



Weston Solutions, Inc.
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March 26, 2018

Mr. Craig Myers
On-Scene Coordinator
United States Environmental Protection Agency, Region 8
1595 Wynkoop Street
Denver, CO 80202

Re: Commodore Level 5 – Site Walk and Initial Water Sampling
Creede, Mineral County, Colorado
TDD: 0001/1803-03
DCN: W0578.1A.01583
WO#: 20408.012.001.0578.00

Dear Mr. Myers:

The United States Environmental Protection Agency (EPA) tasked the Weston Solutions, Inc., (WESTON®) Superfund Technical Assessment and Response Team (START), under Technical Direction Document (TDD) 0001/1803-03 to support the EPA's Removal Program at the Commodore Level 5 (Commodore) site, located near Creede, Mineral County, Colorado (Site, **Figures 1-2**). The purpose of this report is to document the initial START site walk observations, water sampling, and conceptual details from the site debriefing meeting. The site walk was conducted January 30th to 31st, 2018. A photographic log of the site walk is included as **Attachment A**.

SITE DESCRIPTION AND BACKGROUND

The mining history of the Creede area dates back to the 1860s and many different workings have been mined for silver and other mineral resources. The Commodore is part of a greater series of mine workings located approximately 1 mile north of Creede, Colorado. These workings have gone into disrepair as mining operations have ceased since the 1970s. Many tunnels have timber dry rot, roof fall, collapses, and other signs of disrepair. The lower level of these workings is the Nelson-Wooster-Humphries Tunnel (Nelson Tunnel) that acts as a drainage route keeping the upper workings from having active water discharges. The Nelson Tunnel and the Commodore are connected in several locations, for the focus of this project the connections include [from outby (closer to the portal) to inby (further from the portal)] the Bachelor Shaft, Daylight Winze, Commodore Shaft, No Name/Y02 Winze, Del Monte Raise, and the Berkshire Shaft (See **Attachment B Figures** for in-mine locations).

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The Nelson tunnel has three areas of collapse that are acting as unconsolidated, natural water dams creating three mine pools. These are the Upper Nelson Tunnel Mine Pool, the Lower Mine Pool, and the Nelson Tunnel Portal Mine Pool.

The largest pool is the Upper Nelson Tunnel Mine Pool; the volume of which was last estimated to be approximately 19 million gallons (EPA, 2017). The Lower Mine Pool is contained by a partial collapse allowing free flow over the top of the collapse. The resulting free flow feeds the Nelson Tunnel Portal Mine Pool that was created by a lower collapse at the portal of the Nelson Tunnel.

Discharge from the collapsed Nelson Tunnel Portal was last measured at approximately 365 gallons per minute (EPA, 2017). This flows directly into West Willow Creek, which in turn flows into the Rio Grande River approximately four miles downstream (Figure 1).

Currently, the Commodore Level 5 is acting as a relief from additional water impoundment by allowing any additional water from the Upper Nelson Tunnel Mine Pool to flow up the Del Monte Raise and into the Commodore. The flow then travels outby approximately 1,000 feet to the No Name/Y02 Winze. From there, it flows back into the Nelson Tunnel and the Lower Nelson Tunnel Mine Pool.

At the time of the site walk, no water was flowing from the Del Monte Raise in the Commodore and the water was approximately 2 feet below the floor of the Commodore at the Del Monte Raise. The Commodore mine tunnel needs to remain open to allow this flow to continue as needed to keep the impounded water volume from increasing in the Upper Nelson Tunnel Mine Pool. An increase in impounded water volume could create a greater potential for a sudden release of the Nelson Tunnel Mine Pools into West Willow Creek and the Rio Grande River.

PROJECT ACTIVITIES

The EPA tasked START with attending the initial site walk, and conducting water sampling the week of January 29, 2018. In preparation for this event, a Sampling and Analysis Plan, and Site Specific Health and Safety Plan were developed and executed for START activities. The list below is an outline of site activities that were conducted.

January 30, 2018 – EPA and START mobilize from Denver, CO to Creede, CO.

- 1300 – EPA, Colorado Division of Reclamation and Mine Safety (DRMS), Colorado Department of Public Health and Environment (CDPHE), and contractors (START,

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Emergency and Rapid Response Services (ERRS), HDR Engineering (HDR), and Deere and Ault) attended a site briefing.

