE_d (ppb)	0.39	0.4	0.63	0.48	0.37	0.57	1.34	0.48	0.14	0.98
Total HREE % dissolved	52.0	47.6	20.2	25.8	23.0	20.9	16.2	15.8	6.2	103.2

Notes:

Results designated with a "d" (e.g. Eu_d) are dissolved concentrations.

pH, temperature, dissolved oxygen (DO), and conductivity measured in the field.

Total REEs (includes REE + Sc), LREEs, and HREEs non-detects were included at half the reporting limit.

gpm - gallons per minute

HREE - heavy REEs (Tb,Dy, Ho, Er, Tm, Yb, Lu, Y)

L/min - liters per minute

E - estimated, informational purposes, holding time exceedence or other issue

* - anion data is for information purposes (sample exceeded holding time or other) except for the late July 2024 results.

LREE - light REEs (La, Ce, Pr, Nd, Sm, Eu, Gd)

mg/L - milligrams per liter

na - not available

ppm - parts per million

ppb - parts per billion

uS/cm - microsiemens per centimeter

St. Louis Tunnel Water Data Summary

SampleID	SLT-01-22-001	SLT-01-23-001	SLT-02-23-001	SLT-03-23-001	SLT-04-23-001
Date Sampled	11/19/2022	4/24/2023	5/31/2023	7/27/2023	9/30/2023
pH	6.64	6.9	6.33	6.38	6.6
Temperature (°C)	16.1	19.3	na	19.2	18.8
DO (mg/L)	3.54	5.06	4.88	4.01	4.39
Conductivity (uS/cm)	1,140	1,112	1,027	1,122	1,155
Flow (gpm)	168	562	870	1,000	873
Flow (L/min)	636	2,127	3,293	3,785	3,305
Alkalinity (mg/L as CaCO ₃)	97 E	110 E	35.7 E	87.3 E	118 E
Au (ppb)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Au_d (ppb)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Ag (ppb)	< 0.05	< 0.05	0.08	< 0.05	< 0.05
Ag_d (ppb)	0.4	< 0.05	< 0.05	< 0.05	< 0.05
Al (ppb)	1,050	254	2,080	1,610	1,090
Al_d (ppb)	98	21	2190	165	27
As (ppb)	2.3	0.7	0.6	1.6	2.3
As_d (ppb)	< 0.2	< 0.2	0.4	< 0.2	< 0.2
B (ppb)	15	14	3	6	5
B_d (ppb)	6	7	7	5	4
Ba (ppb)	19.4	23.8	21.1	16.9	18.6
Ba_d (ppb)	22.6	25.5	20.5	16	18.9
Be (ppb)	0.98	0.422	0.648	0.978	0.921
Be_d (ppb)	0.5	0.25	1.35	0.382	0.215
Bi (ppb)	0.76	0.11	0.08	0.3	0.56
Bi_d (ppb)	0.2	< 0.01	< 0.01	0.03	< 0.01
Ca (ppb)	287,000	241,000	184,000	211,000	160,000
Ca_d (ppb)	258,000	244,000	226,000	214,000	163,000
Cd (ppb)	23	27.6	138	33.4	23.7
Cd_d (ppb)	17.7	25.9	125	32.4	20.5
Co (ppb)	2.26	2.58	8.03	5	3.31
Co_d (ppb)	0.8	2.14	6.7	5.04	3.22
Cr (ppb)	0.86	0.87	10.9	0.98	0.81
Cr_d (ppb)	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08
Cs (ppb)	0.5	0.5	0.6	0.5	0.5
Cs_d (ppb)	0.564	0.5	0.7	0.5	0.5
Cu (ppb)	255	59.2	1,400	370	258
Cu_d (ppb)	40.9	14.1	1,183	32.6	12.5
Fe (ppb)	9,400	2,620	3,580	14,600	13,000
Fe_d (ppb)	1,800	46	554	94	14
Ga (ppb)	0.7	0.2	0.6	0.7	1
Ga_d (ppb)	< 0.1	< 0.1	0.2	< 0.1	< 0.1
Ge (ppb)	0.4	< 0.1	0.3	0.4	0.5
Ge_d (ppb)	< 0.1	< 0.1	0.1	< 0.1	< 0.1
Hf (ppb)	< 0.1	0.3	0.1	< 0.1	< 0.1
Hf_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	0.4
Hg (ppb)	< 0.1	< 0.01	< 0.01	< 0.01	< 0.01
Hg_d (ppb)	< 0.01	< 0.1	< 0.1	< 0.01	< 0.01
In (ppb)	< 0.1	< 0.1	0.3	0.5	0.6
In_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
K (ppb)	1,730	1,680	1,170	1,610	1,100
K_d (ppb)	4,500 B	1,750	1,480	1,640	1,200
Li (ppb)	24.4	22	13.4	24.6	15.6
Li_d (ppb)	22.6	19.8	36.1	18.8	15.5
Mg (ppb)	20,000	20,200	19,100	18,400	13,400
Mg_d (ppb)	18,600	18,200	23,700	18,700	14,200
Mn (ppb)	1,920	1,740	4,580	3,420	2,020
Mn_d (ppb)	1,780	1,820	4,560	3,280	2,160
Mo (ppb)	17.2	18.8	5.75	24.1	21.1
Mo_d (ppb)	12.4	17.8	3.2	16.1	14.5
Na (ppb)	11,800	12,400	6,390	7,560	6,450
Na_d (ppb)	11,400	9,640	8,060	7,700	6,640
Nb (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Nb_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Ni (ppb)	4.2	4.8	85.6	8.7	5.8
Ni_d (ppb)	68 B	4.6	13.6	8.6	5.8
P (ppb)	10	< 3	< 3	12	4
P_d (ppb)	500 B	< 3	< 3	3	< 3
Pb (ppb)	17.7	2.76	11.1	20.7	24
Pb_d (ppb)	5.4	< 0.09	0.51	0.24	< 0.09
Rb (ppb)	5.6	4.7	10.3	5.8	6.7
Rb_d (ppb)	4.6	5.4	5.6	5.9	4.5
Re (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Re_d (ppb)	4.7	< 0.1	< 0.1	< 0.1	< 0.1
S (ppb)	241,000	199,000	158,000	181,000	143,000
S_d (ppb)	468,000	210,000	221,000	181,000	127,000
Sb (ppb)	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Sb_d (ppb)	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Se (ppb)	0.26	< 0.04	0.41	0.13	0.14
Se_d (ppb)	< 0.04	0.13	0.41	0.11	0.06
Si (ppb)	8,720	7,220	6,290	9,210	6,800
Si_d (ppb)	2,600	7,310	7,417	8,480	6,030
Sn (ppb)	0.09	0.08	1.87	< 0.06	0.2
Sn_d (ppb)	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
Sr (ppb)	4,490	3,748	3,100	2,920	2,880
Sr_d (ppb)	3,756	4,040	3,070	2,860	2,870

St. Louis Tunnel Water Data Summary

SampleID	SLT-01-22-001	SLT-01-23-001	SLT-02-23-001	SLT-03-23-001	SLT-04-23-001
Date Sampled	11/19/2022	4/24/2023	5/31/2023	7/27/2023	9/30/2023
Ta (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Ta_d (ppb)	0.2	< 0.1	< 0.1	< 0.1	< 0.1
Te (ppb)	0.4	0.5	0.1	< 0.1	0.4
Te_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Th (ppb)	0.4	1.1	0.3	0.5	0.3
Th_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Ti (ppb)	0.39	0.46	0.25	0.2	0.3
Ti_d (ppb)	1.1	0.13	0.07	< 0.07	< 0.07
Tl (ppb)	0.051	0.087	0.114	0.089	0.083
Tl_d (ppb)	< 0.005	0.056	0.105	0.096	0.083
U (ppb)	4.8	4.13	3.49	5.62	5.94
U_d (ppb)	2.3	3.58	1.47	2.07	2.64
V (ppb)	0.34	0.16	0.06	0.23	0.34
V_d (ppb)	< 0.01	< 0.01	< 0.01	0.03	< 0.01
W (ppb)	1.32	0.27	0.12	0.8	1.25
W_d (ppb)	< 0.02	0.07	< 0.02	< 0.02	0.05
Zn (ppb)	4,330	5,120	19,700	6,110	3,930
Zn_d (ppb)	3,680	4,940	20,300	5,860	3,770
Zr (ppb)	< 2	< 2	< 2	< 2	< 2
Zr_d (ppb)	< 2	< 2	< 2	< 2	< 2
Cl (ppm)*	< 0.5	< 5	< 5	< 5	< 5
F (ppm)*	1.69	< 2.5	2.54	2.75	< 2.5
NO ₃ (ppm)*	< 0.1	< 1	0.17	< 1	< 1
SO ₄ (ppm)*	614	658	685	550	535
Rare Earth Elements					
Sc (ppb)	0.2	0.3	0.4	1.4	0.4
Sc_d (ppb)	0.013	0.2	0.2	1.2	0.2
Y (ppb)	2.22	0.85	5.6	3.68	3.23
Y_d (ppb)	0.3	0.15	3.99	0.21	0.08
La (ppb)	2	0.8	6.2	3.3	2.4
La_d (ppb)	0.2	0.1	4.9	0.1	< 0.1
Ce (ppb)	4.6	1.28	14.9	10.5	5.42
Ce_d (ppb)	0.22	0.18	7.08	0.27	0.08
Pr (ppb)	0.6	0.2	1.2	0.9	0.7
Pr_d (ppb)	< 0.1	< 0.1	0.7	< 0.1	< 0.1
Nd (ppb)	2.3	0.6	4.5	3.5	2.7
Nd_d (ppb)	< 0.1	< 0.1	2.4	< 0.1	< 0.1
Sm (ppb)	0.5	0.1	0.9	0.7	0.6
Sm_d (ppb)	< 0.1	< 0.1	0.4	< 0.1	< 0.1
Eu (ppb)	0.1	< 0.1	0.2	0.2	0.1
Eu_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Gd (ppb)	0.57	0.15	1.16	0.78	0.68
Gd_d (ppb)	0.02	0.01	0.59	0.02	0.01
Tb (ppb)	< 0.1	< 0.1	0.2	0.1	0.1
Tb_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Dy (ppb)	0.5	0.1	0.8	0.6	0.5
Dy_d (ppb)	< 0.1	< 0.1	0.4	< 0.1	< 0.1
Ho (ppb)	< 0.1	< 0.1	0.2	0.1	< 0.1
Ho_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Er (ppb)	0.2	< 0.1	0.4	0.3	0.3
Er_d (ppb)	< 0.1	< 0.1	0.2	< 0.1	< 0.1
Tm (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Tm_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Yb (ppb)	0.2	< 0.1	0.2	0.2	0.2
Yb_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Lu (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Lu_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Total REE (ppb)	14.2	4.7	37.0	26.4	17.5
Total LREE (ppb)	10.7	3.2	29.1	19.9	12.6
Total HREE (ppb)	3.3	1.3	7.5	5.1	4.5
Total REE_d (ppb)	1.3	1.2	21.2	2.4	1.0
Total REE % dissolved	9.2	25.2	57.3	8.9	5.5
Total LREE_d (ppb)	0.6	0.5	16.1	0.6	0.3
Total LREE % dissolved	6.0	15.4	55.5	3.0	2.7
Total HREE_d (ppb)	0.7	0.5	4.8	0.6	0.4
Total HREE % dissolved	19.6	40.0	64.5	11.0	9.6

Notes:

Results designated with a "d" (e.g. Eu_d) are dissolved concentrations.

pH, temperature, dissolved oxygen (DO), and conductivity measured in the field.

Total REEs (includes REE + Sc), LREEs, and HREEs non-detects were included at half the reporting limit.

gpm - gallons per minute

HREE - heavy REEs (Tb,Dy, Ho, Er, Tm, Yb, Lu, Y)

L/min - liters per minute

B - estimated value, analyte detected in field blank.

E - estimated, informational purposes, holding time exceedence or other issue

* - anion data is for information purposes (sample exceeded holding time or other) except for the late July 2024 results.

LREE - light REEs (La, Ce, Pr, Nd, Sm, Eu, Gd)

mg/L - milligrams per liter

na - not available

ppm - parts per million

ppb - parts per billion

uS/cm - microsiemens per centimeter

Argo Tunnel Water Data Summary

SampleID	AT-01-22-001	AT-01-23-001	AT-02-23-001	AT-03-23-001	AT-04-23-001 FA	AT-01-24-001	AT-02-24-001	AT-03-24-001	AT-04-24-001	AT-05-24-001
Date Sampled	11/12/2022	4/20/2023	5/25/2023	8/2/2023	9/29/2023	5/13/2024	5/30/2024	6/13/2024	7/1/2024	7/25/2024
pH	2.75	2.84	2.89	2.75	2.89	2.75	2.48	2.66	2.67	2.81
Temperature (°C)	13	13.9	17.6	16	na	15.9	7.6	11.6	15.2	18.5
DO (mg/L)	5.69	5.43	5.47	4.4	4.74	3.64	6.73	6.36	7.63	5.04
Conductivity (uS/cm)	2,840	2,660	2,910	2,980	3,270	3,210	3,240	3,650	2,470	3,280
Flow (gpm)	190	144	198	213	197	197.4	217	187	227.5	218
Flow (L/min)	719	545	750	806	746	747	821	708	861	825
Alkalinity (mg/L as CaCO ₃)	< 10	< 10 E	< 10 E	< 10 E	< 10 E	< 10	< 10	< 25	na	< 1
Au (ppb)	< 0.01	0.02	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Au_d (ppb)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Ag (ppb)	0.08	0.21	0.11	0.12	0.1	0.18	0.11	0.14	0.09	0.09
Ag_d (ppb)	0.07	< 0.05	0.05	0.06	< 0.05	0.11	0.09	0.11	0.09	0.06
Al (ppb)	18,100	17,000	13,500	18,500	15,500	20,400	25,600	27,100	26,100	17,100
Al_d (ppb)	19,900	15,300	17,800	18,200	12,800	20,300	19,900	23,000	19,300	18,400
As (ppb)	48	51.3	52.4	50.1	41.7	76.5	85.8	86.8	70.6	56.4
As_d (ppb)	58.4	44.1	51.6	50.5	40	79	83	88	70.8	54
B (ppb)	30	75	16	33	24	23	34	34	28	25
B_d (ppb)	37	27	28	25	24	24	24	27	26	27
Ba (ppb)	1.65	3.29	1.64	1.73	2.42	1.99	1.84	1.96	2.08	1.96
Ba_d (ppb)	2.34	1.82	1.7	1.74	3.01	2.12	1.9	1.92	1.71	2.1
Be (ppb)	8.07	9.24	5.64	13.5	8.61	11.6	15.8	14.7	12.5	9.58
Be_d (ppb)	11.1	7.89	11.6	10.1	8.02	11.3	11	11.7	11.1	10.8
Bi (ppb)	0.04	0.02	0.03	0.04	0.03	0.02	0.04	0.06	0.05	0.04
Bi_d (ppb)	0.04	0.02	0.02	0.04	0.03	0.03	0.15	0.24	0.11	0.05
Ca (ppb)	248,000	313,000	250,000	266,000	220,000	271,000	284,000	284,000	253,000	267,000
Ca_d (ppb)	349,000	291,000	289,000	264,000	211,000	271,000	252,000	250,000	249,000	272,000
Cd (ppb)	83.4	94.1	106	101	102	128	122	128	100	91.6
Cd_d (ppb)	106	85.1	96.4	104	107	133	131	126	115	95.7
Co (ppb)	103	125	120	109	105	118	129	135	123	115
Co_d (ppb)	124	106	117	113	103	121	125	129	121	119
Cr (ppb)	6.51	20.7	8.12	8.52	6.05	6.87	9.24	11.2	9.35	7.26
Cr_d (ppb)	7.76	4.96	6.17	7.88	5.74	7.21	9.14	10.4	8.88	7.56
Cs (ppb)	5.5	6.1	5.4	5.7	5.7	8.1	8.3	9	8.5	7.9
Cs_d (ppb)	8.81	6.1	5.6	5.6	7.3	6.8	6.7	7	5.7	6.5
Cu (ppb)	3,260	3,220	3,500	3,808	3,180	4,440	5,690	6,920	5,320	3,740
Cu_d (ppb)	3,914	2,570	3,167	4,020	3,200	4,340	5,790	6,540	5,320	4,080
Fe (ppb)	103,000	132,000	118,000	117,000	109,000	134,000	142,000	152,000	130,000	130,000
Fe_d (ppb)	141,000	118,000	129,000	121,000	111,000	134,000	130,000	135,000	131,000	133,000
Ga (ppb)	12.6	7.8	9.3	2.5	5	6	6.5	7.1	6	5.2
Ga_d (ppb)	11.8	7.4	8.1	2.6	4.3	6	7	7	6	6.7
Ge (ppb)	5.7	1	6.4	7.6	5.7	5.8	7.2	7.6	6.7	6.6
Ge_d (ppb)	10.2	7.1	7.7	7.3	4.5	6	7	7	5.7	6.7
Hf (ppb)	< 0.1	0.3	< 0.1	< 0.1	0.2	0.1	< 0.1	< 0.1	0.3	0.1
Hf_d (ppb)	< 0.1	0.1	< 0.1	< 0.1	0.1	< 0.1	0.1	< 0.1	< 0.1	0.1
Hg (ppb)	< 0.1	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Hg_d (ppb)	< 0.01	< 0.1	< 0.1	0.02	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
In (ppb)	0.1	0.8	1.2	1.5	1.1	1.7	2.2	2.8	2.18	1.6
In_d (ppb)	0.3	0.9	1.1	1.5	1.2	1.7	2.2	2.6	2.06	1.5
K (ppb)	3360	5040	3700	3580	3310	4000	3740	3310	3210	4600
K_d (ppb)	4332 B	4810	4220	3550	3080	4110	3190	2880	3030	4830
Li (ppb)	26.2	34.5	16.2	41.8	24	29.1	43.5	38.6	33	26
Li_d (ppb)	40.9	25.4	40.1	26.9	24.2	30.2	28	30.8	30.3	29.5
Mg (ppb)	80,400	108,000	82,400	89,600	77,400	93,600	99,900	98,400	93,600	89,700
Mg_d (ppb)	113,000	91,600	98,300	87,900	68,700	101,000	94,100	91,100	89,900	96,000
Mn (ppb)	62,500	83,100	78,000	72,100	59,500	90,100	86,400	83,500	79,700	62,200
Mn_d (ppb)	72,000	73,800	85,400	67,400	62,200	98,800	88,400	82,700	78,302	64,600
Mo (ppb)	0.2	1.06	0.32	0.23	0.23	0.13	0.22	0.27	< 0.4	0.25
Mo_d (ppb)	0.21	0.08	0.14	0.32	0.16	0.32	0.28	0.31	< 0.4	0.22
Na (ppb)	17,000	22,200	17,000	17,300	15,300	18,700	18,500	17,600	17,100	16,800
Na_d (ppb)	22,500	19,000	20,100	16,800	12,900	19,100	16,400	15,800	15,900	18,300
Nb (ppb)	< 0.1	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.12	< 0.1
Nb_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.02	< 0.1
Ni (ppb)	170	192	195	172	164	172	200	221	196	167
Ni_d (ppb)	196 B	159	175	179	166	187	203	217	189	175
P (ppb)	59	50	50	84	45	84	130	132	99	94
P_d (ppb)	85 B	53	74	77	38	94	100	121	98	77
Pb (ppb)	16.2	16.5	16.1	21.4	19.9	15.6	18.5	23.6	28.2	21.1
Pb_d (ppb)	20.5	15	15.9	22.2	22	15.9	19.7	25.1	26.8	22.7
Rb (ppb)	23.5	23.7	44.4	22.8	33.7	26.9	25.7	25.2	25.3	25.3
Rb_d (ppb)	23.3	26.7	22.5	22.9	23.4	23.1	21.7	19.3	22.1	23.6
Re (ppb)	0.4	< 0.1	0.5	0.3	0.4	0.5	0.5	0.5	0.4	0.4
Re_d (ppb)	0.4	0.3	0.4	0.3	0.5	0.5	0.5	0.4	0.4	0.4
S (ppb)	554,000	614,000	446,000	561,000	495,000	496,000	563,000	569,000	585,000	558,000
S_d (ppb)	602,000	595,000	582,000	543,000	408,000	663,000	603,000	605,000	546,000	595,000
Sb (ppb)	1.5	1.4	1.6	1.5	1.8	1.6	1.5	1.6	1.5	1.5
Sb_d (ppb)	1.6	1.2	1.6	1.5	1.5	1.5	1.6	1.7	1.7	1.6
Se (ppb)	< 0.04	< 0.04	0.65	0.83	1.12	0.43	0.53	0.54	0.44	0.51
Se_d (ppb)	0.36	0.05	0.86	0.74	0.7	0.45	0.55	0.6	0.45	0.51
Si (ppb)	16,900	21,100	15,700	28,300	16,400	20,600	26,300	25,600	22,100	18,300
Si_d (ppb)	32,100	21,800	19,357	30,200	16,300	21,400	21,900	23,000	21,400	20,300
Sn (ppb)	< 0.06	1.49	21.7	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
Sn_d (ppb)	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	0.61	0.75	0.27	0.25
Sr (ppb)	1,360	1,462	1,460	1,150	1,220	1,490	1,380	1,390	1,210	1,120