- 1505 – 11 of the 13 attendees enter the Commodore Level 5 mine and conduct a site walk detailing the areas of importance to the project. Attendees included representatives from each agency and contractor, two of the three EPA representatives stayed out of the mine to act as portal attendants.
- 1815 – All 11 attendees exit the mine.
- 1835 – All attendees demobilized to Del Norte for discussion of following day activities.

January 31, 2018 – 0800 – All attendees mobilized from Del Norte to the Site.

- 0930 – 6 attendees enter the mine to:
 - DRMS – Lead entry and provide background information on mine conditions.
 - Deere and Ault/HDR – Provide detailed observation of conditions for design considerations.
 - CDPHE – Assist with observations.
 - START – Provide general observations and collect samples from accessible mine waters.
 - ERRS – Attend site walk to assist with construction subcontractor procurement planning.
- 1415 – START and ERRS exit the mine.
- 1500 – Remainder of attendees exit the mine.
- 1520 – All attendees demobilize to Del Norte for post site walk meeting.
- 1630 – All attendees meet to discuss path forward and details/concerns for the Site.
- 1830 – Meeting concluded.

February 1, 2018 – EPA and START demobilize to Denver.

WATER SAMPLING

Water sampling was conducted on January 31, 2018. The samples were submitted for laboratory analysis of total and dissolved target analyte list (TAL) metals, Chloride, Sulfate, Alkalinity, and pH. Grab samples were collected into 1 liter High Density Polyethylene (HDPE) bottles. Samples were then taken from the in-mine location to the portal area where they were field filtered (dissolved metals), preserved with nitric acid (total and dissolved metals), and placed into laboratory supplied sampling containers and placed on ice until shipped to the laboratory. The samples were shipped via FedEx to ESC Lab Sciences (ESC) located in Mount Juliet, TN. Descriptions of the samples are provided below.

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Sample ID	Description	Reasoning for Sampling
CM-GW-44R-20180131-01	44 Raise – Undisturbed	Water retained behind the roof fall at the 44 Raise, this sample was taken prior to entry to represent settled water conditions.
CM-GW-44R-20180131-02	44 Raise – Disturbed	Water retained behind the roof fall at the 44 Raise, this sample was taken immediately after group had passed through the water, stirring up precipitates to represent water conditions if water were to be disturbed/ drained.
CM-GW-UNT-20180131	Upper Nelson Tunnel Mine Pool (UNT)	Water collected from the Del Monte Raise, this water is from the Upper Nelson Tunnel Mine Pool. This gives representation of the settled water in the upper mine pool.
CM-GW-UNT-20180131a	UNT - Duplicate	Duplicate of Upper Nelson Tunnel Mine Pool for quality control.
CM-ME-NT-20180131a	Nelson Tunnel Effluent	Water discharged from the Nelson Tunnel into West Willow Creek. This water shows the impact of current conditions at the Site. Triple volume collected for Matrix Spike/Matrix Spike Duplicate (MS/MSD).
CM-FB-01	Field Blank	Quality control sample. Deionized water.

Analytical Results

The samples submitted to the laboratory show detections for a majority of the Target Analyte List (TAL) metals, both total and dissolved. Metals of typical concern for mine impacted waters detected include: arsenic, cadmium, lead, manganese, mercury, and zinc. Chloride levels ranged from 1060 to 1580 µg/l. Sulfate levels ranged from 404 to 922 mg/l. Due to the acidic nature of the water, alkalinity was non-detect for all samples and pH ranged from 3.48 to 4.08 SU. For a complete summary of all analytes see the attached **Table 1**. Complete laboratory reports are included as **Attachment C**.

SITE OBSERVATIONS AND SITE WALK CONCLUSIONS

As noted in the site description and background, the Commodore Level 5 provides pressure relief for the Nelson Tunnel Mine Pools. To maintain this condition there are several items to consider, starting outside the mine and working inby.

- Outside the mine there are historic structures that remain in place as part of the local history and tourist economy. These are located north of the Commodore Level 5 Portal along West Willow Creek, and consist primarily of wooden cabins. See the photographic log included as **Attachment A** for images of these buildings.