Argo Tunnel Water Data Summary

SampleID	AT-01-22-001	AT-01-23-001	AT-02-23-001	AT-03-23-001	AT-04-23-001 FA	AT-01-24-001	AT-02-24-001	AT-03-24-001	AT-04-24-001	AT-05-24-001
Date Sampled	11/12/2022	4/20/2023	5/25/2023	8/2/2023	9/29/2023	5/13/2024	5/30/2024	6/13/2024	7/1/2024	7/25/2024
Sr_d (ppb)	1,607	1,440	1,290	1,160	1,250	1,420	1,340	1,260	1,239	1,120
Ta (ppb)	< 0.1	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Ta_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Te (ppb)	0.8	0.5	0.8	0.9	0.8	1	1.1	1.3	1	0.7
Te_d (ppb)	1	0.6	0.8	1	0.5	1	1	1	1.2	0.8
Th (ppb)	15	5.7	10.2	16.3	8.3	10.9	17.4	24.2	20.4	8.2
Th_d (ppb)	10.8	5.2	10.5	16.8	6	9.8	16.5	20.8	16.2	8.9
Ti (ppb)	0.79	1.92	0.58	0.79	4.4	0.66	1.04	1.12	0.97	0.72
Ti_d (ppb)	0.78	0.46	0.6	0.738	0.58	0.66	0.81	0.95	0.9	0.76
TI (ppb)	0.286	0.6	0.299	0.296	0.33	0.261	0.27	0.282	0.287	0.264
TI_d (ppb)	0.353	0.277	0.288	0.312	0.374	0.319	0.297	0.303	0.255	0.282
U (ppb)	62.1	42.2	54.1	61.2	53	62.1	88.6	103	81.2	54.3
U_d (ppb)	66.2	39.5	51.2	64	49.6	65	83.5	95.2	75.4	59.2
V (ppb)	5.14	6.41	6.69	4.85	4.92	7.26	6.92	6.86	6.22	5.34
V_d (ppb)	5.99	5.66	6.66	4.99	4.56	7.53	6.32	6.46	6	5.42
W (ppb)	0.04	0.1	< 0.02	< 0.02	0.29	0.17	0.77	0.12	0.12	12.3
W_d (ppb)	0.08	0.05	0.06	0.04	0.08	0.18	0.76	0.2	0.08	11
Zn (ppb)	27,100	39,500	36,500	31,400	32,400	44,000	41,900	42,900	43,300	31,600
Zn_d (ppb)	36,300	32,300	33,300	33,200	35,800	41,500	38,800	38,200	38,200	33,200
Zr (ppb)	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Zr_d (ppb)	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Cl (ppm)*	18.9	15.9	14.9	18.7	16.8	15.1	18.2	19.9	20.3	18
F (ppm)*	2.31	3.73	3.03	4.42	3.64	4.77	5.06	5.07	4.96	na
NO ₃ (ppm)*	< 0.1	< 1	< 0.1	< 1	< 1	< 2.5	< 2.5	< 2.5	< 2.5	na
SO ₄ (ppm)*	1,647	1,842	1,565	1,707	1,495	1,846	1,472	1,541	1,615	2,100
Rare Earth Elements										
Sc (ppb)	6.3	4.6	8.5	12.2	5.2	8.1	10	12.1	10.1	8.5
Sc_d (ppb)	5.66	6.3	7.5	13.2	4.7	8.4	10.3	12.2	11.1	8.3
Y (ppb)	157	144	162	160	151	170	183	206	170	151
Y_d (ppb)	191	145	154	164	160	173	193	200	179	154
La (ppb)	165	130	141	150	118	162	198	230	193	150
La_d (ppb)	180	127	137	147	117	153	192	207	178	131
Ce (ppb)	353	282	351	398	257	369	445	516	424	337
Ce_d (ppb)	390	323	308	393	254	350	435	461	396	293
Pr (ppb)	48	38.7	40	43.4	34.7	45.8	54.8	63.8	53.8	43
Pr_d (ppb)	53.3	37.8	39.6	43.7	34.3	44.4	54.7	58.5	50.8	38.4
Nd (ppb)	188	154	164	176	139	189	223	261	223	178
Nd_d (ppb)	217	152	165	178	137	187	226	243	211	159
Sm (ppb)	38.9	32.7	35	37.6	30.4	40.6	48.3	55.2	47.7	38.8
Sm_d (ppb)	43.4	34.1	35	37.4	30.2	39.6	48.5	52.2	44.1	35.1
Eu (ppb)	7.3	6.2	6.8	6.9	5.5	7.8	9.2	10.4	9	7.2
Eu_d (ppb)	8.1	6.3	6.6	7	5.6	7.6	9.3	9.8	8.14	6.4
Gd (ppb)	44	35.8	39.9	40.5	33	46.3	54.7	61.4	52.4	43.2
Gd_d (ppb)	50.1	37.1	38.8	40.6	32.8	45	54.9	57.9	50	37.8
Tb (ppb)	6.1	5.2	6	6.4	4.9	6.4	7.7	8.6	7.49	6.1
Tb_d (ppb)	7	5.3	6	6.5	4.8	6.3	7.8	8.1	7.11	5.8
Dy (ppb)	33.2	27.9	30.5	32.1	25.5	35.3	41.4	46.9	40.5	33.3
Dy_d (ppb)	37.3	28.4	30.4	31.7	25.3	33.9	41.8	42.5	37.4	30.6
Ho (ppb)	6.4	5.3	5.7	6	4.9	6.8	7.6	8.7	7.56	6.5
Ho_d (ppb)	7.2	5.5	5.7	6	4.9	6.6	7.8	8.1	7.19	5.7
Er (ppb)	17.1	13.9	15.2	15.9	13.3	17.9	20.5	23.3	19.9	16.5
Er_d (ppb)	18.8	14.6	15.3	16.3	13.1	17.4	20.5	21.6	19.3	14.9
Tm (ppb)	2.1	1.7	2	2.2	1.7	2.3	2.6	3	2.52	2.1
Tm_d (ppb)	2.4	1.8	2	2.1	1.6	2.2	2.7	2.8	2.43	1.9
Yb (ppb)	12.6	10.5	11.5	12.1	10.1	13.8	15.4	17.8	15.2	12.4
Yb_d (ppb)	14.4	10.7	11.4	12.2	9.9	13.3	15.8	16.5	14.3	11.1
Lu (ppb)	1.8	1.5	1.7	1.7	1.4	2	2.3	2.6	2.2	1.8
Lu_d (ppb)	2.1	1.6	1.7	1.7	1.4	1.9	2.3	2.5	2.1	2.3
Total REE (ppb)	1,086.8	894.0	1,020.8	1,101.0	835.6	1,123.1	1,323.5	1,526.8	1,278.4	1,035.4
Total LREE (ppb)	844.2	679.4	777.7	852.4	617.6	860.5	1,033.0	1,197.8	1,002.9	797.2
Total HREE (ppb)	236.3	210.0	234.6	236.4	212.8	254.5	280.5	316.9	265.4	229.7
Total REE_d (ppb)	1,227.8	936.5	964.0	1,100.4	836.6	1,089.6	1,322.4	1,403.7	1,218.0	935.3
Total REE % dissolved	113.0	104.8	94.4	99.9	100.1	97.0	99.9	91.9	95.3	90.3
Total LREE_d (ppb)	941.9	717.3	730.0	846.7	610.9	826.6	1,020.4	1,089.4	938.0	700.7
Total LREE % dissolved	111.6	105.6	93.9	99.3	98.9	96.1	98.8	91.0	93.5	87.9
Total HREE_d (ppb)	280.2	212.9	226.5	240.5	221.0	254.6	291.7	302.1	268.8	226.3
Total HREE % dissolved	118.6	101.4	96.5	101.7	103.9	100.0	104.0	95.3	101.3	98.5

Notes:

Results designated with a "d" (e.g. Eu_d) are dissolved concentrations.

pH, temperature, dissolved oxygen (DO), and conductivity measured in the field.

Total REEs (includes REE + Sc), LREEs, and HREEs non-detects were included at half the reporting limit.

gpm - gallons per minute

HREE - heavy REEs (Tb,Dy, Ho, Er, Tm, Yb, Lu, Y)

L/min - liters per min

B - estimated value, analyte detected in field blank.

* - anion data is for information purposes (sample exceeded holding time or other) except for the late July 2024 results.

LREE - light REEs (La, Ce, Pr, Nd, Sm, Eu, Gd)

mg/L - milligrams per liter

na - not available

ppm - parts per million

ppb - parts per billion

uS/cm - microsiemens per centimeter

E - estimated, informational purposes, holding time exceedence or other issue

Virginia Canyon Water Data Summary

SampleID	VC-01-22-001	VC-01-23-001	VC-02-23-001	VC-03-23-001	VC-04-23-001 FA	VC-01-24-001	VC-02-24-001	VC-03-24-001	VC-04-24-001	VC-05-24-001
Date Sampled	11/12/2022	4/20/2023	5/25/2023	8/2/2023	9/29/2023	5/13/2024	5/30/2024	6/13/2024	7/1/2024	7/25/2024
pH	3.35	3.49	3.4	3.3	3.41	3.46	3.24	3.32	3.32	3.36
Temperature (°C)	13	na	14.3	17	na	12	6.1	9.2	9.8	18
DO (mg/L)	7.6	9.1	7.78	7.2	6.28	7.12	7.09	7.14	8.38	6.37
Conductivity (uS/cm)	2,220	1,927	1,934	2,173	2,450	1,738	1,808	2,001	1,519	2,320
Flow (gpm)	7.8	11.1	38.3	8.4	16.6	19.3	11	10.1	9.4	10.7
Flow (L/min)	30	42	145	32	63	73	42	38	36	41
Alkalinity (mg/L as CaCO ₃)	< 10	< 10 E	< 10 E	< 10 E	< 10 E	< 10	< 10	< 25	na	< 1
Au (ppb)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Au_d (ppb)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Ag (ppb)	0.66	0.46	0.75	1.22	0.79	0.87	0.97	0.94	0.99	0.92
Ag_d (ppb)	0.79	0.41	0.59	0.14	0.76	0.88	0.96	0.95	1.08	0.86
Al (ppb)	66,100	49,200	45,800	43,900	46,300	31,800	43,900	46,300	50,200	40,600
Al_d (ppb)	68,400	47,400	50,800	40,500	38,500	30,800	33,900	39,700	39,000	41,400
As (ppb)	5	4.7	3	13.8	3.1	1.5	2.1	2.3	2.2	2.6
As_d (ppb)	6.2	4.3	5	4.9	2.8	1.5	1.8	2.3	2.2	2.7
B (ppb)	19	17	16	31	20	20	26	25	23	22
B_d (ppb)	23	15	19	25	19	20	18	20	22	23
Ba (ppb)	6.74	6.45	8.1	38.8	9.68	8.84	10.5	10.8	11.1	12.5
Ba_d (ppb)	9.1	5.84	9.46	17.1	13.4	9.74	10.4	10.6	12.9	12.4
Be (ppb)	10.1	8.13	9.73	15.4	8.97	7.08	11.5	12.2	11	9.06
Be_d (ppb)	14	8.55	13.2	11.6	8.85	6.9	8.19	8.94	9.99	9.68
Bi (ppb)	< 0.01	< 0.01	< 0.01	0.09	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Bi_d (ppb)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.02	0.02	< 0.01
Ca (ppb)	223,000	207,000	161,000	183,000	174,000	164,000	177,000	168,000	161,000	187,000
Ca_d (ppb)	301,000	220,000	180,000	182,000	164,000	158,000	158,000	158,000	165,000	191,000
Cd (ppb)	335	283	339	278	319	176	204	224	221	223
Cd_d (ppb)	415	266	314	289	331	184	223	238	254	224
Co (ppb)	233	213	196	199	214	108	144	160	173	198
Co_d (ppb)	276	199	195	202	210	110	134	157	173	199
Cr (ppb)	12.5	10.3	16.3	15.7	11.1	9.42	11.6	13.3	14.5	14
Cr_d (ppb)	14.1	9.24	15.8	13.4	10.5	9.36	11.4	13.6	13.3	14.2
Cs (ppb)	0.2	0.2	0.1	0.5	0.2	0.2	0.3	0.3	0.3	0.4
Cs_d (ppb)	0.307	0.2	0.1	0.2	0.3	0.2	0.3	0.3	0.6	0.6
Cu (ppb)	6,640	5,719	7,600	5,559	6,280	4,600	5,980	6,600	6,310	5,730
Cu_d (ppb)	7,577	5,430	6,968	5,820	6,220	4,440	5,520	6,420	6,130	5,800
Fe (ppb)	1,300	988	1,770	6,310	1,400	1,100	1,420	1,650	1,680	1,870
Fe_d (ppb)	1,710	975	1,860	3,360	1,250	985	1,410	1,630	1,740	2,550
Ga (ppb)	18.9	9.6	12.9	2.6	5.9	2.9	4	4.6	5.1	4.8
Ga_d (ppb)	18.1	10.2	11.2	1.9	5.7	3	4	4	5	6.4
Ge (ppb)	6.7	< 0.1	6.7	6.9	5.2	2.9	4.4	4.9	4.9	5.6
Ge_d (ppb)	10.8	6.6	7.9	6.9	4.7	3	4	5	4.2	5.5
Hf (ppb)	0.1	0.2	0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1	0.1	0.1
Hf_d (ppb)	0.1	0.1	0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.1
Hg (ppb)	< 0.1	< 0.01	< 0.01	0.09	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Hg_d (ppb)	< 0.01	< 0.1	< 0.1	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
In (ppb)	< 0.1	0.3	0.6	0.6	0.3	0.3	0.4	0.5	0.55	0.5
In_d (ppb)	< 0.1	0.2	0.6	0.5	0.3	0.3	0.4	0.5	0.54	0.5
K (ppb)	4,970	4,640	4,730	7,090	5,590	4,760	5,510	5,620	5,240	6,240
K_d (ppb)	6,050 B	4,730	4,760	6,440	4,910	4,580	4,520	4,840	5,090	6,400
Li (ppb)	56.8	54.5	49.6	78.3	54	38.6	65.7	63.3	57	48.7
Li_d (ppb)	89.3	50.5	61.4	50.4	54.8	40	42.6	47.4	50.1	52
Mg (ppb)	82,500	87,000	64,600	70,600	67,200	60,800	65,800	67,100	65,600	71,100
Mg_d (ppb)	115,000	82,100	69,500	70,500	59,900	62,000	62,200	64,200	65,100	74,900
Mn (ppb)	60,900	58,500	43,800	57,400	52,000	26,800	35,100	41,100	48,100	46,100
Mn_d (ppb)	67,200	56,800	52,300	55,500	52,700	29,000	37,300	40,900	48,958	46,100
Mo (ppb)	< 0.04	0.08	< 0.04	0.46	0.06	< 0.04	< 0.04	< 0.04	< 0.4	< 0.04
Mo_d (ppb)	< 0.04	< 0.04	0.04	0.15	< 0.04	0.05	< 0.04	< 0.04	< 0.4	< 0.04
Na (ppb)	19,000	21,800	13,300	28,100	21,700	36,300	47,900	40,900	31,200	26,200
Na_d (ppb)	25,200	20,000	14,400	28,700	18,400	34,100	42,700	37,800	30,300	27,900
Nb (ppb)	0.1	0.1	0.1	0.2	< 0.1	< 0.1	< 0.1	< 0.1	0.03	< 0.1
Nb_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	< 0.1
Ni (ppb)	507	469	448	390	453	278	340	363	384	389
Ni_d (ppb)	574 B	460	425	402	477	291	340	370	375	388
P (ppb)	11	6	4	54	< 3	< 3	< 3	4	< 3	6
P_d (ppb)	< 3 B	< 3	4	7	< 3	< 3	< 3	< 3	< 3	< 3
Pb (ppb)	15.3	13.4	29.7	93.4	23.9	19.2	22.7	27.3	29	26.4
Pb_d (ppb)	19.1	13.3	27.5	39.9	26.3	19.3	22.9	27.7	34.3	26.6
Rb (ppb)	10	6.9	12.4	20.5	18.6	8.5	10.3	11.6	13.9	14.9
Rb_d (ppb)	10.4	8.1	11.1	16.2	12.8	7.3	8.9	9.8	24.1	19.1
Re (ppb)	0.3	< 0.1	0.2	0.3	0.3	0.4	0.4	0.3	0.3	0.3
Re_d (ppb)	0.4	0.2	0.1	0.2	0.4	0.4	0.3	0.3	0.4	0.3
S (ppb)	551,000	456,000	363,000	418,000	417,000	276,000	345,000	340,000	383,000	415,000
S_d (ppb)	546,000	503,000	395,000	415,000	315,000	352,000	366,000	386,000	409,000	431,000
Sb (ppb)	< 0.9	< 0.9	< 0.9	1.7	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Sb_d (ppb)	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Se (ppb)	0.18	0.3	1.42	1.37	1.95	0.54	0.65	0.71	0.61	0.97
Se_d (ppb)	0.82	0.21	1.53	1.24	1.16	0.59	0.67	0.72	0.67	0.9
Si (ppb)	32,100	44,400	30,000	56,600	30,900	27,500	38,700	42,200	37,400	42,600
Si_d (ppb)	60,800	35,700	31,917	59,500	32,500	28,000	32,900	37,100	36,100	44,200
Sn (ppb)	0.07	< 0.06	0.1	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
Sn_d (ppb)	0.09	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	0.07	0.09
Sr (ppb)	682	591	463	521	588	621	592	553	539	527

Virginia Canyon Water Data Summary

SampleID	VC-01-22-001	VC-01-23-001	VC-02-23-001	VC-03-23-001	VC-04-23-001 FA	VC-01-24-001	VC-02-24-001	VC-03-24-001	VC-04-24-001	VC-05-24-001
Date Sampled	11/12/2022	4/20/2023	5/25/2023	8/2/2023	9/29/2023	5/13/2024	5/30/2024	6/13/2024	7/1/2024	7/25/2024
Sr_d (ppb)	765	641	438	521	586	601	601	582	552	533
Ta (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Ta_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Te (ppb)	< 0.1	< 0.1	0.2	0.2	< 0.1	0.2	< 0.1	< 0.1	< 0.1	< 0.1
Te_d (ppb)	< 0.1	< 0.1	0.2	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Th (ppb)	7	4.3	7.5	9.7	4.4	3	4.1	5.4	7.2	5.4
Th_d (ppb)	4.9	2.3	8.3	8.7	3	2.4	3.7	4.9	5.6	5.3
Ti (ppb)	1.65	1.09	1.51	112	3.9	1.05	1.45	1.61	1.86	1.84
Ti_d (ppb)	1.37	0.93	1.46	1.79	1.13	0.94	1.1	1.55	1.5	1.77
Tl (ppb)	0.054	0.045	0.067	0.129	0.087	0.052	0.065	0.063	0.084	0.086
Tl_d (ppb)	0.075	0.046	0.076	0.101	0.104	0.057	0.076	0.081	0.102	0.098
U (ppb)	163	111	178	154	144	111	150	180	173	151
U_d (ppb)	173	109	161	160	139	100	136	163	209	155
V (ppb)	0.05	0.05	0.07	3.93	0.12	0.04	0.06	0.06	0.08	0.06
V_d (ppb)	0.03	0.03	0.06	0.13	0.03	0.04	0.05	0.06	0.07	0.06
W (ppb)	0.09	0.07	< 0.02	0.07	0.2	0.29	0.07	0.03	0.08	1.13
W_d (ppb)	0.08	0.07	0.08	0.02	0.09	0.28	0.27	0.1	0.06	0.93
Zn (ppb)	56,900	55,000	53,500	46,200	55,200	35,900	44,200	48,600	52,000	44,800
Zn_d (ppb)	72,500	53,300	51,400	48,900	59,800	33,200	40,900	45,100	48,200	45,100
Zr (ppb)	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Zr_d (ppb)	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Cl (ppm)*	20.9	20.9	19	40.7	30.3	58.5	64.5	49.2	41.4	25
F (ppm)*	3.91	5.06	5.86	5.46	5.2	3.33	4	4.52	5.08	na
NO ₃ (ppm)*	4.1	2.47	3.81	5.72	4.92	6.31	7.2	6.36	6.31	na
SO ₄ (ppm)*	1,884	1,439	1,336	1,307	1,363	1,068	1,123	1,181	1,423	1,600
Rare Earth Elements										
Sc (ppb)	7.3	6	12.5	17.1	5.3	5.3	7.3	8.9	10.6	11.1
Sc_d (ppb)	6.68	6.7	11.1	18	5.3	5.3	7	8.9	10.9	10.6
Y (ppb)	293	216	248	204	236	142	170	190	194	201
Y_d (ppb)	318	227	236	208	245	141	174	196	206	198
La (ppb)	260	177	213	177	164	118	154	178	197	187
La_d (ppb)	273	172	214	174	157	117	149	170	183	160
Ce (ppb)	583	395	474	493	373	268	356	422	472	440
Ce_d (ppb)	609	399	488	461	356	266	342	403	437	379
Pr (ppb)	81.9	57.5	64.3	59.8	52.7	35.5	45.8	55.1	61.4	60.8
Pr_d (ppb)	86	53.9	65.4	60	50.4	35.5	45.4	53.9	59.3	53.9
Nd (ppb)	335	238	270	244	209	148	189	229	255	259
Nd_d (ppb)	353	219	272	243	203	147	190	223	250	224
Sm (ppb)	72.5	52.5	60.7	52.9	47.3	32.6	42.5	51.2	58.2	59.1
Sm_d (ppb)	76.2	50.1	61.3	55.3	45.7	32.9	42.8	50	54.4	50.7
Eu (ppb)	15.8	11.3	12.6	10.8	10	6.9	8.9	10.8	12.1	12
Eu_d (ppb)	16.5	10.7	12.7	11.2	9.5	6.9	9	10.7	11.8	10.2
Gd (ppb)	84.3	58.3	65.9	55.2	52.3	36.5	47.6	55.8	61.9	62.6
Gd_d (ppb)	87.8	55.8	66.4	56.9	50	36.2	48.1	54.1	61.2	53.1
Tb (ppb)	12.5	8.8	10.5	9.2	7.8	5.4	6.9	8	8.9	8.8
Tb_d (ppb)	13	8.4	10.4	8.5	7.6	5.3	6.9	7.8	8.85	8
Dy (ppb)	69.7	48.1	51.9	43.9	41.7	29.3	36.7	43.6	47.4	48.7
Dy_d (ppb)	71.3	46.3	54.6	46.4	39.6	29.1	37.9	43.3	47.4	42.6
Ho (ppb)	13.1	9.4	9.8	8.1	7.9	5.4	6.9	8.1	8.6	9.1
Ho_d (ppb)	13.5	8.8	10	8.6	7.5	5.5	7	8	8.88	7.9
Er (ppb)	35.7	24.7	26	21.9	21	14.7	18.8	21.8	23.5	23.8
Er_d (ppb)	36.5	23.5	27	23.3	20.4	14.5	18.3	21.3	23.6	21
Tm (ppb)	4.5	3.1	3.6	3.2	2.7	1.9	2.5	2.9	3.08	3.1
Tm_d (ppb)	4.7	3	3.6	3	2.5	1.9	2.4	2.8	3.04	2.8
Yb (ppb)	27.7	19.6	20.6	17.4	16.7	11.9	15.2	17.7	18.8	18.5
Yb_d (ppb)	29.4	18.6	21.3	18.5	16.3	11.9	15.2	17.2	18.6	16.5
Lu (ppb)	4.1	2.9	3	2.4	2.4	1.7	2.2	2.5	2.7	2.8
Lu_d (ppb)	4.3	2.8	3.1	2.7	2.2	1.7	2.2	2.5	2.8	3.2
Total REE (ppb)	1,900.1	1,328.2	1,546.4	1,419.9	1,249.8	863.1	1,110.3	1,305.4	1,435.2	1,407.4
Total LREE (ppb)	1,432.5	989.6	1,160.5	1,092.7	908.3	645.5	843.8	1,001.9	1,117.6	1,080.5
Total HREE (ppb)	460.3	332.6	373.4	310.1	336.2	212.3	259.2	294.6	306.98	315.8
Total REE_d (ppb)	1,998.9	1,305.6	1,556.9	1,398.4	1,218.0	857.7	1,097.2	1,272.5	1,386.8	1,241.5
Total REE % dissolved	105.2	98.3	100.7	98.5	97.5	99.4	98.8	97.5	96.6	88.2
Total LREE_d (ppb)	1,501.5	960.5	1,179.8	1,061.4	871.6	641.5	826.3	964.7	1,056.7	930.9
Total LREE % dissolved	104.8	97.1	101.7	97.1	96.0	99.4	97.9	96.3	94.6	86.2
Total HREE_d (ppb)	490.7	338.4	366	319	341.1	210.9	263.9	298.9	319.17	300
Total HREE % dissolved	106.6	101.7	98.0	102.9	101.5	99.3	101.8	101.5	104.0	95.0

Notes:

Results designated with a "d" (e.g. Eu_d) are dissolved concentrations.

pH, temperature, dissolved oxygen (DO), and conductivity measured in the field.

Total REEs (includes REE + Sc), LREEs, and HREEs non-detects were included at half the reporting limit.

gpm - gallons per minute

HREE - heavy REEs (Tb,Dy, Ho, Er, Tm, Yb, Lu, Y)

L/min - liters per minute

B - estimated value, analyte detected in field blank.

* - anion data is for information purposes (sample exceeded holding time or other) except for the late July 2024 results.

LREE - light REEs (La, Ce, Pr, Nd, Sm, Eu, Gd)

mg/L - milligrams per liter

na - not available

ppm - parts per million

ppb - parts per billion

uS/cm - microsiemens per centimeter

E - estimated, informational purposes, holding time exceedence or other issue

Big Five Tunnel Water Data Summary

SampleID	B5-01-22-001	B5-01-23-001	B5-02-23-001	B5-03-23-001	B5-04-23-001	B5-01-24-001	B5-02-24-001	B5-03-24-001	B5-04-24-001	B5-05-24-001
Date Sampled	11/12/2022	4/20/2023	5/25/2023	8/2/2023	9/29/2023	5/13/2024	5/30/2024	6/13/2024	7/1/2024	7/25/2024
pH	5.85	5.75	5.88	5.63	5.57	5.46	5.28	5.36	5.28	5.44
Temperature (°C)	13	13.9	13.5	18	na	14.5	12.4	9	15.1	14.5
DO (mg/L)	6.58	4.97	6.13	3.09	5.17	4.3	4.71	5.33	6.39	4.25
Conductivity (uS/cm)	2,340	2,400	2,430	2,500	2,840	2,570	2,520	2,650	1,943	2,770
Flow (gpm)	15	14.4	16	22	21	23.5	28.7	27.9	20	14.5
Flow (L/min)	57	55	61	83	79	89	109	106	76	55
Alkalinity (mg/L as CaCO ₃)	< 10	< 10 E	< 10 E	< 10 E	< 10 E	< 10	< 10	< 25	na	< 1
Au (ppb)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Au_d (ppb)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Ag (ppb)	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Ag_d (ppb)	0.4	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Al (ppb)	640	604	2540	1160	811	1430	1570	2970	1920	1110
Al_d (ppb)	67	79	140	179	280	407	575	745	559	571
As (ppb)	5	3.9	20.7	6.4	3.7	6.4	6.4	14.3	7.4	3.3
As_d (ppb)	1.8	0.2	0.4	0.3	0.3	0.4	0.4	0.6	0.3	0.6
B (ppb)	42	43	35	42	34	37	38	41	44	32
B_d (ppb)	42	41	39	35	33	35	35	35	33	35
Ba (ppb)	10.4	10.5	11.2	11.1	11.7	11.5	11.3	11.6	11.7	10.2
Ba_d (ppb)	14.2	11.6	11	10.6	12.8	11.3	11.4	11.3	12.6	9.97
Be (ppb)	1.19	1.04	2.96	2.15	1.53	2	2.17	3.04	2.66	1.66
Be_d (ppb)	1	0.82	1.14	1.06	1.18	1.5	1.44	1.6	1.35	1.32
Bi (ppb)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Bi_d (ppb)	0.4	< 0.01	0.03	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Ca (ppb)	341,000	377,000	335,000	393,000	291,000	391,000	385,000	386,000	393,000	347,000
Ca_d (ppb)	377,000	402,000	383,000	387,000	286,000	362,000	341,000	359,000	335,000	358,000
Cd (ppb)	3.54	3.71	4.35	4.16	4.8	5.83	6.23	6.81	6.59	5.32
Cd_d (ppb)	3.4	3.27	3.07	A	4.88	5.97	6.84	6.93	6.45	6.1
Co (ppb)	91.9	99.3	97.9	94.4	90.2	104	103	107	112	93.8
Co_d (ppb)	94.1	95.1	91.5	96.7	87.5	102	99.6	105	91	97.1
Cr (ppb)	0.15	0.21	0.53	0.15	0.15	0.19	0.2	0.39	0.24	0.25
Cr_d (ppb)	0.6	< 0.08	< 0.08	0.22	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08
Cs (ppb)	7.9	7.1	7.2	7.9	8.8	9.1	8.9	9.2	9.6	9.5
Cs_d (ppb)	9.29	9	8.1	7.5	8.9	7.8	7.9	7.8	16.9	7.4
Cu (ppb)	89.2	93.7	420	125	125	200	202	347	214	166
Cu_d (ppb)	34.5	31.5	26.6	28.7	55.7	99	129	171	111	140
Fe (ppb)	74,700	77,700	158,000	89,800	64,700	92,500	95,000	115,000	92,500	76,000
Fe_d (ppb)	55,400	62,100	58,500	59,500	49,600	64,800	64,000	61,500	60,400	63,500
Ga (ppb)	0.6	0.5	2	0.2	0.3	0.6	0.6	0.8	0.6	0.6
Ga_d (ppb)	0.1	0.3	0.2	< 0.1	0.1	0.4	0.5	0.6	0.4	0.7
Ge (ppb)	1.4	1	5.3	2.6	2.2	2	2.1	3	2.3	2
Ge_d (ppb)	< 0.1	1.5	1.5	1.3	0.8	1	1	1	0.9	1.6
Hf (ppb)	< 0.1	0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1
Hf_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1	< 0.1
Hg (ppb)	< 0.1	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Hg_d (ppb)	< 0.01	< 0.1	< 0.1	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
In (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	< 0.1
In_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	< 0.1
K (ppb)	12,200	12,600	11,200	13,100	10,100	13,100	13,600	14,000	13,600	11,200
K_d (ppb)	14,500 B	13,900	11,600	12,900	9,270	11,700	11,600	11,900	10,700	11,600
Li (ppb)	53.1	53.7	49	70.9	54.8	56.3	61.7	70.2	75	48.1
Li_d (ppb)	64.6	59.1	64	54.3	60.8	55.2	57.6	60.6	51.8	52.2
Mg (ppb)	115,000	124,000	110,000	125,000	101,000	130,000	130,000	138,000	138,000	115,000
Mg_d (ppb)	127,000	122,000	129,000	123,000	95,200	130,000	127,000	133,000	115,000	124,000
Mn (ppb)	27,400	27,100	26,500	29,400	24,100	28,800	26,900	26,800	29,000	24,000
Mn_d (ppb)	26,900	28,000	27,400	28,200	24,800	28,000	28,900	27,700	28,710	24,500
Mo (ppb)	35.2	31.7	55.4	25.8	20.8	27.2	23	30.5	28.1	17.1
Mo_d (ppb)	0.9	0.6	0.48	18.7	0.26	16.3	14.9	14.4	19	11.8
Na (ppb)	62,400	62,800	59,900	65,200	52,700	66,500	65,100	68,100	68,100	55,300
Na_d (ppb)	65,400	60,400	68,600	64,700	48,200	61,300	60,600	63,600	57,100	58,500
Nb (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.01	< 0.1
Nb_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	< 0.1
Ni (ppb)	180	195	197	179	180	217	212	217	230	179
Ni_d (ppb)	259 B	190	182	181	179	215	216	223	187	184
P (ppb)	5	5	< 3	4	< 3	4	< 3	5	4	10
P_d (ppb)	100 B	< 3	< 3	3	< 3	< 3	< 3	< 3	< 3	< 3
Pb (ppb)	0.59	0.35	2	0.96	0.81	1.4	1.35	3.01	1.83	0.78
Pb_d (ppb)	5	0.26	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09	< 0.09
Rb (ppb)	44.9	35	48.4	44.7	62.1	44.5	42.4	43.9	46.2	43.1
Rb_d (ppb)	41.5	45.8	42.3	43.5	40.8	38.6	41.6	40.1	80.1	39.1
Re (ppb)	0.6	< 0.1	0.5	0.5	0.5	0.6	0.5	0.5	0.6	0.5
Re_d (ppb)	5.9	0.4	0.4	0.5	0.6	0.5	0.5	0.5	0.6	0.5
S (ppb)	600,000	585,000	500,000	608,000	507,000	540,000	566,000	566,000	721,000	552,000
S_d (ppb)	786,000	612,000	580,000	581,000	423,000	637,000	622,000	640,000	597,000	584,000
Sb (ppb)	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Sb_d (ppb)	2	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Se (ppb)	0.06	< 0.04	0.27	0.1	0.22	< 0.04	0.04	0.08	0.04	0.06
Se_d (ppb)	0.5	< 0.04	0.04	0.1	0.06	0.04	< 0.04	0.05	< 0.04	0.07
Si (ppb)	13,100	14,600	16,000	19,700	13,700	16,400	17,400	21,000	18,900	13,000
Si_d (ppb)	4,900	14,100	13,131	20,600	12,400	15,400	14,500	15,100	14,300	13,600
Sn (ppb)	0.08	< 0.06	0.09	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	0.18
Sn_d (ppb)	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
Sr (ppb)	2,798	2,544	2,690	2,710	2,460	3,140	2,910	2,990	2,960	2,190

Big Five Tunnel Water Data Summary

SampleID	B5-01-22-001	B5-01-23-001	B5-02-23-001	B5-03-23-001	B5-04-23-001	B5-01-24-001	B5-02-24-001	B5-03-24-001	B5-04-24-001	B5-05-24-001
Date Sampled	11/12/2022	4/20/2023	5/25/2023	8/2/2023	9/29/2023	5/13/2024	5/30/2024	6/13/2024	7/1/2024	7/25/2024
Sr_d (ppb)	2,378	2,840	2,500	2,590	2,450	2,870	2,830	2,870	2,580	2,200
Ta (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Ta_d (ppb)	0.3	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Te (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Te_d (ppb)	< 0.1	< 0.1	0.3	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Th (ppb)	0.2	1.1	1.2	0.2	0.2	0.2	0.1	0.3	0.1	0.2
Th_d (ppb)	< 0.1	0.2	< 0.1	0.3	0.3	0.2	0.1	0.1	0.1	0.2
Ti (ppb)	0.21	0.15	0.19	0.11	0.2	0.17	0.15	0.17	0.2	0.12
Ti_d (ppb)	0.2	0.13	0.1	< 0.07	< 0.07	0.13	0.11	0.09	0.1	0.06
Tl (ppb)	0.213	0.188	0.251	0.232	0.258	0.227	0.224	0.226	0.241	0.199
Tl_d (ppb)	< 0.005	0.204	0.209	0.216	0.293	0.243	0.246	0.256	0.241	0.284
U (ppb)	5.38	5.02	23.7	8.96	8.01	10.2	11.8	19.9	12.8	8
U_d (ppb)	0.4	1.64	1.63	1.94	2.3	3.69	4.51	5.19	4.49	3.64
V (ppb)	0.02	0.05	0.04	0.04	0.01	0.04	0.04	0.07	0.04	0.03
V_d (ppb)	0.3	< 0.01	0.01	0.03	< 0.01	0.02	0.02	0.02	0.01	< 0.01
W (ppb)	0.06	0.49	0.11	0.15	17	0.1	0.06	0.04	0.12	2.06
W_d (ppb)	0.18	< 0.02	< 0.02	< 0.02	0.52	0.05	0.15	0.04	0.03	0.18
Zn (ppb)	4,930	5,420	6,420	5,760	5,390	7,450	7,020	7,470	6,750	5,280
Zn_d (ppb)	5,370	5,410	5,210	5,680	6,010	6,560	6,700	6,750	6,180	5,930
Zr (ppb)	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Zr_d (ppb)	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Cl (ppm)*	9.76	11.6	10.8	10.1	111	11.1	11	10.5	11.1	9
F (ppm)*	0.47	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	na
NO ₃ (ppm)*	< 0.1	< 1	< 0.1	< 1	< 1	< 2.5	< 2.5	< 2.5	< 2.5	na
SO ₄ (ppm)*	2,038	1,811	1,665	1,750	1,445	1,924	1,681	1,931	1,842	1,900
Rare Earth Elements										
Sc (ppb)	0.2	0.6	1.3	2.6	0.4	0.9	0.9	1.1	1	0.8
Sc_d (ppb)	0.048	0.5	0.2	2.8	0.3	0.6	0.6	0.7	0.5	0.7
Y (ppb)	13.6	11.7	61.8	21	15.2	20.5	20.4	31.1	21.3	16.4
Y_d (ppb)	2.1	3.88	4.64	5.42	6.32	12.8	16.4	20.6	13.2	17.4
La (ppb)	6.6	5.7	27.8	8.8	5.8	8.2	8.9	13.1	8.88	8.3
La_d (ppb)	0.9	1.6	2	2.2	2.8	5.4	6.8	8.6	5.76	7.7
Ce (ppb)	14.3	12.3	87.3	32.8	13.1	19.3	20	34.2	21.3	18.7
Ce_d (ppb)	0.9	2.55	2.64	4.56	4.35	8.94	12	17.8	10.8	14.9
Pr (ppb)	2	1.8	10.1	3.2	1.9	2.9	3	5.4	3.31	2.7
Pr_d (ppb)	< 0.1	0.2	0.3	0.4	0.5	1.1	1.6	2.4	1.38	1.9
Nd (ppb)	9.2	7.9	46.7	14.4	8.7	13.3	13.7	25.4	15.5	12.4
Nd_d (ppb)	0.4	0.7	1.2	1.5	2.2	4.6	6.6	10.5	5.9	8.3
Sm (ppb)	2	1.7	10.3	3.3	2	3	3.1	5.6	3.56	3
Sm_d (ppb)	< 0.1	0.2	0.2	0.3	0.5	1	1.4	2.4	1.22	1.7
Eu (ppb)	0.6	0.5	3	0.9	0.6	0.9	0.9	1.7	1	0.9
Eu_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	0.1	0.3	0.5	0.7	0.4	0.5
Gd (ppb)	2.78	2.27	13.9	4.02	2.51	4.01	4.14	7.23	4.52	3.82
Gd_d (ppb)	0.14	0.27	0.4	0.53	0.68	1.69	2.4	3.72	2.2	2.82
Tb (ppb)	0.4	0.3	2	0.6	0.4	0.5	0.6	1	0.65	0.5
Tb_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	0.1	0.3	0.3	0.5	0.3	0.4
Dy (ppb)	2	1.7	10	3.1	1.8	2.9	3	5.3	3.36	3
Dy_d (ppb)	0.1	0.2	0.4	0.4	0.6	1.3	1.9	2.7	1.6	2.2
Ho (ppb)	0.4	0.3	1.9	0.6	0.4	0.5	0.6	1	0.63	0.6
Ho_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	0.1	0.3	0.4	0.5	0.3	0.4
Er (ppb)	1	0.8	4.7	1.4	0.9	1.4	1.4	2.5	1.58	1.4
Er_d (ppb)	< 0.1	0.1	0.2	0.2	0.3	0.6	0.8	1.2	0.75	1
Tm (ppb)	0.1	< 0.1	0.6	0.2	0.1	0.2	0.2	0.3	0.19	0.2
Tm_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.1	0.1	0.08	0.1
Yb (ppb)	0.6	0.5	3.1	1	0.6	0.9	1	1.8	1.09	0.9
Yb_d (ppb)	< 0.1	< 0.1	< 0.1	0.1	0.1	0.3	0.5	0.8	0.46	0.5
Lu (ppb)	< 0.1	< 0.1	0.5	0.2	< 0.1	0.1	0.1	0.3	0.2	0.1
Lu_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.1	< 0.1	1
Total REE (ppb)	55.83	48.17	285	98.12	54.46	79.51	81.94	137.03	88.07	73.72
Total LREE (ppb)	37.48	32.17	199.1	67.42	34.61	51.61	53.74	92.63	58.07	49.82
Total HREE (ppb)	18.15	15.4	84.6	28.1	19.45	27	27.3	43.3	29	23.1
Total REE_d (ppb)	5.038	10.5	12.48	18.66	19.05	39.33	52.35	73.32	44.9	61.52
Total REE % dissolved	9.0	21.8	4.4	19.0	35.0	49.5	63.9	53.5	51.0	83.5
Total LREE_d (ppb)	2.49	5.57	6.79	9.54	11.13	23.03	31.3	46.12	27.66	37.82
Total LREE % dissolved	6.6	17.3	3.4	14.2	32.2	44.6	58.2	49.8	47.6	75.9
Total HREE_d (ppb)	2.5	4.43	5.49	6.32	7.62	15.7	20.45	26.5	16.74	23
Total HREE % dissolved	13.8	28.8	6.5	22.5	39.2	58.1	74.9	61.2	57.7	99.6

Notes:

Results designated with a "d" (e.g. Eu_d) are dissolved concentrations.

pH, temperature, dissolved oxygen (DO), and conductivity measured in the field.

Total REEs (includes REE + Sc), LREEs, and HREEs non-detects were included at half the reporting limit.

gpm - gallons per minute

HREE - heavy REEs (Tb,Dy, Ho, Er, Tm, Yb, Lu, Y)

L/min - liters per minute

B - estimated value, analyte detected in field blank.

* - anion data is for information purposes (sample exceeded holding time or other) except for the late July 2024 results.

LREE - light REEs (La, Ce, Pr, Nd, Sm, Eu, Gd)