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- A river crossing would need to be created to allow equipment staging and access. This could consist of a series of culverts or a bridge designed to handle heavy equipment.
- A new flume installed downstream of the Nelson Tunnel portal area, not impacting the portal area, would allow continued monitoring of the flowrate and a fixed point for monitoring water chemistry discharging from the Nelson Tunnel.
- The initial portion of the Commodore appears to need minimal rehabilitation outside of some minor tunnel maintenance including rock scaling, track and tie replacement, securing the portal and reconstructing competent air doors. There is one area that is widened that could be used to store scaled rock or in-mine supplies. At the intersection with the Bachelor Shaft tunnel (approximately 2,100 feet inby) there is a larger area that has multiple stopes that will need to be secured to minimize rock fall and improve ventilation.
- Along the Bachelor Shaft tunnel, some maintenance may be needed and the shaft itself needs to be maintained to allow observation of the Nelson Tunnel inby the collapsed portal. This could be accomplished with new platforms and ladders to allow safe ingress and egress to the observation tunnels connected to the Nelson Tunnel.
- Back at the Commodore tunnel, past the Bachelor Shaft intersection, the Daylight Winze (approximately 2,200 feet inby) has dry rotting timbers, ladders, and platforms. In addition to replacing these failing features the Winze itself may need reinforcement to ensure it stays open to allow water to flow down from the Commodore into the Nelson Tunnel.
- *Note: The area from the portal to the point just past the Daylight Winze is critical to ensuring access to the Nelson Tunnel, and preventing any discharge from the Commodore.*
- Once past the Daylight Winze there are areas that will need rock scaling, timber/steel sets, stope/raise protection, track maintenance, and widening to allow equipment through. The next feature in the tunnel is the blacksmith shop area that could be used to stage scaled rock, removed timber/steel sets, or construction materials.
- Continuing inby, there are a couple side passages that may be useful for staging. At the Commodore shaft area, there is a large room for additional staging.
- Shortly beyond the Commodore shaft area (approximately 4,000 feet inby), is the 44 Raise and an area of retained water. Approximately 15,000 gallons of water (estimate provided by EPA personnel during this site walk) is being retained by active roof fall. The pooled

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water will need to be drained to allow for rehabilitation further inby. During the planning meeting a potential remedy was discussed by the EPA and DRMS that would prevent any additional discharge to West Willow Creek. This plan consists of installing a temporary coffer dam (i.e. sandbag wall) at the Daylight Winze, followed by removing the roof fall material at the 44 Raise. This would allow the stored water to flow outby to the Daylight Winze, and down back into the Nelson Tunnel. This would prevent any external discharge, and allow the mine impacted water to settle out in the Nelson Tunnel Portal Mine Pool. From there it would be discharged through the current Nelson Tunnel discharge path.

- Additionally at the 44 Raise, the active roof fall area will need to be stabilized to prevent additional pooling of water.
- Beyond the 44 Raise are additional areas that will require scaling, timber/steel sets, track and tie maintenance, and roof fall material clean up. These areas include multiple stopes, an area where an upwelling was observed, decaying timber/steel sets, encroaching hanging walls, and track/tie decay.
- At approximately 4,700 feet inby, the No Name/Y02 Winze is encountered. This winze will need to have the ladders and platforms replaced, and the winze secured to maintain access to the Nelson Tunnel.
- *Note: From the Y02/No Name Winze to the Del Monte Raise is the second critical area.*
- The tunnel from the Y02/No Name to the Del Monte Raise allows for water to be released from the Upper Nelson Tunnel Mine Pool through the Del Monte Raise, and returned to the Nelson Tunnel Lower Mine Pool through the No Name Winze. This section goes through an area referred to as a heavy squeeze zone. This area of ground is unstable and will require additional stabilization to ensure the tunnel remains open. Beyond this area is the Del Monte Raise, and the furthest inby point of this Project (approximately 5,750 feet inby).

General Observations

- The Commodore mine tunnel system is deteriorating. This is apparent from the newly sluffed material, dry rotting timbers, decaying ladders and track disrepair. This is also confirmed by Willow Creek Reclamation Committee and DRMS in-mine activities conducted from 2000 to 2008 (EPA, 2017). DRMS utilized the rail system to move equipment back to the Del Monte Raise and beyond during this work (field discussions with DRMS during

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this site walk). As shown in the photo log (pooled water, rotted timbers, roof fall, etc.) it is apparent that the track system could not be used that way today without significant maintenance.

- For safety reasons, in-tunnel work must be performed sequentially from the portal inby to each feature. For example rehabilitation work cannot begin on the No Name Winze until the tunnel has been rehabilitated from the portal to the No Name Winze. This creates a schedule constraint because multiple construction areas cannot be worked concurrently. Due to the limited construction season in this remote mountain area, this may limit the scope of work to be completed in a single season. One potential work-around for this constraint is to conduct multiple working shifts per day.
- None of the observations or potential actions in this report require accessing or investigating the Nelson Tunnel directly.