mg/L - milligrams per liter

na - not available

ppm - parts per million

ppb - parts per billion

uS/cm - microsiemens per centimeter

E - estimated, informational purposes, holding time exceedence or other issue

North Clear Creek (NCC) WTP Water Data Summary

SampleID	BH-WTP-001	BH-WTP-01-23-001	BH-02-23-001	BHWTP-03-23-001	BH-WTP-04-23-001	BH-01-24-001	BH-02-24-001	BH-03-24-001	BH-04-24-001	BH-05-24-001
Date Sampled	11/1/2022	4/20/2023	5/25/2023	8/2/2023	9/29/2023	5/13/2024	5/30/2024	6/13/2024	7/1/2024	7/25/2024
pH	4.42	4.87	4.94	4.84	5.46	5.12	5.08	4.89	4.7	4.84
Temperature (°C)	na	13.7	14.6	16.4	na	12.1	8.3	15	14.9	15.6
DO (mg/L)	7.15	7.78	7.54	7.6	6.79	7.59	7.18	7.44	7.84	7.48
Conductivity (uS/cm)	2,036	1,955	2,057	1,940	2,420	2,063	2,050	2,094	1,616	2,290
Flow (gpm)	140	135	140	152	167	139.9	180	160	160	177.67
Flow (L/min)	530	511	530	575	632	530	681	606	606	673
Alkalinity (mg/L as CaCO ₃)	< 10	< 10 E	< 10 E	< 10 E	< 10 E	< 10	< 25	na	na	< 1
Au (ppb)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Au_d (ppb)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Ag (ppb)	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	0.08	< 0.05	< 0.05	< 0.05	< 0.05
Ag_d (ppb)	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Al (ppb)	2,190	1,610	1,080	1,480	1,050	1,980	1,720	1,990	2,320	1,610
Al_d (ppb)	2280	1,510	1,500	1,230	653	1,730	1,310	1,480	1,690	1,700
As (ppb)	4.5	4.7	3.2	4.7	4	4.9	3.3	4	4.9	3.9
As_d (ppb)	4.2	3.8	3.4	2.9	1.9	3.4	1.9	2	2.5	2.4
B (ppb)	47	52	33	49	37	44	43	47	49	37
B_d (ppb)	55	47	51	37	30	43	42	39	44	41
Ba (ppb)	7.09	6.76	6.76	6.85	7.6	7.26	7.48	8.04	7.88	6.77
Ba_d (ppb)	8.79	7.27	6.78	6.78	9.11	7.42	7.53	7.88	6.64	7.06
Be (ppb)	3.46	2.88	2.25	4.46	2.78	4.08	3.45	3.94	4.8	3.13
Be_d (ppb)	4.53	3.15	4.05	3.13	2.37	3.94	3.16	3.06	3.97	3.41
Bi (ppb)	< 0.01	< 0.01	< 0.01	< 0.01	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Bi_d (ppb)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Ca (ppb)	246,000	278,000	244,000	301,000	226,000	273,000	295,000	295,000	296,000	273,000
Ca_d (ppb)	330,000	281,000	286,000	292,000	231,000	265,000	279,000	261,000	266,000	288,000
Cd (ppb)	7.01	6.39	7.07	7.24	6.63	8.38	7.08	8.24	7.59	6.33
Cd_d (ppb)	8.4	6.04	6.56	7.29	7	8.64	7.94	8.62	8.1	6.87
Co (ppb)	108	130	120	115	108	109	100	105	112	94.8
Co_d (ppb)	120	111	127	118	109	115	101	99.5	102	100
Cr (ppb)	0.19	0.16	0.13	< 0.08	0.16	< 0.08	0.1	0.18	0.19	0.1
Cr_d (ppb)	0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	0.09
Cs (ppb)	7.6	6.9	7.3	7.6	7.7	10.1	9.6	9.4	10.2	10.3
Cs_d (ppb)	10.2	8.5	7.7	7.4	9.3	7.9	8	7.6	7.8	7.9
Cu (ppb)	446	341	290	283	261	441	409	499	635	452
Cu_d (ppb)	508	303	282	271	219	435	403	458	522	493
Fe (ppb)	96,900	122,000	121,000	127,000	101,000	112,000	89,900	96,900	103,000	90,800
Fe_d (ppb)	120,000	114,000	130,000	121,000	96,200	104,000	81,800	80,800	93,200	88,200
Ga (ppb)	5.6	3.6	3.6	0.6	1.5	2	1.6	1.7	2	1.7
Ga_d (ppb)	5.4	3.4	3.3	0.6	1.5	2	2	2	2	2
Ge (ppb)	3.6	7.1	5	5.1	4.2	3.5	3.5	3.8	4.2	3.6
Ge_d (ppb)	6.4	5.3	5.2	4.6	2.5	4	3	3	2.8	3.6
Hf (ppb)	< 0.1	0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Hf_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Hg (ppb)	< 0.1	< 0.01	< 0.01	0.01	0.02	< 0.01	< 0.01	< 0.01	< 0.01	0.02
Hg_d (ppb)	< 0.01	< 0.1	< 0.1	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
In (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.01	< 0.1
In_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	< 0.1
K (ppb)	7,780	8,660	7,140	8,530	6,500	8,760	9,030	9,300	8,800	7,540
K_d (ppb)	9,006	8,670	8,170	8,390	6,350	8,380	7,820	7,730	7,380	8,140
Li (ppb)	23.7	29.9	17.9	38.3	22.9	28.2	28.1	32	33.6	22.5
Li_d (ppb)	35.7	26.8	38.1	22.8	22.4	27	26.8	24.4	27.5	26.6
Mg (ppb)	66,800	79,800	62,700	79,900	60,900	74,400	74,000	78,900	79,300	65,100
Mg_d (ppb)	88,800	76,200	79,900	76,700	59,000	78,900	76,700	73,200	76,300	73,600
Mn (ppb)	24,100	25,700	24,300	27,700	22,000	23,100	21,700	22,800	24,200	18,900
Mn_d (ppb)	26,500	25,100	25,700	26,800	23,700	24,200	23,500	22,400	23,423	20,700
Mo (ppb)	0.09	0.21	0.09	0.08	0.23	0.22	0.19	0.27	< 0.4	0.08
Mo_d (ppb)	0.06	< 0.04	< 0.04	< 0.04	< 0.04	0.51	0.38	0.27	< 0.4	0.07
Na (ppb)	43,500	45,100	36,800	43,700	31,400	48,600	48,200	53,000	51,900	41,700
Na_d (ppb)	54,800	42,400	45,800	42,300	29,200	49,300	47,200	45,400	49,700	46,500
Nb (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	< 0.1
Nb_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	< 0.1
Ni (ppb)	172	198	188	176	176	184	166	174	183	146
Ni_d (ppb)	188	177	188	180	178	197	170	171	167	153
P (ppb)	7	5	< 3	< 3	< 3	< 3	4	9	3	9
P_d (ppb)	< 3	< 3	< 3	< 3	< 3	< 3	< 3	< 3	< 3	< 3
Pb (ppb)	15.9	9.24	9.5	14.6	11.2	18.1	9.61	13.8	16.9	12.5
Pb_d (ppb)	16.3	7.78	4.94	3.11	0.2	6.8	1.14	2.97	4.87	8.9
Rb (ppb)	39.6	34.4	43.3	40.6	52.4	39.8	38.4	38.1	41.5	37.1
Rb_d (ppb)	37.3	42.1	37.4	40.1	35	37.2	37.9	34.1	39.9	35.5
Re (ppb)	1.1	0.3	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.1
Re_d (ppb)	1.2	0.8	1	1.1	1.5	1.1	1.2	1.1	1.2	1.1
S (ppb)	415,000	417,000	351,000	460,000	360,000	357,000	370,000	374,000	440,000	379,000
S_d (ppb)	420,000	446,000	428,000	443,000	302,000	451,000	441,000	418,000	425,000	414,000
Sb (ppb)	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Sb_d (ppb)	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	1.3	< 0.9	< 0.9
Se (ppb)	0.06	< 0.04	0.36	0.45	0.59	0.22	0.19	0.2	0.24	0.26
Se_d (ppb)	0.16	< 0.04	0.45	0.4	0.31	0.3	0.2	0.21	0.21	0.22
Si (ppb)	14,000	15,800	12,300	18,500	13,000	16,600	15,300	16,500	16,800	11,900
Si_d (ppb)	22,200	15,800	14,012	21,200	13,000	17,300	13,800	13,900	15,700	13,300
Sn (ppb)	0.07	0.13	0.07	< 0.06	< 0.06	< 0.06	0.28	< 0.06	< 0.06	0.12
Sn_d (ppb)	0.12	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
Sr (ppb)	2,120	2,060	2,190	2,200	2,060	2,360	2,270	2,310	2,230	1,790

North Clear Creek (NCC) WTP Water Data Summary

SampleID	BH-WTP-001	BH-WTP-01-23-001	BH-02-23-001	BHWTP-03-23-001	BH-WTP-04-23-001	BH-01-24-001	BH-02-24-001	BH-03-24-001	BH-04-24-001	BH-05-24-001
Date Sampled	11/1/2022	4/20/2023	5/25/2023	8/2/2023	9/29/2023	5/13/2024	5/30/2024	6/13/2024	7/1/2024	7/25/2024
Sr_d (ppb)	2,447	2,190	2,110	2,150	2,150	2,310	2,300	2,110	2,227	1,800
Ta (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Ta_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Te (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Te_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Th (ppb)	0.2	0.2	0.2	0.3	< 0.1	< 0.1	< 0.1	0.1	< 0.1	< 0.1
Th_d (ppb)	< 0.1	< 0.1	0.1	0.3	0.2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Ti (ppb)	0.2	0.15	0.15	0.16	0.5	0.19	0.34	2.09	0.25	0.15
Ti_d (ppb)	0.12	0.12	0.14	< 0.07	< 0.07	0.13	0.08	0.1	0.1	0.11
Tl (ppb)	0.278	0.256	0.265	0.283	0.315	0.301	0.273	0.292	0.302	0.259
Tl_d (ppb)	0.369	0.249	0.25	0.285	0.366	0.303	0.307	0.296	0.286	0.317
U (ppb)	6.03	4.5	4.62	4.58	4.2	6.14	5.26	5.7	6.97	5.08
U_d (ppb)	6.22	4.4	4.23	4.18	2.42	5.63	4.58	4.48	6.13	4.86
V (ppb)	0.04	0.05	0.05	0.1	0.09	0.05	0.06	0.12	0.06	0.05
V_d (ppb)	< 0.01	0.02	0.01	0.02	< 0.01	0.02	0.02	0.02	0.01	0.02
W (ppb)	0.03	0.04	< 0.02	< 0.02	0.24	< 0.02	< 0.02	0.03	0.04	0.06
W_d (ppb)	0.04	0.03	0.04	< 0.02	0.04	0.05	0.09	0.02	< 0.02	0.06
Zn (ppb)	4,380	5,080	5,080	5,190	4,990	6,030	5,250	5,680	5,670	4,330
Zn_d (ppb)	5,470	4,770	5,000	5,400	5,610	5,750	4,990	5,100	5,490	4,780
Zr (ppb)	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Zr_d (ppb)	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Cl (ppm)*	104	104	101	106	97.8	129	119	125	126	100
F (ppm)*	0.81	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	na
NO ₃ (ppm)*	< 0.1	< 1	< 0.1	< 1	< 1	< 2.5	< 2.5	< 2.5	< 2.5	na
SO ₄ (ppm)*	1,337	1,328	1,332	1,367	1,277	1,366	1,266	1,283	1,293	1,000
Rare Earth Elements										
Sc (ppb)	0.7	0.9	0.8	2.8	0.5	1.2	1	1.1	1.3	1.1
Sc_d (ppb)	0.649	0.9	0.5	3	0.3	1.1	0.8	0.9	1	1
Y (ppb)	115	108	118	112	94.6	119	92.6	98.8	115	92.2
Y_d (ppb)	133	112	117	110	97.4	119	95.5	94.3	112	93.2
La (ppb)	71.7	68.5	64.8	63.5	48.3	72.1	55.9	58.9	68.5	67.3
La_d (ppb)	76.6	63.9	65.5	61.2	45.6	69.8	57.3	54.8	64.2	51.5
Ce (ppb)	160	152	183	186	106	178	138	143	170	153
Ce_d (ppb)	170	182	145	179	94.5	167	134	128	149	119
Pr (ppb)	21.1	21.2	19.6	19.7	13.9	21.9	16.9	17.4	21.3	20.1
Pr_d (ppb)	21.8	19.4	19.1	18.4	12.1	20.9	16.5	16	19.3	15.6
Nd (ppb)	88.2	86.2	79.6	80.7	57.3	91	69.9	72.9	89.4	85.8
Nd_d (ppb)	90.4	82.3	81.4	77	49.2	87.5	69.3	65.9	83.2	65.4
Sm (ppb)	18.9	18.9	17.7	17.3	12.4	19.5	15.1	15.7	19.9	18.9
Sm_d (ppb)	19.4	17.9	17.5	16.1	10.2	18.8	14.7	14.1	17.2	14.5
Eu (ppb)	3.5	3.4	3.3	3.3	2.3	3.5	2.8	2.8	3.5	3.4
Eu_d (ppb)	3.5	3.2	3.2	3	1.9	3.3	2.7	2.6	3.11	2.6
Gd (ppb)	23.5	22.7	21.7	21.2	15.4	24.1	18.8	19.9	24.1	24.1
Gd_d (ppb)	24.5	21.6	21.1	19.9	13.7	23.3	18.6	18	22.9	17.7
Tb (ppb)	3.5	3.4	3.4	3.2	2.4	3.4	2.7	2.9	3.53	3.3
Tb_d (ppb)	3.5	3.2	3.4	3	2.1	3.4	2.8	2.6	3.28	2.8
Dy (ppb)	19.5	19.2	18.7	18.3	13	19.8	15.3	16	19.7	19.4
Dy_d (ppb)	20	18.2	18.5	17.6	11.2	19	15.4	14.7	18	15.4
Ho (ppb)	3.9	3.9	3.7	3.6	2.6	3.9	3.1	3.2	3.82	3.9
Ho_d (ppb)	4.1	3.7	3.7	3.5	2.3	3.8	3.1	3	3.61	3
Er (ppb)	10.5	10.2	9.9	9.9	7.1	10.6	8.2	8.5	10.4	10.3
Er_d (ppb)	11.1	9.8	9.8	9.2	6.1	10.1	8.1	7.7	9.67	8
Tm (ppb)	1.3	1.3	1.3	1.2	0.8	1.4	1	1.1	1.32	1.3
Tm_d (ppb)	1.4	1.2	1.3	1.1	0.7	1.3	1	1	1.22	1.1
Yb (ppb)	7.5	7.3	6.9	6.8	5	7.8	5.9	6.2	7.69	7.4
Yb_d (ppb)	8.1	6.9	6.9	6.6	4	7.3	5.9	5.7	7.11	5.7
Lu (ppb)	1.1	1.1	1	1	0.7	1.1	0.9	0.9	1.1	1.1
Lu_d (ppb)	1.2	1	1	1	0.6	1.1	0.9	0.9	1.1	1.5
Total REE (ppb)	549.9	528.2	553.4	550.5	382.3	578.3	448.1	469.3	560.6	512.6
Total LREE (ppb)	386.9	372.9	389.7	391.7	255.6	410.1	317.4	330.6	396.7	372.6
Total HREE_d (ppb)	182.4	156	161.6	152	124.4	165	132.7	129.9	156.0	130.7
Total REE_d (ppb)	589.2	547.2	514.9	529.6	351.9	556.7	446.6	430.2	515.9	418
Total REE % dissolved	107.2	103.6	93.0	96.2	92.0	96.3	99.7	91.7	92.0	81.5
Total LREE_d (ppb)	406.2	390.3	352.8	374.6	227.2	390.6	313.1	299.4	358.9	286.3
Total LREE % dissolved	105.0	104.7	90.5	95.6	88.9	95.2	98.6	90.6	90.5	76.8
Total HREE (ppb)	162.3	154.4	162.9	156	126.2	167	129.7	137.6	162.6	138.9
Total HREE % dissolved	112.4	101.0	99.2	97.4	98.6	98.8	102.3	94.4	96.0	94.1

Notes:

Results designated with a "d" (e.g. Eu_d) are dissolved concentrations.

pH, temperature, dissolved oxygen (DO), and conductivity measured in the field.

Total REEs (includes REE + Sc), LREEs, and HREEs non-detects were included at half the reporting limit.

gpm - gallons per minute

HREE - heavy REEs (Tb,Dy, Ho, Er, Tm, Yb, Lu, Y)

L/min - liters per minute

E - estimated, informational purposes, holding time exceedence or other issue

* - anion data is for information purposes (sample exceeded holding time or other) except for the late July 2024 results.

LREE - light REEs (La, Ce, Pr, Nd, Sm, Eu, Gd)

mg/L - milligrams per liter

na - not available

ppm - parts per million

ppb - parts per billion

uS/cm - microsiemens per centimeter

Nelson Tunnel Water Data Summary

SampleID	NT-01-22-001	NT-01-23-001	NT-02-23-001	NT-03-23-001	NT-04-23-001 FA	NT-01-24-001	NT-02-24-001	NT-03-24-001	NT-04-24-001	NT-05-24-001
Date Sampled	11/18/2022	4/23/2023	5/30/2023	7/26/2023	9/29/2023	5/8/2024	5/30/2024	6/14/2024	6/27/2024	7/17/2024
pH	5.18	4.63	5.17	4.28	4.28	4.73	4.7	4.67	4.58	4.52
Temperature (°C)	18	8.8	7.4	12.2	11.5	16.9	18.1	na	19.6	23
DO (mg/L)	6.41	6.38	6.31	6.24	6.3	6.71	6.56	6.33	6.25	5.98
Conductivity (uS/cm)	1,119	1,096	822	787	917	1,033	990	1,152	1,128	813
Flow (gpm)	346	333	339	327	315	315	333	315	315	315
Flow (L/min)	1,310	1,261	1,283	1,238	1,192	1,192	1,261	1,192	1,192	1,192
Alkalinity (mg/L as CaCO ₃)	< 10 E	< 10 E	< 10 E	< 10 E	< 10 E	< 10	< 25	< 25	na	< 1
Au (ppb)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Au_d (ppb)	0.15	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Ag (ppb)	1.44	0.31	3.78	0.9	0.3	1.27	2.89	0.41	0.37	0.25
Ag_d (ppb)	1.3	0.19	3.04	0.48	0.29	0.65	2.4	0.22	0.3	0.22
Al (ppb)	308	270	1,400	714	349	663	1,800	720	576	399
Al_d (ppb)	307	238	1,930	664	322	565	1,400	488	443	443
As (ppb)	8.7	7.5	6.8	5.8	2.8	8.4	7.4	7.4	8.4	6.8
As_d (ppb)	3.3	3.9	4.6	2	1.9	4.9	4.6	4.2	4.6	4.5
B (ppb)	35	14	9	14	12	14	14	15	14	12
B_d (ppb)	12	17	14	12	10	14	12	11	11	13
Ba (ppb)	15.6	16.7	18.6	15.9	15.1	18	20.1	18.2	16.2	13.9
Ba_d (ppb)	20.8	17.9	18.3	13.6	16.4	17.8	19.4	14.1	17.7	14.8
Be (ppb)	3.22	3.04	1.74	3.63	2.41	3.06	3.09	3.68	3.64	2.74
Be_d (ppb)	4	3.24	3.18	3.09	2.31	3.14	2.69	2.53	2.74	3.2
Bi (ppb)	< 0.01	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Bi_d (ppb)	0.3	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Ca (ppb)	185,000	155,000	89,500	114,000	90,400	148,000	132,000	164,000	150,000	141,000
Ca_d (ppb)	175,000	160,000	111,000	115,000	94,700	142,000	115,000	117,000	135,000	157,000
Cd (ppb)	81.8	79.8	472	126	92.1	133	247	133	116	83.5
Cd_d (ppb)	87.9	78.4	452	129	97.4	140	252	115	123	91.5
Co (ppb)	26.2	25.9	28.3	19.3	17.3	25.8	27.6	28.6	27.2	23.7
Co_d (ppb)	26.2	23.9	29.9	19.5	16.7	25.8	25.6	21.9	24.5	26.4
Cr (ppb)	0.14	0.13	0.16	< 0.08	0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08
Cr_d (ppb)	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08
Cs (ppb)	18.6	15.4	12.8	15.4	16	18	16.6	19.1	19.9	20.2
Cs_d (ppb)	22	18.4	13.7	14.4	17.2	16.6	15	14.3	34.9	16.7
Cu (ppb)	27.7	28.5	560	104	34	120	378	118	83	57
Cu_d (ppb)	40.1	24.7	563	102	34.1	125	370	108	76	63
Fe (ppb)	2,360	1,530	722	1,740	928	1,240	938	832	1,630	1,460
Fe_d (ppb)	100	47	70	78	68	129	55	80	10	87
Ga (ppb)	4.2	2.9	2.1	0.4	1.1	1.4	1.3	1.6	1.5	1.5
Ga_d (ppb)	4.5	2.8	2	0.4	1.1	1	1	1	1	1.8
Ge (ppb)	2	2.3	1.1	1.5	0.9	1.2	1.3	1.5	1.3	1.3
Ge_d (ppb)	< 0.1	1.8	1.4	1.5	0.9	1	1	1	1	1.3
Hf (ppb)	< 0.1	0.7	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Hf_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Hg (ppb)	< 0.1	< 0.01	0.02	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Hg_d (ppb)	< 0.01	< 0.1	< 0.1	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
In (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	< 0.1
In_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	< 0.1
K (ppb)	11,600	4,540	3,560	4,350	3,210	4,540	4,740	4,910	4,360	4,010
K_d (ppb)	13,900 B	4,630	4,240	4,360	3,080	4,340	4,000	3,590	3,860	4,490
Li (ppb)	185	149	74.2	125	116	147	144	180	156	120
Li_d (ppb)	178	139	121	96.3	115	146	118	119	124	139
Mg (ppb)	10,600	10,400	6,150	7,550	5,830	9,500	8,920	10,300	9,940	8,520
Mg_d (ppb)	10,400	10,000	7,740	7,490	5,970	10,100	8,260	8,390	8,280	9,650
Mn (ppb)	16,000	15,400	10,800	9,250	7,230	14,500	12,700	14,700	16,200	12,800
Mn_d (ppb)	16,500	14,900	12,100	8,960	7,740	14,800	13,000	12,500	16,459	13,800
Mo (ppb)	0.07	0.11	0.04	0.05	0.07	< 0.04	0.39	< 0.04	< 0.4	< 0.04
Mo_d (ppb)	1	< 0.04	< 0.04	< 0.04	< 0.04	0.07	0.09	0.05	< 0.4	< 0.04
Na (ppb)	45,800	47,900	26,600	39,900	30,600	43,800	39,300	46,500	44,500	37,600
Na_d (ppb)	48,600	45,200	34,400	39,700	30,000	41,800	35,600	36,400	38,500	42,500
Nb (ppb)	< 0.1	0.3	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.01	< 0.1
Nb_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	< 0.1
Ni (ppb)	10.9	11.2	11.1	7.1	6.3	10.8	11.9	14	11.6	9.3
Ni_d (ppb)	78.7 B	10.1	12.2	7	6.5	11	11	10	9.9	10
P (ppb)	< 3	7	< 3	5	< 3	5	9	9	< 3	8
P_d (ppb)	400 B	< 3	< 3	4	< 3	< 3	< 3	11	< 3	< 3
Pb (ppb)	684	586	797	1630	1413	770	900	765	828	689
Pb_d (ppb)	533	527	772	1570	1588	648	780	526	800	668
Rb (ppb)	21.4	17.5	22.5	19.7	25.5	20.9	21.5	20.9	21.5	21.2
Rb_d (ppb)	20.9	22.5	19.9	19.5	17.1	18.6	19.1	15.8	38.4	20
Re (ppb)	0.1	0.5	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Re_d (ppb)	5.7	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
S (ppb)	237,000	196,000	123,000	160,000	129,000	172,000	160,000	196,000	218,000	181,000
S_d (ppb)	472,000	223,000	155,000	159,000	112,000	211,000	178,000	180,000	195,000	202,000
Sb (ppb)	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Sb_d (ppb)	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9	< 0.9
Se (ppb)	0.53	0.58	0.65	0.62	0.65	0.53	0.51	0.52	0.57	0.46
Se_d (ppb)	0.9	0.42	0.79	0.67	0.46	0.53	0.53	0.44	0.45	0.5
Si (ppb)	18,400	16,900	12,500	22,800	14,500	18,300	19,000	20,000	17,700	13,500
Si_d (ppb)	10,200	17,700	15,575	25,100	15,700	17,100	16,700	14,400	13,800	15,800
Sn (ppb)	< 0.06	0.18	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
Sn_d (ppb)	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
Sr (ppb)	1,750	1,648	1,090	1,260	1,270	1,760	1,480	1,820	1,780	1,410

Nelson Tunnel Water Data Summary

SampleID	NT-01-22-001	NT-01-23-001	NT-02-23-001	NT-03-23-001	NT-04-23-001 FA	NT-01-24-001	NT-02-24-001	NT-03-24-001	NT-04-24-001	NT-05-24-001
Date Sampled	11/18/2022	4/23/2023	5/30/2023	7/26/2023	9/29/2023	5/8/2024	5/30/2024	6/14/2024	6/27/2024	7/17/2024
Sr_d (ppb)	1,684	1,750	1,080	1,260	1,290	1,640	1,380	1,380	1,643	1,480
Ta (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Ta_d (ppb)	0.3	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Te (ppb)	< 0.1	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Te_d (ppb)	1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Th (ppb)	0.4	0.3	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.2	< 0.1
Th_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Ti (ppb)	0.4	0.24	0.39	0.68	0.2	0.47	0.7	0.33	0.14	0.15
Ti_d (ppb)	0.6	0.1	0.12	< 0.07	0.08	0.16	0.1	0.11	< 0.1	< 0.05
Tl (ppb)	2.49	2.38	4	2.92	2.74	2.89	3.71	2.74	2.69	2.16
Tl_d (ppb)	0.9	2.32	3.96	2.91	3.05	3.01	3.79	2.36	2.97	2.33
U (ppb)	0.287	0.307	1.82	0.717	0.545	0.617	1.44	0.626	0.694	0.367
U_d (ppb)	< 0.002	0.274	1.85	0.678	0.398	0.626	1.37	0.475	0.547	0.412
V (ppb)	0.03	0.02	0.04	0.04	0.01	0.05	0.05	0.01	< 0.01	< 0.01
V_d (ppb)	< 0.01	0.01	0.01	0.01	< 0.01	0.01	< 0.01	< 0.01	< 0.01	< 0.01
W (ppb)	< 0.02	0.07	< 0.02	0.03	0.1	0.15	120	0.03	0.36	< 0.02
W_d (ppb)	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	0.04	63.9	0.09	< 0.02	< 0.02
Zn (ppb)	34,400	31,600	39,900	31,100	26,700	38,400	39,800	41,400	38,300	28,800
Zn_d (ppb)	35,000	31,500	42,600	32,000	31,100	36,200	35,800	29,800	35,200	32,400
Zr (ppb)	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Zr_d (ppb)	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Cl (ppm)*	0.66	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 1
F (ppm)*	0.51	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5	na
NO ₃ (ppm)*	< 0.1	< 1	0.31	< 1	< 1	< 2.5	< 2.5	< 2.5	< 2.5	na
SO ₄ (ppm)*	729	689	451	475	467	634	582	666	662	660
Rare Earth Elements										
Sc (ppb)	0.1	0.3	0.2	2.9	0.3	0.6	0.7	0.6	0.7	0.5
Sc_d (ppb)	0.095	0.2	0.2	3.1	0.3	0.6	0.6	0.5	0.4	0.7
Y (ppb)	20	18.6	19.4	14	13	20.5	20.9	21.2	21.2	18
Y_d (ppb)	18.4	20	19.5	13.8	12.7	20.1	20.1	16.9	20.2	19.3
La (ppb)	97.9	78.7	49.4	54.9	47.8	72.1	60.4	79.1	84.2	82.9
La_d (ppb)	93.4	84	49.9	53.5	48.8	70.6	59.9	61.6	81.3	69.7
Ce (ppb)	183	145	128	157	91.1	145	126	152	163	157
Ce_d (ppb)	174	197	93.1	145	92.4	139	119	124	155	133
Pr (ppb)	19.1	16.1	10.3	12.3	10.2	14.4	12.4	14.7	16.3	16.6
Pr_d (ppb)	17.7	16.3	10.6	12	10.4	14	12.3	12.2	15.8	13.5
Nd (ppb)	65.3	54.4	35.2	40.2	34.6	49.2	43.1	50.5	56.3	57.4
Nd_d (ppb)	59.4	56.3	36.3	41	33.8	47.6	43	41.4	55.1	47.1
Sm (ppb)	9.7	8.2	5.7	6.3	5.3	7.3	6.6	7.6	8.29	9
Sm_d (ppb)	8.8	8.5	5.8	6.4	5.3	7.2	6.7	6.4	8.12	7.3
Eu (ppb)	1.5	1.3	1	0.9	0.7	1.1	1.1	1.2	1.3	1.4
Eu_d (ppb)	1.4	1.3	0.9	0.9	0.7	1.2	1.1	1	1.3	1.1
Gd (ppb)	9.75	7.86	5.8	5.58	4.95	7.47	6.92	8.03	8.71	9.13
Gd_d (ppb)	9.26	8.05	5.88	5.68	4.84	7.33	7.08	6.46	8.4	7.36
Tb (ppb)	1	0.8	0.7	0.6	0.5	0.8	0.7	0.8	0.88	0.9
Tb_d (ppb)	0.9	0.9	0.7	0.6	0.6	0.8	0.8	0.7	0.88	0.8
Dy (ppb)	4.3	3.5	3.2	2.6	2.1	3.3	3.4	3.4	3.83	4
Dy_d (ppb)	3.9	3.7	3.3	2.7	2.1	3.3	3.3	2.8	3.54	3.4
Ho (ppb)	0.7	0.6	0.5	0.4	0.3	0.6	0.6	0.5	0.59	0.6
Ho_d (ppb)	0.6	0.6	0.6	0.4	0.3	0.6	0.6	0.5	0.58	0.5
Er (ppb)	1.6	1.2	1.3	1	0.8	1.2	1.3	1.2	1.35	1.4
Er_d (ppb)	1.5	1.3	1.4	1	0.8	1.2	1.3	1.1	1.35	1.2
Tm (ppb)	0.2	0.1	0.2	< 0.1	< 0.1	0.1	0.1	0.1	0.13	0.1
Tm_d (ppb)	0.1	0.1	0.2	< 0.1	< 0.1	0.1	0.2	0.1	0.12	0.1
Yb (ppb)	0.7	0.6	0.8	0.4	0.3	0.6	0.8	0.6	0.64	0.7
Yb_d (ppb)	0.6	0.6	0.8	0.5	0.3	0.6	0.7	0.5	0.62	0.5
Lu (ppb)	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Lu_d (ppb)	< 0.1	< 0.1	0.1	< 0.1	< 0.1	< 0.1	0.1	0.1	< 0.1	0.6
Total REE (ppb)	414.9	337.3	261.8	299.2	212.1	324.3	285.1	341.6	367.5	359.7
Total LREE (ppb)	386.3	311.6	235.4	277.2	194.7	296.6	256.5	313.1	338.1	333.4
Total HREE (ppb)	28.6	25.5	26.2	19.1	17.1	27.2	27.9	27.9	28.7	25.8
Total REE_d (ppb)	390.1	398.9	229.3	286.7	213.4	314.3	276.8	276.3	352.8	306.2
Total REE % dissolved	94.0	118.3	87.6	95.8	100.7	96.9	97.1	80.9	96.0	85.1
Total LREE_d (ppb)	364.0	371.5	202.5	264.5	196.2	286.9	249.1	253.1	325.0	279.1
Total LREE % dissolved	94.2	119.2	86.0	95.4	100.8	96.7	97.1	80.8	96.1	83.7
Total HREE_d (ppb)	26.1	27.3	26.6	19.1	16.9	26.8	27.1	22.7	27.3	26.4
Total HREE % dissolved	91.2	107.1	101.5	100.0	98.8	98.5	97.3	81.5	95.4	102.5

Notes:

Results designated with a "d" (e.g. Eu_d) are dissolved concentrations.

pH, temperature, dissolved oxygen (DO), and conductivity measured in the field.

Total REEs (includes REE + Sc), LREEs, and HREEs non-detects were included at half the reporting limit.

gpm - gallons per minute

HREE - heavy REEs (Tb,Dy, Ho, Er, Tm, Yb, Lu, Y)

L/min - liters per minute

B - estimated value, analyte detected in field blank.

* - anion data is for information purposes (sample exceeded holding time or other) except for the late July 2024 results.

LREE - light REEs (La, Ce, Pr, Nd, Sm, Eu, Gd)

mg/L - milligrams per liter

na - not available

ppm - parts per million

ppb - parts per billion

uS/cm - microsiemens per centimeter

E - estimated, informational purposes, holding time exceedence or other issue

Gladstone WTP Water Data Summary

SampleID	G-WTP-01-22-001	G-WTP-01-23-001	G-WTP-02-23-001	GWTP-03-23-001	G-WTP-04-23-001	G-WTP-01-24-001	G-WTP-02-24-001	G-WTP-03-24-001	G-WTP-04-24-001	G-WTP-05-24-001
Date Sampled	11/18/2022	4/24/2023	5/31/2023	7/27/2023	9/30/2023	5/13/2024	5/30/2024	6/14/2024	7/12/2024	7/19/2024
pH	3.67	5.2	2.8	3.04	3.44	5.5	3	2.76	3	3.2
Temperature (°C)	8.9	na	na	na	8.4	5.5	6.7	8.3	8.9	11.5
DO (mg/L)	7.61	7.33	6.87	na	8.22	8.25	7.52	5.84	6.71	7.7
Conductivity (uS/cm)	1,639	1,564	na	2,360	2,146	1,740	2,020	2,760	2,230	2,390
Flow (gpm)	346	460	430	255	435	300	300	200	265	280
Flow (L/min)	1,310	1,741	1,628	965	1,647	1,136	1,136	757	1,003	1,060
Alkalinity (mg/L as CaCO ₃)	< 10 E	< 10 E	< 10 E	< 10 E	< 10 E	< 10	< 25	< 25	na	< 1
Au (ppb)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Au_d (ppb)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Ag (ppb)	< 0.05	< 0.05	0.08	0.06	< 0.05	< 0.05	0.06	0.09	< 0.05	< 0.05
Ag_d (ppb)	< 0.05	< 0.05	0.13	< 0.05	< 0.05	< 0.05	< 0.05	0.07	< 0.05	< 0.05
Al (ppb)	21,200	9,130	13,100	31,800	22,100	9,360	21,200	46,100	29,100	27,000
Al_d (ppb)	21,800	4,940	40,100	30,600	14,600	3,310	17,300	38,400	12,700	27,900
As (ppb)	18.3	11.7	66.5	43.2	33.5	13	46.2	82.9	28.5	40.6
As_d (ppb)	2.3	1.4	147	6.3	3	0.9	7.9	72	5.4	13
B (ppb)	10	3	3	4	< 2	2	2	3	3	2
B_d (ppb)	3	4	2	2	< 2	2	2	3	2	2
Ba (ppb)	9.28	8.55	7.4	8.34	8.74	9.38	9.16	16.7	9.63	8.68
Ba_d (ppb)	10.4	9.74	7.45	7.79	9.96	8.98	9.08	8.09	8.21	8.45
Be (ppb)	6.65	2.81	4.24	7.54	7.88	3.37	4.76	6.55	5.84	5.67
Be_d (ppb)	7.46	2.22	4.99	6.48	7.03	1.92	4.25	5.58	4.48	5.95
Bi (ppb)	3.92	1.36	2.88	8.39	9.03	2.14	2.65	3.44	2.11	8.74
Bi_d (ppb)	0.21	< 0.01	2.17	2.01	0.69	0.01	0.41	2.62	0.78	1.83
Ca (ppb)	391,000	360,000	95,600	333,000	303,000	347,000	335,000	281,000	333,000	332,000
Ca_d (ppb)	430,000	372,000	267,000	321,000	218,000	333,000	299,000	248,000	172,000	337,000
Cd (ppb)	60.5	33.2	60.9	78.5	80.5	31.5	56.6	120	72.3	65.9
Cd_d (ppb)	61.6	35.4	136	81.7	62	36	45.7	59	46.8	66.2
Co (ppb)	71.4	47.7	41.8	82.5	91.3	41.9	54.3	92.5	72.9	75.8
Co_d (ppb)	77.2	45.2	97	83.1	67.8	43.6	53.7	89.8	39.7	76.7
Cr (ppb)	2.21	1.19	45.5	5.7	3.41	1.36	4.04	10.7	5.35	5.65
Cr_d (ppb)	1.59	< 0.08	12.3	5.03	1.6	< 0.08	3.35	10.2	2.24	4.9
Cs (ppb)	5.7	2.9	8.3	7.5	5.6	3.7	5.3	10.3	6.9	9.5
Cs_d (ppb)	6.72	3.8	9	6.9	6.4	3.4	4.9	8.1	5.3	10.4
Cu (ppb)	5,010	2,591	3,200	5,672	5,250	2,580	4,040	8,580	4,920	5,650
Cu_d (ppb)	5,327	2,180	6,610	5,720	3,990	1,840	3,900	7,970	2,550	5,610
Fe (ppb)	55,200	35,900	82,900	114,000	84,900	38,900	79,900	170,000	86,500	107,000
Fe_d (ppb)	50,900	25,900	198,000	88,800	48,700	26,500	42,400	155,000	35,900	90,700
Ga (ppb)	3.4	1.6	19.9	6.4	4	1.6	4.3	13	5.3	6
Ga_d (ppb)	2.2	0.6	18.8	5.7	1.9	0.3	3	13	4	6.4
Ge (ppb)	2	1	2.5	3.5	2.9	0.9	2.1	4.6	2.6	3
Ge_d (ppb)	2.4	0.9	6.6	3	1.1	0.6	1	4	0.8	2.7
Hf (ppb)	0.2	1	< 0.1	< 0.1	0.2	< 0.1	< 0.1	< 0.1	< 0.1	0.6
Hf_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.1
Hg (ppb)	< 0.1	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Hg_d (ppb)	< 0.01	< 0.1	< 0.1	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
In (ppb)	1.1	2.5	40.4	17.3	9.4	3.1	11.5	42.6	14.6	16.8
In_d (ppb)	1.1	< 0.1	40	15.8	6.1	< 0.1	9.1	40.4	12.9	15.5
K (ppb)	1,910	1,400	272	1,970	1,650	1,410	1,300	1,170	1,420	1,760
K_d (ppb)	2051 B	1,490	941	1,820	1,260	1,310	1,210	986	627	1,910
Li (ppb)	35.3	24	40.8	45.1	28.5	24.3	33.7	61.9	43.9	33.1
Li_d (ppb)	39.1	24.7	47.7	34.6	26.7	26.5	30.7	52.1	33.2	34.4
Mg (ppb)	19,300	14,300	8,350	23,100	18,800	14,800	17,100	29,600	21,700	21,300
Mg_d (ppb)	22,100	14,600	26,700	22,500	13,400	14,500	17,200	28,000	10,800	21,700
Mn (ppb)	26,100	19,300	7,540	26,700	30,200	17,500	17,300	22,000	21,400	19,500
Mn_d (ppb)	29,300	19,500	22,100	25,700	24,100	18,200	18,400	21,900	20,892	19,500
Mo (ppb)	1.52	1.52	5.21	4.09	3.95	1.58	4.37	5.48	2.6	4.04
Mo_d (ppb)	0.09	0.1	10.7	0.46	0.21	0.13	0.46	4.28	< 0.4	0.94
Na (ppb)	4,180	3,880	1,060	3,910	3,700	4,150	3,940	3,770	4,040	3,750
Na_d (ppb)	4,810	3,870	3,400	3,920	2,660	3,890	3,710	3,230	1,860	3,960
Nb (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	0.2
Nb_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.01	< 0.1
Ni (ppb)	41.3	26.8	29.2	48.9	50.5	23.6	33.2	64.7	46.9	42.9
Ni_d (ppb)	43.2 B	25.2	62.3	49.2	37.8	25	34	59	23.9	43
P (ppb)	760	502	742	1,530	1220	541	1,070	1,870	801	1,440
P_d (ppb)	8 B	< 3	2150	267	48	< 3	123	1600	132	493
Pb (ppb)	24.6	9.38	24.3	34.6	33.5	12.5	16.8	22.7	18.8	27.7
Pb_d (ppb)	22.7	1.48	22	33.8	27.3	0.6	11.3	21.3	16.3	25.3
Rb (ppb)	15.1	8.5	8.2	20.2	18.5	10.3	10.5	14	13.9	17.4
Rb_d (ppb)	13.7	11.2	10.9	19.6	15.8	9.5	10.3	12	14.4	24
Re (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Re_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
S (ppb)	452,000	353,000	159,000	506,000	396,000	304,000	344,000	455,000	450,000	440,000
S_d (ppb)	438,000	374,000	489,000	482,000	247,000	358,000	402,000	570,000	249,000	456,000
Sb (ppb)	1.6	< 0.9	1.5	2.3	3.6	< 0.9	1.5	1.6	< 0.9	2.8
Sb_d (ppb)	< 0.9	< 0.9	2.9	< 0.9	< 0.9	< 0.9	< 0.9	1.1	< 0.9	< 0.9
Se (ppb)	0.27	0.19	1.71	1.28	0.99	0.22	0.94	2.22	0.87	1.09
Se_d (ppb)	0.19	0.05	4.17	0.76	0.34	0.08	0.36	2.39	0.3	0.72
Si (ppb)	9,560	7,770	3,220	12,900	7,990	8,380	9,180	11,300	10,800	9,320
Si_d (ppb)	12,100	7,870	8,536	13,300	7,960	7,630	8,150	9,760	4,900	9,800
Sn (ppb)	0.48	0.12	0.12	0.83	1.72	0.13	0.22	0.32	0.15	1.03
Sn_d (ppb)	< 0.06	< 0.06	0.29	0.09	< 0.06	< 0.06	< 0.06	0.28	< 0.06	0.18
Sr (ppb)	5,830	5,510	1,980	4,980	5,630	6,430	5,920	5,000	5,770	4,840

Gladstone WTP Water Data Summary

SampleID	G-WTP-01-22-001	G-WTP-01-23-001	G-WTP-02-23-001	GWTP-03-23-001	G-WTP-04-23-001	G-WTP-01-24-001	G-WTP-02-24-001	G-WTP-03-24-001	G-WTP-04-24-001	G-WTP-05-24-001
Date Sampled	11/18/2022	4/24/2023	5/31/2023	7/27/2023	9/30/2023	5/13/2024	5/30/2024	6/14/2024	7/12/2024	7/19/2024
Sr_d (ppb)	6,919	6,080	3,970	4,970	4,190	5,970	5,890	4,680	3,271	4,810
Ta (ppb)	0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Ta_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Te (ppb)	11.8	3.8	12.3	31.7	30.3	4.1	10	19.4	9.7	29.3
Te_d (ppb)	2.9	0.2	13.6	13	4.5	< 0.1	3.1	16	5	12.9
Th (ppb)	2.2	1.9	5.5	6.1	4.7	0.8	2.7	7.8	4.5	4
Th_d (ppb)	1.2	< 0.1	5.4	6.4	1.2	< 0.1	3.8	13.9	3.6	3.3
Ti (ppb)	0.39	0.53	2.68	2.4	1.5	0.54	2.1	3.92	1.38	1.8
Ti_d (ppb)	0.07	0.08	6.59	0.683	0.23	0.09	0.42	3.08	0.2	0.98
TI (ppb)	0.265	0.163	0.221	0.389	0.32	0.217	0.215	0.247	0.208	0.329
TI_d (ppb)	0.321	0.169	0.193	0.395	0.352	0.233	0.223	0.275	0.191	0.355
U (ppb)	8.42	3.63	12.4	10.3	9.28	3.69	6.96	12.9	7.7	8.67
U_d (ppb)	8.23	2.16	12.5	10.4	7.85	0.936	6.7	12.3	7.42	8.6
V (ppb)	10.4	8.1	18.8	21.2	22.4	9.09	18.2	26.8	12	18.9
V_d (ppb)	0.34	0.04	40.1	1.66	0.75	0.08	2.17	19.5	1.45	3.36
W (ppb)	0.05	0.1	0.16	0.1	0.2	0.08	2.11	1.18	0.25	0.19
W_d (ppb)	< 0.02	< 0.02	0.19	< 0.02	0.03	0.03	2.22	0.11	0.05	0.05
Zn (ppb)	19,200	10,400	12,200	19,400	22,400	11,200	15,200	30,500	18,700	16,700
Zn_d (ppb)	20,800	10,300	25,400	19,900	18,700	10,400	14,600	27,600	10,400	16,900
Zr (ppb)	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Zr_d (ppb)	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Cl (ppm)*	< 0.5	< 5	< 5	< 5	< 5	< 5	20.5	< 5	< 5	< 1
F (ppm)*	8.58	4.33	8.72	10.8	11.1	3.69	< 2.5	9.11	8.25	na
NO ₃ (ppm)*	< 0.1	< 1	< 0.1	< 1	< 1	< 2.5	< 2.5	< 2.5	< 2.5	na
SO ₄ (ppm)*	1,175	1,093	1,265	1,236	1,165	1,037	1,906	1,290	1,166	1,600
Rare Earth Elements										
Sc (ppb)	0.8	0.6	7.9	4.1	0.9	0.6	1.7	5.2	2.3	2.2
Sc_d (ppb)	0.669	0.3	7.4	4.3	0.7	0.4	1.6	5.3	2	2.3
Y (ppb)	41.3	21.2	22.3	50.2	55.3	22.4	30.2	53.4	43.9	43.6
Y_d (ppb)	48	19.8	46	51	39	15.9	31.7	53.5	25	43.1
La (ppb)	19.8	8.1	46	24	18.2	7.4	16.4	44.7	22.7	21.9
La_d (ppb)	18.7	7.2	45.8	24.8	18.4	5.8	16.3	42.5	21.3	18.5
Ce (ppb)	46.8	17.9	160	82	41.6	17.1	44.9	136	60.4	57.6
Ce_d (ppb)	45.1	20.5	132	77.8	41.5	11.6	43.5	125	57.3	48.7
Pr (ppb)	6.4	2.6	7.8	8.9	5.8	2.4	7	18.8	9	8.6
Pr_d (ppb)	6	2	7.7	9.2	5.7	1.5	6.7	18.1	8.55	7.3
Nd (ppb)	29.2	11.4	35.4	41.5	26.1	11.2	31.7	85.6	41.1	40.3
Nd_d (ppb)	27.6	9.1	35.7	43.5	25.4	6.4	31.1	82.6	39.3	33.8
Sm (ppb)	8.8	3.5	8.5	11.8	7.8	3.5	8.3	20.7	10.7	12
Sm_d (ppb)	8.3	2.5	8.3	12.4	7.6	1.6	7.9	20	10.4	9.6
Eu (ppb)	4.1	1.7	2.7	4.8	3.4	1.6	3.1	6.8	4.1	4.8
Eu_d (ppb)	3.8	1.2	2.5	5	3.4	0.8	3	6.6	4.01	3.8
Gd (ppb)	15.7	6.4	9.28	16.8	12.6	6.46	11.3	24.7	15.1	17.3
Gd_d (ppb)	14.7	4.82	8.62	17.5	12	3.46	11	23.8	15.1	13.7
Tb (ppb)	2.3	1	3.3	2.7	2	0.9	1.6	3.4	2.17	2.4
Tb_d (ppb)	2.2	0.7	3.3	2.6	1.9	0.5	1.5	3.3	2.12	2.1
Dy (ppb)	11.7	4.7	6	12.6	9.5	4.7	7.8	16.4	10.5	12.3
Dy_d (ppb)	11	3.5	5.8	13.3	9.4	2.5	7.4	15.6	10.1	10.2
Ho (ppb)	1.9	0.8	1	2	1.6	0.8	1.2	2.6	1.67	2
Ho_d (ppb)	1.8	0.6	0.9	2.1	1.5	0.4	1.2	2.5	1.7	1.6
Er (ppb)	4.4	1.7	2.2	4.5	3.6	1.7	2.9	6.1	3.8	4.4
Er_d (ppb)	4.2	1.3	2.1	4.9	3.6	1	2.8	5.9	4.07	3.6
Tm (ppb)	0.5	0.2	0.7	0.5	0.4	0.2	0.3	0.7	0.44	0.5
Tm_d (ppb)	0.5	0.1	0.6	0.5	0.4	0.1	0.3	0.7	0.44	0.4
Yb (ppb)	2.6	1	1.4	2.8	2.2	1	1.8	3.9	2.39	2.7
Yb_d (ppb)	2.5	0.7	1.3	3	2.2	0.5	1.7	3.7	2.38	2.2
Lu (ppb)	0.3	0.1	0.1	0.3	0.3	0.1	0.2	0.5	0.3	0.3
Lu_d (ppb)	0.3	< 0.1	< 0.1	0.4	0.3	< 0.1	0.2	0.5	0.3	0.6
Total REE (ppb)	196.6	82.9	314.58	269.5	191.3	82.06	170.4	429.5	230.57	232.9
Total LREE (ppb)	130.8	51.6	269.68	189.8	115.5	49.66	122.7	337.3	163.1	162.5
Total HREE (ppb)	65	30.7	37	75.6	74.9	31.8	46	87	65.17	68.2
Total REE_d (ppb)	195.37	74.37	308.07	272.3	173	52.51	167.9	409.6	204.07	201.5
Total REE % dissolved	99.4	89.7	97.9	101.0	90.4	64.0	98.5	95.4	88.5	86.5
Total LREE_d (ppb)	124.2	47.32	240.62	190.2	114	31.16	119.5	318.6	155.96	135.4
Total LREE % dissolved	95.0	91.7	89.2	100.2	98.7	62.7	97.4	94.5	95.6	83.3
Total HREE_d (ppb)	70.5	26.75	60.05	77.8	58.3	20.95	46.8	85.7	46.11	63.8
Total HREE % dissolved	108.5	87.1	162.3	102.9	77.8	65.9	101.7	98.5	70.8	93.5

Notes:

Results designated with a "d" (e.g. Eu_d) are dissolved concentrations.

pH, temperature, dissolved oxygen (DO), and conductivity measured in the field.

Total REEs (includes REE + Sc), LREEs, and HREEs non-detects were included at half the reporting limit.

gpm - gallons per minute

HREE - heavy REEs (Tb,Dy, Ho, Er, Tm, Yb, Lu, Y)

L/minute - liters per minute

B - estimated value, analyte detected in field blank.

* - anion data is for information purposes (sample exceeded holding time or other) except for the late July 2024 results.

LREE - light REEs (La, Ce, Pr, Nd, Sm, Eu, Gd)

mg/L - milligrams per liter

na - not available

ppm - parts per million

ppb - parts per billion

uS/cm - microsiemens per centimeter

E - estimated, informational purposes, holding time exceedence or other issue

Summitville Mine Water Data Summary

General Location	Reynolds Adit	Reynolds Adit	Summitville Dam Impoundment Effluent	Summitville Dam Impoundment Effluent	Summitville Dam Impoundment Effluent	Summitville Dam Impoundment Influent
SampleID	SV-01-24-001	SV-04-24-001	SV-02-24-001	SV-03-24-001	SV-05-24-001	SV-04-24-003
Date Sampled	5/7/2024	6/28/2024	5/30/2024	6/14/2024	7/18/2024	6/28/2024
pH	2.91	2.65	3.63	3.04	2.94	2.86
Temperature (°C)	14.4	9.3	16.5	na	15.4	12.6
DO (mg/L)	4.77	1.8	7.58	6	4.35	7.7
Conductivity (uS/cm)	2,360	4,160	827	1,166	1,261	2,660
Flow (gpm)	31.9	145	1,800	na	1,208	na
Flow (L/min)	121	549	6,814	na	4,573	na
Alkalinity (mg/L as CaCO ₃)	< 10	na	< 25	< 25	< 1	na
Au (ppb)	< 0.01	< 0.01	0.01	< 0.01	< 0.01	< 0.01
Au_d (ppb)	< 0.01	< 0.01	0.02	< 0.01	< 0.01	< 0.01
Ag (ppb)	0.12	0.17	< 0.05	0.07	< 0.05	0.19
Ag_d (ppb)	< 0.05	0.08	0.05	< 0.05	< 0.05	0.1
Al (ppb)	132,000	181,000	14,000	28,500	49,500	111,000
Al_d (ppb)	98,500	65,800	12,100	23,600	55,500	52,700
As (ppb)	344	947	6.6	53.5	79.2	531
As_d (ppb)	295	536	0.5	53	59	349
B (ppb)	2	2	3	3	3	3
B_d (ppb)	3	< 2	3	3	3	< 2
Ba (ppb)	11.1	7.07	12.9	15.1	7.24	10.8
Ba_d (ppb)	10.5	6.04	12.9	12.1	7.24	8.17
Be (ppb)	17.1	35	2.49	5.96	10.1	21.3
Be_d (ppb)	19.1	23.7	2.65	5.32	12	11.4
Bi (ppb)	0.34	1.86	0.02	0.11	0.18	1.35
Bi_d (ppb)	0.12	1.6	< 0.01	0.15	0.15	0.98
Ca (ppb)	92,000	119,000	91,300	74,600	106,000	92,500
Ca_d (ppb)	86,400	59,300	84,900	69,300	118,000	56,700
Cd (ppb)	171	116	10.3	16.7	39.7	71.6
Cd_d (ppb)	148	72.8	11.1	18.2	42.9	54.1
Co (ppb)	319	592	58.7	98.2	221	349
Co_d (ppb)	323	292	56.9	96.3	242	222
Cr (ppb)	21.2	43.3	1.43	4.58	9.64	25.2
Cr_d (ppb)	20.9	21.2	1.32	4.68	11.1	14.8
Cs (ppb)	1	0.9	0.1	0.2	0.3	0.6
Cs_d (ppb)	0.8	0.6	0.1	0.2	0.3	0.8
Cu (ppb)	21,300	47,100	2,380	6,040	13,000	29,300
Cu_d (ppb)	20,600	24,300	2,230	5,810	14,200	17,900
Fe (ppb)	269,000	466,000	11,100	34,500	93,300	277,000
Fe_d (ppb)	246,000	254,000	7,780	36,700	96,400	176,000
Ga (ppb)	8.6	26.7	0.5	2.1	5.2	14.6
Ga_d (ppb)	9	24	0.6	2	5.8	13
Ge (ppb)	6.3	12.1	0.7	1.5	3.4	7.7
Ge_d (ppb)	7	4.7	0.6	2	3.6	3.4
Hf (ppb)	< 0.1	0.1	< 0.1	< 0.1	< 0.1	< 0.1
Hf_d (ppb)	< 0.1	0.2	< 0.1	< 0.1	< 0.1	< 0.1
Hg (ppb)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Hg_d (ppb)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
In (ppb)	8.9	22.5	0.2	1.5	4.1	11.4
In_d (ppb)	8.6	21.5	0.2	1.6	4.3	11
K (ppb)	2,920	2,070	1,920	1,600	1,860	1,870
K_d (ppb)	2,700	986	1,700	1,320	2,080	1,120
Li (ppb)	25.3	45.3	6.4	11.8	16	28.9
Li_d (ppb)	29.9	28.7	6.7	10.2	18.4	15
Mg (ppb)	37,800	48,900	16,400	16,600	26,100	33,400
Mg_d (ppb)	37,500	23,800	16,700	16,400	29,600	20,200
Mn (ppb)	16,700	22,600	3,910	5,200	9,720	14,500
Mn_d (ppb)	17,400	22,200	3,560	4,890	10,600	13,911
Mo (ppb)	1.2	2.6	< 0.04	0.08	0.21	1.4
Mo_d (ppb)	1.16	1.5	< 0.04	0.2	0.15	1
Na (ppb)	5,950	4,750	3,940	3,350	5,370	4,120
Na_d (ppb)	5,670	2,150	3,990	3,100	6,100	2,390
Nb (ppb)	< 0.1	< 0.01	< 0.1	< 0.1	< 0.1	< 0.01
Nb_d (ppb)	< 0.1	0.04	< 0.1	< 0.1	< 0.1	< 0.01
Ni (ppb)	411	701	75.7	125	245	440
Ni_d (ppb)	414	372	69	123	269	282
P (ppb)	758	3040	23	181	321	1730
P_d (ppb)	601	1500	< 3	175	247	977
Pb (ppb)	460	323	10.9	29.5	72.5	173
Pb_d (ppb)	432	285	17	36	76.1	132
Rb (ppb)	16.4	14.7	3.3	4.4	7.7	11.2
Rb_d (ppb)	15.2	13.3	3.2	4.1	7.6	13
Re (ppb)	0.2	0.2	< 0.1	< 0.1	< 0.1	< 0.1
Re_d (ppb)	0.1	0.2	< 0.1	< 0.1	< 0.1	< 0.1
S (ppb)	435,000	801,000	127,000	163,000	322,000	530,000
S_d (ppb)	596,000	420,000	149,000	184,000	364,000	334,000
Sb (ppb)	4.5	12.3	< 0.9	< 0.9	1.3	7.5
Sb_d (ppb)	3.7	12.6	< 0.9	< 0.9	< 0.9	6
Se (ppb)	0.38	1.74	0.09	0.22	0.33	1.04
Se_d (ppb)	0.4	1.02	0.15	0.28	0.36	0.7
Si (ppb)	36,900	34,600	7,770	11,500	16,300	27,900
Si_d (ppb)	35,300	17,000	7,680	10,500	18,600	15,200
Sn (ppb)	< 0.06	0.16	< 0.06	< 0.06	< 0.06	0.08
Sn_d (ppb)	< 0.06	0.16	< 0.06	0.07	< 0.06	< 0.06
Sr (ppb)	323	372	391	289	370	302
Sr_d (ppb)	314	212	380	294	397	208

Summitville Mine Water Data Summary

General Location	Reynolds Adit	Reynolds Adit	Summitville Dam Impoundment Effluent	Summitville Dam Impoundment Effluent	Summitville Dam Impoundment Effluent	Summitville Dam Impoundment Influent
SampleID	SV-01-24-001	SV-04-24-001	SV-02-24-001	SV-03-24-001	SV-05-24-001	SV-04-24-003
Ta (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Ta_d (ppb)	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Te (ppb)	1.9	9.1	< 0.1	0.5	1.2	5.1
Te_d (ppb)	1.3	7.4	< 0.1	0.6	1	3.8
Th (ppb)	1.3	16.4	0.4	1.6	2	8.9
Th_d (ppb)	1	10.8	0.3	1.6	2.1	5.1
Ti (ppb)	0.27	0.56	0.33	0.44	0.37	0.52
Ti_d (ppb)	0.23	0.3	0.1	0.16	0.16	0.2
Tl (ppb)	5.57	4.51	0.37	0.705	1.42	3
Tl_d (ppb)	5.99	3.92	0.361	0.753	1.45	2.28
U (ppb)	24.3	48.3	2.42	6.23	11.3	25.9
U_d (ppb)	25.7	41.8	2.55	6.5	12.2	20.2
V (ppb)	37.5	76.5	0.32	2.1	5.44	41.6
V_d (ppb)	37.1	37.8	0.02	1.6	3.56	25.2
W (ppb)	0.17	0.24	57.7	0.08	0.05	0.14
W_d (ppb)	0.14	1.8	40.2	0.06	0.03	0.31
Zn (ppb)	14,800	22,000	1,500	3,190	5,910	13,100
Zn_d (ppb)	13,500	10,500	1,440	3,010	6,550	7,950
Zr (ppb)	< 2	< 2	< 2	< 2	< 2	< 2
Zr_d (ppb)	< 2	< 2	< 2	< 2	< 2	< 2
Cl (ppm)*	< 5	< 5	< 5	< 5	2	< 5
F (ppm)*	5.2	8.97	< 2.5	< 2.5	na	5.07
NO ₃ (ppm)*	< 2.5	< 2.5	< 2.5	< 2.5	na	< 2.5
SO ₄ (ppm)*	1,294	1,899	379	473	1,300	1,006
Rare Earth Elements						
Sc (ppb)	5.3	15.2	1.1	2.3	4.4	9.3
Sc_d (ppb)	5.5	13.9	1.1	2.5	4.9	8.2
Y (ppb)	92.1	139	16	25.7	53.7	86.8
Y_d (ppb)	90.4	79.5	15.5	26.5	57.6	60.3
La (ppb)	63.6	154	15.2	25.5	51.5	83.5
La_d (ppb)	60.1	138	15	26.2	46.3	82.3
Ce (ppb)	153	327	34.5	56.6	120	194
Ce_d (ppb)	141	286	34	57.1	105	182
Pr (ppb)	18.6	37.9	4.5	7.2	14.3	23.5
Pr_d (ppb)	18	34.7	4.4	7.4	13	21.7
Nd (ppb)	82.4	162	18.9	30.5	59.7	98.5
Nd_d (ppb)	80.3	150	17.8	31.2	54.5	93.4
Sm (ppb)	18	35.4	3.6	6.1	12.1	20.6
Sm_d (ppb)	17.7	34.1	3.4	6.1	11.3	21.2
Eu (ppb)	5.4	9.9	1	1.6	3.4	5.8
Eu_d (ppb)	5.2	9.87	1	1.7	3.1	6.15
Gd (ppb)	24.2	43.8	4.22	7.07	15.5	25.1
Gd_d (ppb)	23.4	41.7	3.92	7.3	13.3	25
Tb (ppb)	3.5	6.12	0.5	0.9	2	3.47
Tb_d (ppb)	3.3	5.86	0.5	1	1.9	3.5
Dy (ppb)	18.7	30.9	2.8	4.7	10	18.2
Dy_d (ppb)	17.6	31.1	2.6	4.9	9.9	19.2
Ho (ppb)	3.4	5.6	0.5	0.8	1.9	3.26
Ho_d (ppb)	3.3	5.63	0.5	0.9	1.8	3.36
Er (ppb)	8.8	14.7	1.2	2.1	4.8	8.26
Er_d (ppb)	8.5	15	1.2	2.2	4.3	8.8
Tm (ppb)	1.1	1.83	0.2	0.3	0.6	1.04
Tm_d (ppb)	1	1.89	0.2	0.3	0.6	1.11
Yb (ppb)	6.6	10.9	0.9	1.6	3.5	6.25
Yb_d (ppb)	6.2	10.7	0.8	1.7	3.2	6.68
Lu (ppb)	1	1.6	0.1	0.2	0.5	0.9
Lu_d (ppb)	0.9	1.7	0.1	0.3	0.8	1
Total REE (ppb)	505.7	995.9	105.2	173.2	357.9	588.5
Total LREE (ppb)	365.2	770.0	81.9	134.6	276.5	451.0
Total HREE (ppb)	135.2	210.7	22.2	36.3	77.0	128.2
Total REE_d (ppb)	482.4	859.7	102.0	177.3	331.5	543.9
Total REE % dissolved	95.4	86.3	97.0	102.4	92.6	92.4
Total LREE_d (ppb)	345.7	694.4	79.5	137.0	246.5	431.8
Total LREE % dissolved	94.7	90.2	97.1	101.8	89.2	95.7
Total HREE_d (ppb)	131.2	151.4	21.4	37.8	80.1	104.0
Total HREE % dissolved	97.0	71.9	96.4	104.1	104.0	81.1

Notes:

Results designated with a "d" (e.g. Eu_d) are dissolved concentrations.

pH, temperature, dissolved oxygen (DO), and conductivity measured in the field.

Total REEs (includes REE + Sc), LREEs, and HREEs non-detects were included at half the reporting limit.

gpm - gallons per minute

HREE - heavy REEs (Tb,Dy, Ho, Er, Tm, Yb, Lu, Y)

L/min - liters per minute

* - anion data is for information purposes (sample exceeded holding time or other) except for the late July 2024 results.

LREE - light REEs (La, Ce, Pr, Nd, Sm, Eu, Gd)

mg/L - milligrams per liter

na - not available

ppm - parts per million

ppb - parts per billion

uS/cm - microsiemens per centimeter

APPENDIX C (electronic download)

APPENDIX D

Appendix D - Summary of water concentration ranges.

	Eagle WTP (n = 10)						Eagle Mine North Groundwater Extraction Trench (n=10)						LMDT (n=10)						Argo Tunnel (n=10)					
	Min	Max	Median	Mean	25th	75th	Min	Max	Median	Mean	25th	75th	Min	Max	Median	Mean	25th	75th	Min	Max	Median	Mean	25th	75th
pH	5.14	6.1	5.88	5.75	5.57	5.93	6.21	6.63	6.49	6.46	6.40	6.54	6.1	7.4	7.03	6.93	6.77	7.16	2.48	2.89	2.75	2.75	2.69	2.83
Temperature (°C)	6.9	19.7	17.4	15.6	14.0	18.0	8.8	18.6	11.7	12.5	11.1	13.4	6.7	13.3	9.55	9.6	8.1	11.0	7.6	18.5	15.2	14.4	13.0	16.0
DO (mg/L)	1.48	4.04	1.95	2.21	1.75	2.49	2.21	5.58	2.93	3.639	2.49	5.10	6.29	8.8	7.67	7.60	7.33	7.89	3.64	7.63	5.45	5.51	4.82	6.19
Conductivity (uS/cm)	2,005	3,400	2,790	2,708	2,570	2,919	1,679	2,850	2,560	2,493	2,448	2,710	347	570	451	461	377	546	2,470	3,650	3,095	3,051	2,858	3,263
Flow (gpm)	132	230	163	174	149	191	na	na	na	na	na	na	820	1355	1111	1085.3	983	1182.5	144	227.5	197.7	198.9	191.8	216
Flow (L/min)	500	871	615	657	564	724	na	na	na	na	na	na	3104	5129	4206	4108	3721	4476	545	861	748	753	726	818
Alkalinity (mg/L as CaCO ₃)	10	102	41	46.8	23.8	60.9	< 8	106	42.7	44.2	8.0	67.0	39.4	163	127	119.3	120	129	< 1	< 25	5	5.3	5	5
Au (ppb)	< 0.01	< 0.01	0.005	0.005	0.005	0.005	< 0.01	< 0.01	0.005	0.005	0.005	0.005	< 0.01	< 0.01	0.005	0.005	0.005	0.005	< 0.01	0.02	0.005	0.0065	0.005	0.005
Au_d (ppb)	< 0.01	< 0.01	0.005	0.005	0.005	0.005	< 0.01	< 0.01	0.005	0.005	0.005	0.005	< 0.01	< 0.01	0.005	0.005	0.005	0.005	< 0.01	< 0.01	0.005	0.005	0.005	0.005
Ag (ppb)	0.06	1.01	0.215	0.292	0.0875	0.2925	< 0.05	0.41	0.025	0.0635	0.025	0.025	0.09	0.43	0.14	0.186	0.13	0.165	0.08	0.21	0.11	0.123	0.0925	0.135
Ag_d (ppb)	0.05	0.7	0.17	0.217	0.025	0.3425	< 0.05	0.9	0.0425	0.1445	0.025	0.06	< 0.05	< 0.05	0.025	0.025	0.025	0.025	< 0.05	0.11	0.065	0.069	0.0525	0.09
Al (ppb)	244	848	310.5	366.8	267.5	350.5	< 1	634	156	202.2	13	323.3	130	2960	466	729.4	193.5	881.8	13,500	27,100	18,300	19,890	17,025	24,300
Al_d (ppb)	14	468	30.5	93.1	24.5	47	< 1	491	79	129.75	19.5	161.5	3	48	8.5	12.7	5.25	11.75	12,800	23,000	18,850	18,490	17,900	19,900
As (ppb)	67.5	275	135.5	141.71	100.9	170.0	1.9	364.0	263.5	191.0	42.4	300.3	0.4	3.3	1.3	1.4	1.1	1.4	41.7	86.8	54.4	62.0	50.4	75.0
As_d (ppb)	15.0	58.1	24.0	31.6	18.9	46.1	0.7	344.0	234.5	170.7	17.0	284.8	< 0.2	0.5	0.1	0.2	0.1	0.3	40.0	88.0	56.2	61.9	50.8	77.0
B (ppb)	25	34	29	29.3	27.25	31.5	92	169	124	125.3	111.5	137.75	4	12	5	6.2	5	6.75	16	75	29	32.2	24.25	33.75
B_d (ppb)	24	33	28	28.1	26.25	29.75	106	146	120.5	119.6	112	122.75	4	10	5	5.4	4.25	5.75	24	37	26.5	26.9	24.25	27
Ba (ppb)	8.7	11.5	11.0	10.8	10.6	11.3	9.5	13.9	11.9	11.7	11.1	12.5	70.1	82.5	75.2	75.9	74.6	76.4	1.6	3.3	2.0	2.1	1.8	2.1
Ba_d (ppb)	8.76	15.40	10.40	10.94	10.23	11.28	9.31	15.60	12.15	12.07	10.93	12.93	70.50	93.60	74.55	76.47	73.23	77.68	1.70	3.01	1.91	2.04	1.76	2.12
Be (ppb)	0.31	1.04	0.61	0.63	0.57	0.70	0.02	0.41	0.21	0.19	0.05	0.29	0.02	0.50	0.10	0.12	0.04	0.12	5.64	15.80	10.59	10.92	8.77	13.25
Be_d (ppb)	0.22	0.91	0.39	0.47	0.30	0.55	0.02	0.50	0.21	0.21	0.03	0.33	0.01	0.07	0.02	0.02	0.01	0.02	7.89	11.70	11.05	10.46	10.28	11.25
Bi (ppb)	0.02	0.21	0.03	0.05	0.02	0.04	< 0.01	0.06	0.01	0.01	0.01	0.01	< 0.01	0.08	0.01	0.01	0.01	0.01	0.02	0.06	0.04	0.04	0.03	0.04
Bi_d (ppb)	0.01	0.3	0.005	0.04	0.005	0.025	< 0.01	0.3	0.005	0.036	0.005	0.005	< 0.01	< 0.01	0.005	0.005	0.005	0.005	0.02	0.24	0.04	0.073	0.03	0.095
Ca (ppb)	266000	382000	330000	332700	314250	363000	163000	225000	208000	203400	190000	218500	40000	70700	54550	54750	50650	59825	220000	313000	266500	265600	250750	280750
Ca_d (ppb)	258000	371000	347500	334900	326250	359000	157000	220000	202000	199700	195500	212250	43200	71100	55800	56980	50325	64500	211000	349000	267500	269800	250500	284750
Cd (ppb)	41.2	354	90.2	133.31	64.675	125.25	0.301	1.54	0.696	0.7761	0.53475	0.98725	7.55	131	29.9	36.685	12.55	43	83.4	128	101.5	105.61	95.575	118
Cd_d (ppb)	42	340	93.3	129.97	67.475	132.5	0.38	1.3	0.7965	0.7759	0.50775	0.96825	7.89	129	29.15	36.067	12.5	43.525	85.1	133	106.5	109.92	98.3	123.25
Co (ppb)	9.1	20.2	15.5	15.0	14.3	16.7	6.9	9.2	8.4	8.2	7.6	9.0	0.3	3.9	1.0	1.3	0.6	1.7	103.0	135.0	119.0	118.2	110.5	124.5
Co_d (ppb)	9.2	19.8	15.6	14.7	13.6	16.6	6.2	9.3	8.2	8.0	7.8	8.6	0.3	3.9	1.0	1.3	0.6	1.7	103.0	129.0	120.0	117.8	114.0	123.3
Cr (ppb)	0.17	3.53	0.25	0.66	0.21	0.38	< 0.08	0.35	0.08	0.12	0.04	0.19	0.18	1.15	0.35	0.39	0.24	0.36	6.05	20.70	8.32	9.38	6.97	9.23
Cr_d (ppb)	0.08	1.40	0.04	0.18	0.04	0.04	< 0.08	0.74	0.04	0.17	0.04	0.09	< 0.08	< 0.08	0.04	0.04	0.04	0.04	4.96	10.40	7.66	7.57	6.43	8.63
Cs (ppb)	5.3	7.1	6.5	6.4	6.0	6.9	6.1	10.6	9.4	9.1	9.2	9.8	< 0.1	0.2	0.1	0.1	0.1	0.1	5.4	9.0	7.0	7.0	5.7	8.3
Cs_d (ppb)	5.6	6.8	6.1	6.1	5.7	6.3	7.4	12.0	8.4	8.9	8.2	8.9	< 0.1	0.2	0.1	0.1	0.1	0.1	5.6	8.8	6.6	6.6	5.8	7.0
Cu (ppb)	226.0	920.0	267.5	346.9	253.3	311.0	1.4	5.2	2.4	2.7	1.9	3.5	5.3	203.0	23.1	45.1	10.1	55.6	3,180	6,920	3,774	4,308	3,320	5,100
Cu_d (ppb)	62.0	801.0	132.5	209.9	100.8	160.0	1.2	42.0	7.4	11.8	2.4	15.3	0.6	47.0	4.3	9.5	1.5	10.6	2,570	6,540	4,050	4,294	3,379	5,075
Fe (ppb)	40200	59500	51600	51290	47550	55550	51600	166000	103600	104070	70900	129750	827	19200	4200	5038.7	2235	5180	103000	152000	130000	126700	117250	133500
Fe_d (ppb)	23500	49300	35950	36080	32500	39450	46000	168000	106800	99300	62425	126250	8	851	116	286.9	52	547.75	111000	141000	130500	128300	123000	133750
Ga (ppb)	0.30	1.90	0.95	1.01	0.80	1.08	< 0.10	1.00	0.75	0.66	0.63	0.80	< 0.10	0.40	0.08	0.11	0.05	0.10	2.50	12.60	6.25	6.80	5.40	7.63
Ga_d (ppb)	0.10	0.60	0.30	0.27	0.13	0.38	0.20	1.40	0.75	0.67	0.50	0.80	< 0.10	0.10	0.05	0.06	0.05	0.05	2.60	11.80	6.85	6.69	6.00	7.30
Ge (ppb)	0.80	1.60	1.25	1.23	1.13	1.40	1.10	4.70	2.40	2.62	1.40	3.70	< 0.10	3.30	0.20	0.50	0.09	0.20	1.00	7.60	6.50	6.03	5.73	7.08
Ge_d (ppb)	< 0.10	1.10	0.85	0.80	0.73	0.98	< 0.10	4.00	2.50	2.20	1.03	3.15	< 0.10	< 0.10	0.05	0.05	0.05	0.05	4.50	10.20	7.00	6.92	6.18	7.25
Hf (ppb)	< 0.10	0.20	0.05	0.09	0.05	0.09	< 0.10	0.20	0.05	0.07	0.05	0.05	< 0.10	< 0.10	0.05	0.05	0.05	0.05	< 0.10	0.30	0.08	0.13	0.05	0.18
Hf_d (ppb)	< 0.10	0.20	0.05	0.07	0.05	0.05	< 0.10	< 0.10	0.05	0.05	0.05	0.05	< 0.10	< 0.10	0.05	0.05	0.05	0.05	< 0.10	0.10	0.05	0.07	0.05	0.10
Hg (ppb)	< 0.01	0.1	0.005	0.014	0.005	0.005	< 0.01	0.1	0.005	0.016	0.005	0.005	< 0.01	0.1	0.005	0.015	0.005	0.005	< 0.01	< 0.1	0.005	0.0095	0.005	0.005
Hg_d (ppb)	< 0.01	0.1	0.005	0.0145	0.005	0.00875	< 0.01	< 0.1	0.005	0.014	0.005	0.005	< 0.01	< 0.1	0.005	0.014	0.005	0.005	< 0.01	0.1	0.005	0.0155	0.005	0.01625
In (ppb)	< 0.10	1.00	0.40	0.42	0.31	0.48	< 0.01	< 0.10	0.05	0.05	0.05	0.05	< 0.10	6.30	0.59	1.21	0.25	1.28	0.10	2.80	1.55	1.52	1.13	2.06
In_d (ppb)	< 0.01	0.10	0.05	0.05	0.05	0.05	< 0.01	< 0.10	0.05	0.05	0.05	0.05	< 0.01	< 0.10	0.05	0.05	0.05	0.05	0.30	2.60	1.50	1.51	1.13	1.97
K (ppb)	7760	11300	9965	9794	9085	10825	7750	15000	9480	9685	8220	10130	711	1520	1050	1058.2	927.25	1190	3210	5040	3640	3785	3322.5	3935
K_d (ppb)	7000	11800	9675	9590	9205	10435	7240	13100	8975	9440	8467.5	9790	772	1550	998	1038.2	908.75	1086	2880	4830	3830	3803.2	3107.5	4304
Li (ppb)	18.80	28.00	23.90	22.93	19.73	24.80	95.10	182.00	145.00	140.71	121.00	156.00	1.30	6.00	2.35	2.74	1.80	3.30	16.20	43.50	31.05	31.2		

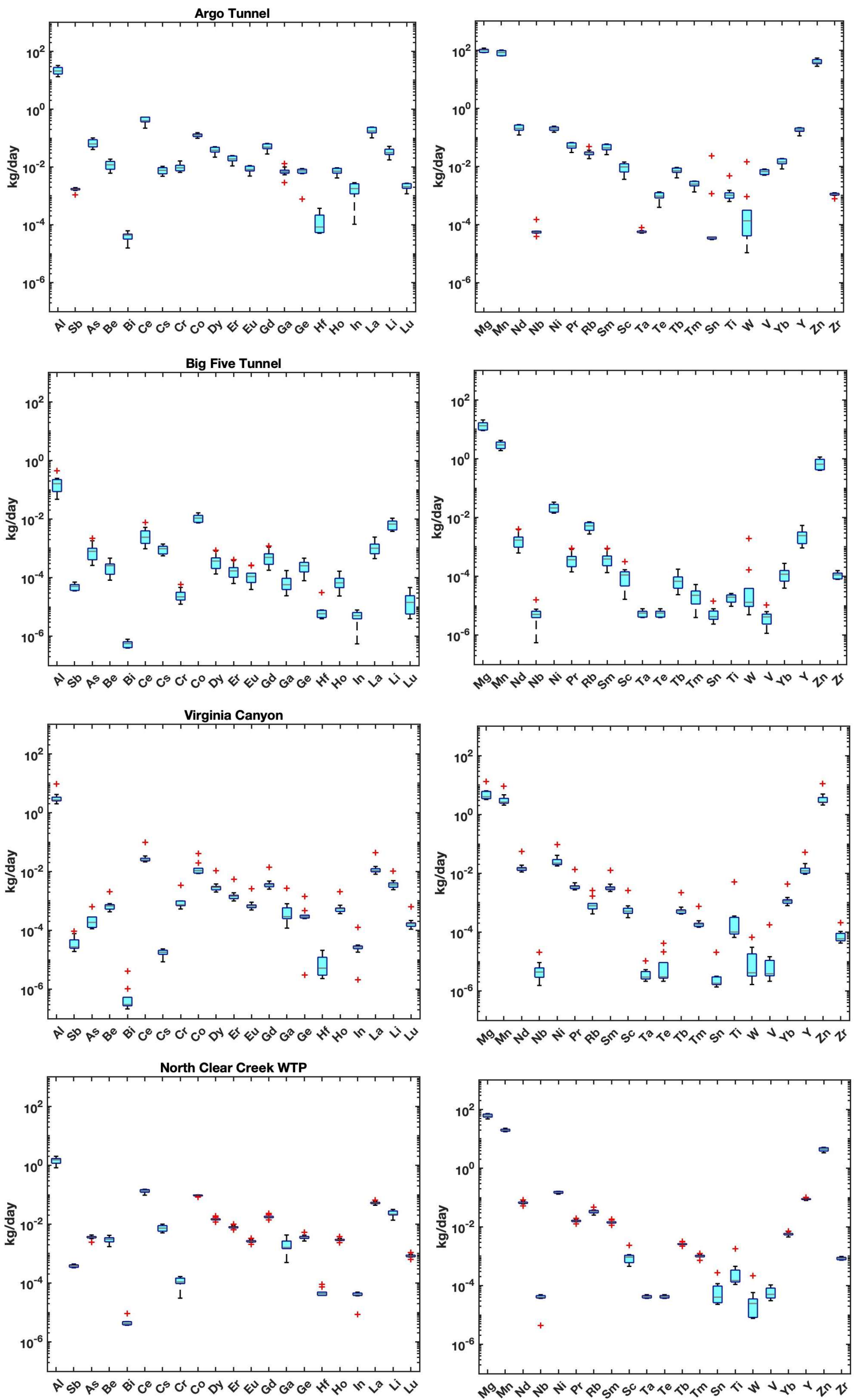
Appendix D (cont.) - Summary of water concentration ranges.

	Virginia Canyon (n=10)						Big Five Tunnel (n=10)						NCC WTP (n=10)						Nelson Tunnel (n=10)					
	Min	Max	Median	Mean	25th	75th	Min	Max	Median	Mean	25th	75th	Min	Max	Median	Mean	25th	75th	Min	Max	Median	Mean	25th	75th
pH	3.24	3.49	3.36	3.37	3.32	3.41	5.28	5.88	5.52	5.55	5.38	5.72	4.42	5.46	4.88	4.92	4.84	5.05	4.28	5.18	4.65	4.67	4.54	4.72
Temperature (°C)	6.1	18	12.5	12.4	9.7	15.0	9	18	13.9	13.8	13	14.5	8.3	16.4	14.8	13.8	13.3	15.2	7.4	23	16.9	15.1	11.5	18.1
DO (mg/L)	6.28	9.1	7.17	7.41	7.10	7.74	3.09	6.58	5.07	5.09	4.40	5.93	6.79	7.84	7.51	7.44	7.25	7.60	5.98	6.71	6.32	6.35	6.26	6.40
Conductivity (uS/cm)	1,519	2,450	1,968	2,009	1,838	2,208	1,943	2,840	2,510	2,496	2,408	2,630	1,616	2,420	2,054	2,052	1,975	2,086	787	1,152	1,012	986	846	1,113
Flow (gpm)	7.8	38.3	10.9	14.3	9.6	15.2	14.4	28.7	20.5	20.3	15.3	23.1	135	180	156	155.2	140	165.3	315	346	321	325.3	315	333
Flow (L/min)	30	145	41	54	36	58	55	109	78	77	58	88	511	681	591	587	530	626	1,192	1,310	1,215	1,231	1,192	1,261
Alkalinity (mg/L as CaCO ₃)	< 1	< 25	5	5.3	5	5	< 1	< 25	5	5.3	5	5	< 1	< 25	5	5.4	5	5	< 1	< 25	5	6	5	5
Au (ppb)	< 0.01	< 0.01	0.005	0.005	0.005	0.005	< 0.01	< 0.01	0.005	0.005	0.005	0.005	< 0.01	< 0.01	0.005	0.005	0.005	0.005	< 0.01	< 0.01	0.005	0.005	0.005	0.005
Au_d (ppb)	< 0.01	< 0.01	0.005	0.005	0.005	0.005	< 0.01	< 0.01	0.005	0.005	0.005	0.005	< 0.01	< 0.01	0.005	0.005	0.005	0.005	< 0.01	< 0.01	0.005	0.0195	0.005	0.005
Ag (ppb)	0.46	1.22	0.895	0.857	0.76	0.9625	< 0.05	< 0.05	0.025	0.025	0.025	0.025	< 0.05	0.08	0.025	0.0305	0.025	0.025	0.25	3.78	0.655	1.192	0.325	1.3975
Ag_d (ppb)	0.14	1.08	0.825	0.742	0.6325	0.9325	< 0.05	0.4	0.025	0.0625	0.025	0.025	< 0.05	< 0.05	0.025	0.025	0.025	0.025	0.19	3.04	0.39	0.909	0.2375	1.1375
Al (ppb)	31,800	66,100	46,050	46,410	43,900	48,475	604	2,970	1,295	1,476	885.8	1,833	1,050	2,320	1,665	1,703	1,513	1,988	270	1800	619.5	719.9	361.5	718.5
Al_d (ppb)	30,800	68,400	40,100	43,040	38,625	45,900	67	745	343.5	360.2	150	568	653	1,730	1,500	1,423	1,310	1,690	238	1930	465.5	680	352.25	639.25
As (ppb)	1.5	13.8	2.8	4.0	2.2	4.3	3.3	20.7	6.4	7.8	4.2	7.2	3.2	4.9	4.3	4.2	3.9	4.7	2.8	8.7	7.4	7.0	6.8	8.2
As_d (ppb)	1.5	6.2	2.8	3.4	2.2	4.8	0.2	1.8	0.4	0.5	0.3	0.6	1.9	3.8	2.5	2.7	2.0	3.4	1.9	4.9	4.4	3.9	3.5	4.6
B (ppb)	16	31	21	21.9	19.25	24.5	32	44	39.5	38.8	35.5	42	33	52	45.5	43.8	38.5	48.5	9	35	14	15.3	12.5	14
B_d (ppb)	15	25	20	20.4	19	22.75	33	42	35	36.3	35	38	30	55	42.5	42.9	39.5	46.25	10	17	12	12.6	11.25	13.75
Ba (ppb)	6.5	38.8	10.1	12.4	8.3	11.0	10.2	11.7	11.3	11.1	10.7	11.6	6.8	8.0	7.2	7.2	6.8	7.6	13.9	20.1	16.5	16.8	15.7	18.2
Ba_d (ppb)	5.84	17.10	10.50	11.09	9.53	12.78	9.97	14.20	11.35	11.68	11.08	12.35	6.64	9.11	7.35	7.53	6.85	7.79	13.60	20.80	17.75	17.08	15.20	18.20
Be (ppb)	7.08	15.40	9.92	10.32	8.99	11.38	1.04	3.04	2.08	2.04	1.56	2.54	2.25	4.80	3.46	3.52	2.94	4.05	1.74	3.68	3.08	3.03	2.82	3.53
Be_d (ppb)	6.90	14.00	9.31	9.99	8.63	11.20	0.82	1.60	1.25	1.24	1.08	1.42	2.37	4.53	3.29	3.48	3.14	3.96	2.31	4.00	3.12	3.01	2.70	3.20
Bi (ppb)	< 0.01	0.01	0.09	0.01	0.01	0.01	< 0.01	< 0.01	0.01	0.01	0.01	0.01	< 0.01	0.01	0.01	0.01	0.01	0.01	< 0.01	0.01	0.01	0.01	0.01	0.01
Bi_d (ppb)	< 0.01	0.02	0.005	0.008	0.005	0.005	< 0.01	0.4	0.005	0.047	0.005	0.005	< 0.01	< 0.01	0.005	0.005	0.005	0.005	< 0.01	0.3	0.005	0.035	0.005	0.005
Ca (ppb)	161000	223000	175500	180500	165000	186000	291000	393000	381000	363900	342500	389750	226000	301000	275500	272700	252750	295000	89500	185000	144500	136890	118500	153750
Ca_d (ppb)	158000	301000	172500	187700	159500	188750	286000	402000	360500	345250	381500	381500	231000	330000	280000	277900	265250	287500	94700	175000	126000	132170	115000	153250
Cd (ppb)	176	339	251	260.2	221.5	310	3.54	6.81	5.06	5.134	4.2075	6.13	6.33	8.38	7.075	7.196	6.725	7.5025	79.8	472	121	156.42	85.65	133
Cd_d (ppb)	184	415	260	273.8	227.5	307.75	3.07	6.93	5.97	5.212222	3.4	6.45	6.04	8.64	7.615	7.546	6.9025	8.325	78.4	452	119	156.62	92.975	137.25
Co (ppb)	108.0	233.0	197.0	183.8	163.3	209.5	90.2	112.0	98.6	99.4	94.0	103.8	94.8	130.0	108.5	110.2	105.8	114.3	17.3	28.6	26.1	25.0	24.2	27.5
Co_d (ppb)	110.0	276.0	197.0	185.5	161.0	201.3	87.5	105.0	95.9	96.0	92.2	99.0	99.5	127.0	110.0	110.3	101.3	117.3	16.7	29.9	25.1	24.0	22.4	26.1
Cr (ppb)	9.42	16.30	12.90	12.87	11.23	14.38	0.15	0.53	0.21	0.25	0.16	0.25	< 0.08	0.19	0.15	0.13	0.10	0.18	< 0.08	0.16	0.04	0.08	0.04	0.12
Cr_d (ppb)	9.24	15.80	13.35	12.49	10.73	13.98	< 0.08	0.60	0.04	0.11	0.04	0.04	< 0.08	0.09	0.04	0.05	0.04	0.04	< 0.08	< 0.08	0.04	0.04	0.04	0.04
Cs (ppb)	0.1	0.5	0.3	0.3	0.2	0.3	7.1	9.6	8.9	8.5	7.9	9.2	6.9	10.3	8.6	8.7	7.6	10.0	12.8	20.2	17.3	17.2	15.6	19.0
Cs_d (ppb)	0.1	0.6	0.3	0.3	0.2	0.3	7.4	16.9	8.0	9.1	7.8	9.0	7.4	10.2	7.9	8.2	7.7	8.4	13.7	34.9	16.7	18.3	14.6	18.1
Cu (ppb)	4,600	7,600	6,130	6,102	5,722	6,528	89.2	420.0	183.0	198.2	125.0	211.0	261.0	635.0	425.0	405.7	302.8	450.5	27.7	560.0	93.5	151.0	39.8	119.5
Cu_d (ppb)	4,440	7,577	5,975	6,033	5,590	6,370	26.6	171.0	77.4	82.7	32.3	124.5	219.0	522.0	419.0	389.4	287.3	484.3	24.7	563.0	89.0	150.6	45.8	120.8
Fe (ppb)	988	6310	1535	1948.8	1325	1747.5	64700	158000	91150	93590	76425	94375	89900	127000	102000	106050	96900	118750	722	2360	1350	1338	930.5	1605
Fe_d (ppb)	975	3360	1670	1747	1290	1830	49600	64800	60950	59930	58750	63150	80800	130000	100100	102920	89450	118500	10	129	74	72.4	58.25	85.25
Ga (ppb)	2.60	18.90	4.95	7.13	4.15	8.68	0.20	2.00	0.60	0.68	0.53	0.60	0.60	5.60	1.85	2.39	1.63	3.20	0.40	4.20	1.50	1.80	1.33	1.98
Ga_d (ppb)	1.90	18.10	5.35	6.95	4.00	9.25	< 0.10	0.70	0.35	0.34	0.13	0.48	0.60	5.40	2.00	2.42	2.00	2.98	0.40	4.50	1.05	1.66	1.00	1.95
Ge (ppb)	< 0.10	6.90	5.05	4.83	4.53	6.43	1.00	5.30	2.15	2.39	2.00	2.53	3.50	7.10	4.00	4.36	3.60	4.80	0.90	2.30	1.30	1.44	1.23	1.50
Ge_d (ppb)	3.00	10.80	5.25	5.86	4.33	6.83	< 0.10	1.60	1.00	1.07	0.93	1.45	2.50	6.40	3.80	4.04	3.00	5.05	< 0.10	1.80	1.00	1.10	1.00	1.38
Hf (ppb)	< 0.10	0.20	0.10	0.10	0.05	0.10	< 0.10	0.20	0.05	0.07	0.05	0.05	< 0.10	0.10	0.05	0.06	0.05	0.05	< 0.10	0.70	0.05	0.12	0.05	0.05
Hf_d (ppb)	< 0.10	0.10	0.08	0.08	0.05	0.10	< 0.10	0.10	0.05	0.06	0.05	0.05	< 0.10	< 0.10	0.05	0.05	0.05	0.05	< 0.10	< 0.10	0.05	0.05	0.05	0.05
Hg (ppb)	< 0.01	0.1	0.005	0.018	0.005	0.005	< 0.01	< 0.1	0.005	0.0095	0.005	0.005	< 0.01	0.1	0.005	0.013	0.005	0.0175	< 0.01	0.1	0.005	0.011	0.005	0.005
Hg_d (ppb)	< 0.01	< 0.1	0.005	0.014	0.005	0.005	< 0.01	< 0.1	0.005	0.014	0.005	0.005	< 0.01	0.1	0.005	0.0145	0.005	0.00875	< 0.01	< 0.1	0.005	0.014	0.005	0.005
In (ppb)	< 0.10	0.60	0.45	0.41	0.30	0.54	< 0.01	< 0.10	0.05	0.05	0.05	0.05	< 0.01	0.10	0.05	0.05	0.05	0.05	< 0.01	< 0.10	0.05	0.05	0.05	0.05
In_d (ppb)	< 0.10	0.60	0.45	0.39	0.30	0.50	< 0.01	< 0.10	0.05	0.05	0.05	0.05	< 0.01	< 0.10	0.05	0.05	0.05	0.05	< 0.01	< 0.10	0.05	0.05	0.05	0.05
K (ppb)	4640	7090	5375	5439	4812.5	5612.5	10100	14000	12850	12470	11450	13475	6500	9300	8595	8204	7600	8790	3210	11600	4450	4982	4095	4690
K_d (ppb)	4520	6440	4875	5232	4737.5	5810	9270	14500	11650	11967	11600	12650	6350	9006	8155	8003.6	7752.5	8387.5	3080	13900	4290	5049	3895	4457.5
Li (ppb)	38.60	78.30	55.65	56.65	50.70	61.73	48.10	75.00	55.55	59.28	53.25	68.08	17.90	38.30	28.15	27.71	2							

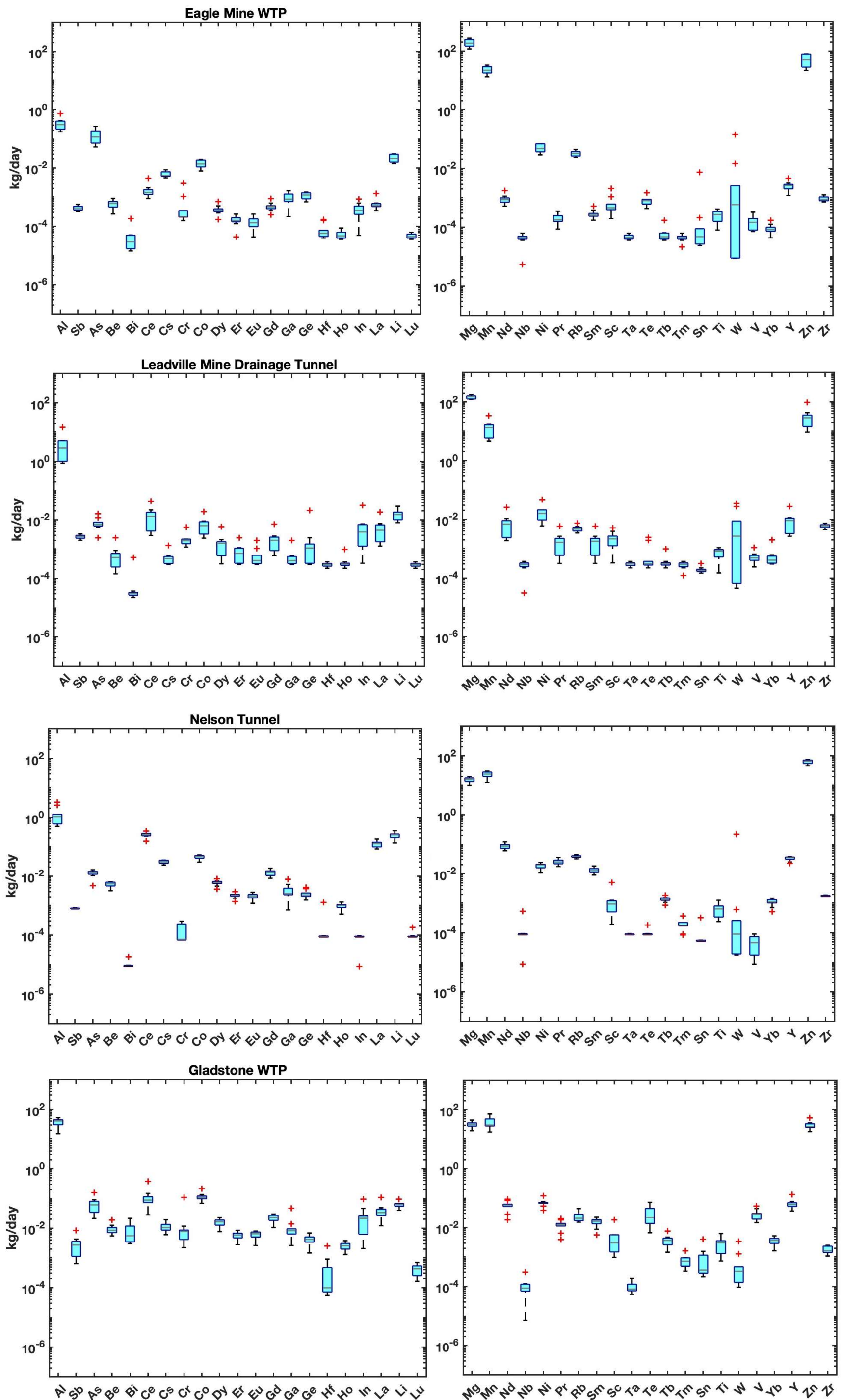
Appendix D (cont.) - Summary of water concentration ranges.

	Gladstone WTP (n=10)						St. Louis Tunnel (n=10)						Reynolds Adit (n=2)						Summitville Dam Impoundment Effluent (n=3)					
	Min	Max	Median	Mean	25th	75th	Min	Max	Median	Mean	25th	75th	Min	Max	Median	Mean	25th	75th	Min	Max	Median	Mean	25th	75th
pH	2.76	5.5	3.12	3.56	3.00	3.61	6.33	6.9	6.6	6.57	6.38	6.64	2.65	2.91	2.78	2.78	2.72	2.85	2.94	3.63	3.04	3.20	2.99	3.34
Temperature (°C)	5.5	11.5	8.4	8.3	7.5	8.9	16.1	19.3	19	18.4	18.1	19.2	9.3	14.4	11.9	11.9	10.6	13.1	15.4	16.5	16.0	16.0	15.7	16.2
DO (mg/L)	5.84	8.25	7.52	7.34	6.87	7.7	3.54	5.06	4.39	4.38	4.01	4.88	1.8	4.77	3.29	3.29	2.54	4.03	4.35	7.58	6	5.98	5.18	6.79
Conductivity (uS/cm)	1,564	2,760	2,146	2,094	1,740	2,360	1,027	1,155	1,122	1,111	1,112	1,140	2,360	4,160	3,260	3,260	2,810	3,710	827	1,261	1,166	1,085	997	1,214
Flow (gpm)	200	460	300	327.1	268.8	409	168	1000	870	694.6	562	873	31.9	145	88.5	88.5	60.2	116.7	1,208	1,800	1,504	1,504	1,356	1,652
Flow (L/min)	757	1,741	1,136	1,238	1,017	1,548	636	3,785	3,293	2,629	2,127	3305	121	549	335	335	228	442	4,573	6,814	5,693	5,693	5,133	6,253
Alkalinity (mg/L as CaCO ₃)	< 1	< 25	5	6.2	5	5	35.7	118	97	89.6	87.3	110	< 10	10	5	5	5	5	< 1	< 25	12.5	8.5	6.5	12.5
Au (ppb)	< 0.01	< 0.01	0.005	0.005	0.005	0.005	< 0.01	< 0.01	0.005	0.005	0.005	0.005	< 0.01	< 0.01	0.005	0.005	0.005	0.005	< 0.01	0.01	0.005	0.006667	0.005	0.0075
As (ppb)	< 0.01	< 0.01	0.005	0.005	0.005	0.005	< 0.01	< 0.01	0.005	0.005	0.005	0.005	< 0.01	< 0.01	0.005	0.005	0.005	0.005	< 0.01	0.02	0.005	0.01	0.005	0.0125
Ag (ppb)	< 0.05	0.09	0.025	0.044	0.025	0.06	< 0.05	0.08	0.025	0.036	0.025	0.025	0.12	0.17	0.145	0.145	0.1325	0.1575	< 0.05	0.07	0.025	0.04	0.025	0.0475
Ag_d (ppb)	< 0.05	0.13	0.025	0.04	0.025	0.025	< 0.05	0.4	0.025	0.1	0.025	0.025	< 0.05	0.08	0.0525	0.0525	0.03875	0.06625	< 0.05	0.05	0.025	0.033333	0.025	0.0375
Al (ppb)	9,130	46,100	21,650	23,009	15,125	28,575	254	2080	1090	1,217	1050	1610	132,000	181,000	156,500	156,500	144,250	168,750	14,000	49,500	28,500	30,667	21,250	39,000
Al_d (ppb)	3,310	40,100	19,550	21,165	13,175	29,925	21	2190	98	500.2	27	165	65800	98500	82150	82150	73975	90325	12,100	55,500	23,600	30,400	17,850	39,550
As (ppb)	11.7	82.9	37.1	38.4	20.9	45.5	0.6	2.3	1.6	1.5	0.7	2.3	344.0	947.0	645.5	645.5	494.8	796.3	6.6	79.2	53.5	46.4	30.1	66.4
As_d (ppb)	0.9	147.0	5.9	25.9	2.5	11.7	< 0.2	0.4	0.1	0.2	0.1	0.1	295.0	536.0	415.5	415.5	355.3	475.8	0.5	59.0	53.0	37.5	26.8	56.0
B (ppb)	< 2	10	3	3.3	2	3	3	15	6	8.6	5	14	2	2	2	2	2	2	3	3	3	3	3	3
B_d (ppb)	< 2	4	2	2.3	2	2.75	4	7	6	5.8	5	7	< 2	3	2	2	1.5	2.5	3	3	3	3	3	3
Ba (ppb)	7.4	16.7	9.0	9.6	8.6	9.4	16.9	23.8	19.4	20.0	18.6	21.1	7.1	11.1	9.1	9.1	8.1	10.1	7.2	15.1	12.9	11.7	10.1	14.0
Ba_d (ppb)	7.45	10.40	8.72	8.82	8.12	9.58	16.00	25.50	20.50	20.70	18.90	22.60	6.04	10.50	8.27	8.27	7.16	9.39	7.24	12.90	12.10	10.75	9.67	12.50
Be (ppb)	2.81	7.88	5.76	5.53	4.37	6.63	0.42	0.98	0.92	0.79	0.65	0.98	17.10	35.00	26.05	26.05	21.58	30.53	2.49	10.10	5.96	6.18	4.23	8.03
Be_d (ppb)	1.92	7.46	5.29	5.04	4.31	6.35	0.22	1.35	0.38	0.54	0.25	0.50	19.10	23.70	21.40	21.40	20.25	22.55	2.65	12.00	5.32	6.66	3.99	8.66
Bi (ppb)	1.36	9.03	3.16	4.47	2.27	7.27	0.08	0.76	0.30	0.36	0.11	0.56	0.34	1.86	1.10	1.10	0.72	1.48	0.02	0.18	0.11	0.10	0.07	0.15
Bi_d (ppb)	< 0.01	2.62	0.735	1.074	0.26	1.965	< 0.01	0.2	0.005	0.049	0.005	0.03	0.12	1.6	0.86	0.86	0.49	1.23	< 0.02	0.15	0.15	0.1	0.1	0.078
Ca (ppb)	95600	391000	333000	311060	310250	344000	166000	287000	211000	216600	184000	241000	92000	119000	105500	105500	98750	112250	74600	106000	91300	90633.3	82950	98650
Ca_d (ppb)	172000	430000	310000	299700	252750	336000	163000	258000	226000	221000	214000	244000	59300	86400	72850	72850	66075	79625	69300	118000	84900	90733.3	77100	101450
Cd (ppb)	31.5	120	63.4	65.99	57.575	76.95	23	138	27.6	49.14	23.7	33.4	116	171	143.5	143.5	129.75	157.25	10.3	39.7	16.7	22.2	13.5	28.2
Cd_d (ppb)	35.4	136	60.3	63.04	45.975	65.15	17.7	125	25.9	44.3	20.5	32.4	72.8	148	110.4	110.4	91.6	129.2	11.1	42.9	18.2	24.1	14.65	30.55
Co (ppb)	41.8	92.5	72.2	67.2	49.4	80.8	2.3	8.0	3.3	4.2	2.6	5.0	319.0	592.0	455.5	455.5	387.3	523.8	58.7	221.0	98.2	126.0	78.5	159.6
Co_d (ppb)	39.7	97.0	72.3	67.4	47.3	81.6	0.8	6.7	3.2	3.6	2.1	5.0	292.0	323.0	307.5	307.5	299.8	315.3	56.9	242.0	96.3	131.7	76.6	169.2
Cr (ppb)	1.19	45.50	4.70	8.51	2.51	5.69	0.81	10.90	0.87	2.88	0.86	0.98	21.20	43.30	32.25	32.25	26.73	37.78	1.43	9.64	4.58	5.22	3.01	7.11
Cr_d (ppb)	< 0.08	12.30	2.80	4.13	1.59	5.00	< 0.08	< 0.08	0.04	0.04	0.04	0.04	20.90	21.20	21.05	21.05	20.98	21.13	1.32	11.10	4.68	5.70	3.00	7.89
Cs (ppb)	2.9	10.3	6.3	6.6	5.4	8.1	< 0.05	0.5	0.6	0.5	0.5	0.5	0.9	1.0	1.0	1.0	0.9	1.0	0.1	0.3	0.2	0.2	0.2	0.3
Cs_d (ppb)	3.4	10.4	6.6	6.5	5.0	7.8	0.5	0.7	0.5	0.6	0.5	0.6	0.6	0.8	0.7	0.7	0.7	0.8	0.1	0.3	0.2	0.2	0.2	0.3
Cu (ppb)	2,580	8,580	4,965	4,749	3,410	5,550	59.2	1,400	258.0	468.4	255.0	370.0	21,300	47,100	34,200	34,200	27,750	40,650	2,380	13,000	6,040	7,140	4,210	9,520
Cu_d (ppb)	1,840	7,970	4,659	4,570	2,888	5,693	12.5	1,183	32.6	256.6	14.1	40.9	20,600	24,300	22,450	22,450	21,525	23,375	2,230	14,200	5,810	7,413	4,020	10,005
Fe (ppb)	35900	170000	83900	85520	61375	101875	2620	14600	9400	8640	3580	13000	269000	466000	367500	367500	318250	416750	11100	93300	34500	46300	22800	63900
Fe_d (ppb)	25900	198000	49800	76280	37525	90225	14	1800	94	501.6	46	554	246000	254000	250000	250000	248000	252000	7780	96400	36700	46960	22240	66550
Ga (ppb)	1.60	19.90	4.80	6.55	3.55	6.30	0.20	1.00	0.70	0.64	0.60	0.70	8.60	26.70	17.65	17.65	13.13	22.18	0.50	5.20	2.10	2.60	1.30	3.65
Ga_d (ppb)	0.30	18.80	3.50	5.59	1.98	6.23	< 0.10	0.20	0.05	0.08	0.05	0.05	9.00	24.00	16.50	16.50	12.75	20.25	0.60	5.80	2.00	2.80	1.30	3.90
Ge (ppb)	0.90	4.60	2.55	2.51	2.03	2.98	< 0.10	0.50	0.40	0.33	0.30	0.40	6.30	12.10	9.20	9.20	7.75	10.65	0.70	3.40	1.50	1.87	1.10	2.45
Ge_d (ppb)	0.60	6.60	1.75	2.31	0.93	2.93	< 0.10	0.10	0.05	0.06	0.05	0.05	4.70	7.00	5.85	5.85	5.28	6.43	0.60	3.60	2.00	2.07	1.30	2.80
Hf (ppb)	< 0.10	1.00	0.05	0.23	0.05	0.20	< 0.10	0.30	0.05	0.11	0.05	0.10	< 0.10	0.10	0.08	0.08	0.06	0.09	< 0.10	< 0.10	0.05	0.05	0.05	0.05
Hf_d (ppb)	< 0.10	0.10	0.05	0.06	0.05	0.05	< 0.10	0.40	0.05	0.12	0.05	0.05	< 0.10	0.20	0.13	0.13	0.09	0.16	< 0.10	< 0.10	0.05	0.05	0.05	0.05
Hg (ppb)	< 0.01	< 0.1	0.005	0.0095	0.005	0.005	< 0.01	< 0.1	0.005	0.014	0.005	0.005	< 0.01	< 0.01	0.005	0.005	0.005	0.005	< 0.01	< 0.01	0.005	0.005	0.005	0.005
Hg_d (ppb)	< 0.01	< 0.1	0.005	0.014	0.005	0.005	< 0.01	< 0.1	0.005	0.023	0.005	0.05	< 0.01	< 0.01	0.005	0.005	0.005	0.005	< 0.01	< 0.01	0.005	0.005	0.005	0.005
In (ppb)	1.10	42.60	13.05	15.93	4.68	17.18	< 0.10	0.60	0.30	0.30	0.05	0.50	8.90	22.50	15.70	15.70	12.30	19.10	0.20	4.10	1.50	1.93	0.85	2.80
In_d (ppb)	< 0.10	40.40	11.00	14.10	2.35	15.73	< 0.10	< 0.10	0.05	0.05	0.05	0.05	8.60	21.50	15.05	15.05	11.83	18.28	0.20	4.30	1.60	2.03	0.90	2.95
K (ppb)	272	1970	1415	1426.2	1325	1732.5	1100	1730	1610	1458	1170	1680	2070	2920	2495	2495	2282.5	2707.5	1600	1920	1860	1793.333	1730	1890
K_d (ppb)	627	2051	1285	1360.5	1042	1737.5	1200	4500	1640	2114	1480	1750	986	2700	1843	1843	1414.5	2271.5	1320	2080	1700	1700	1510	1890
Li (ppb)	24.00	61.90	34.50	37.06	29.65	43.13	13.40	24.60	22.00	20.00	15.60	24.40	25.30	45.30	35.30</									

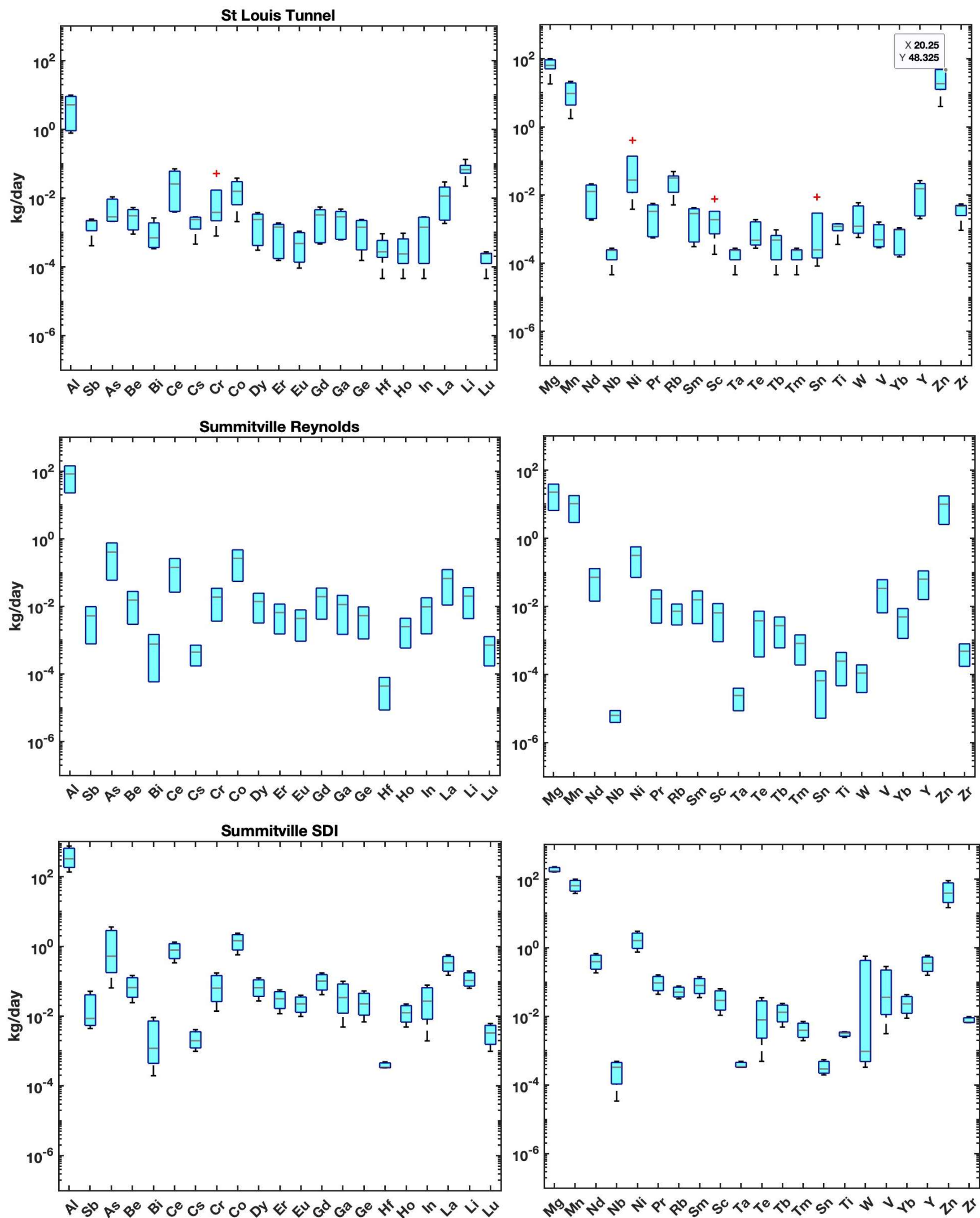
APPENDIX E



Appendix E – Box and whisker plots for critical mineral loads at each site. Ranges include all measurements collected over the 2-year sampling period. One-half of the reporting limit was plotted for results reported below the reporting limit.



Appendix E (cont.) – Box and whisker plots for critical mineral loads at each site. Ranges include all measurements collected over the 2-year sampling period. One-half of the reporting limit was plotted for results reported below the reporting limit.



Appendix E (cont.) – Box and whisker plots for critical mineral loads at each site. Ranges include all measurements collected over the 2-year sampling period. One-half of the reporting limit was plotted for results reported below the reporting limit.