The observations identified in this report are items noted by START during the site walk, and all potential actions included above were items of discussion by site walk attendees (EPA, DRMS, CDPHE, and EPA contractors/subcontractors [START, ERRS, HDR, and Deere and Ault]). Further analysis and design prior to implementation will be required.

HDR has been tasked by the EPA to prepare an in-depth report on current in-mine conditions and conceptual remedies. EPA requested DRMS to provide a report detailing observations and recommendations by their department as well.

If there are any questions or comments regarding this report, please do not hesitate to contact me at 303-729-6156 or elliott.petri@westonsolutions.com. Should I be unavailable to respond, please contact Robert Reed Jr. (Task Order Manager) at 303-729-6113.

Very truly yours,

WESTON SOLUTIONS, INC.

A handwritten signature in blue ink, appearing to read "Elliott Petri", is written over a horizontal line.

Elliott Petri, P.E.

START Project Team Leader

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References

Nelson Tunnel/CWRP Superfund Site Interim Action for OU2 – Proposed Plan for Public
Comment. (EPA, 2017)

Attachments:

Table 1	Water Sampling Analytical Results Table
Figure 1	Site Location Map
Figure 2	Site Vicinity Maps
Attachment A	Photographic Log
Attachment B	Deere and Ault Technical Memorandum: <i>Commodore 5 Tunnel Rehabilitation Concept; Creede, Colorado</i> . December 13, 2017
Attachment C	Analytical Laboratory Report

cc: Robert Reed Jr. Task Order Manager
START DCN File: W0578.1A.01583

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Tables

Table 1: Water Sampling Analytical Results Table

Water Sampling Analytical Results Table

Validated Data						
	CM-ME-NT-20180131	CM-GW-44R-20180131-01	CM-GW-44R-20180131-02	CM-GW-NTU-20180131	CM-GW-NTU-20180131A	CM-FB-01-20180131
	Nelson Tunnel Effluent	Retained Water - Undisturbed	Retained Water - Disturbed	Upper Mine Pool	Upper Mine Pool Duplicate	Field Blank
Total Metals (ug/L)						
Aluminum	407	7180	7820	9120	9170	13.7 U
Antimony	0.754 U	0.82 J	14	0.774 J	0.754 U	0.754 U
Arsenic	8.06	5.94	101	2.29 J+	3.44	0.51 J
Barium	14.9	17.5	297	6.59	8.42	0.36 U
Beryllium	3.62 J+	6.29	6.35	3.81	3.9	0.12 U
Cadmium	113	1360	1400	703	705	0.16 U
Calcium	192000	46300	46500	147000	146000	46 U
Chromium	0.54 U	0.597 J	1.45 J	0.54 U	0.54 U	0.54 U
Cobalt	31.9	78.5	77.8	137	139	0.26 U
Copper	24.4	2350	2570	1080	1100	0.927 J
Iron	2910	15100	22500	861 J	1200 J	15 U
Lead	1260	2020	3760	1420	1450	0.959 U
Magnesium	12600	8530	8530	21300	21000	100 U
Manganese	14600	12600	11800	70100	66600	3.88 U
Mercury	0.049 U	0.16 J	2.1	0.049 U	0.0502 J	0.049 U
Nickel	12.6	31.5	31.5	66.2	64.1	0.379 J
Potassium	4890	16400	16700	11000	10800	37 U
Selenium	2.83 J+	0.851 J	1.35 J	2.04	1.72 J	0.38 U
Silver	0.31 U	5.9	58.6	1.59 J	1.81 J	0.31 U
Sodium	53100	22600	22400	54500	52900	295 J
Thallium	3.38 J+	11.9	12.9	14.1	14.5	0.19 U
Vanadium	0.18 U	0.762 U	4.6 J	0.18 U	0.18 U	0.18 U
Zinc	47600	103000	104000	218000	213000	28.9
Dissolved Metals (ug/L)						
Aluminum,Dissolved	415	7140	7310	9270	9060	16.2 J
Antimony,Dissolved	0.754 U	0.754 U	0.758 J	0.754 U	0.754 U	0.754 U
Arsenic,Dissolved	8.52	4.14	4.77	1.79 U	1.45 U	0.495 J
Barium,Dissolved	15	14.7	15.8	6.82	6.96	0.73 J
Beryllium,Dissolved	3.76	6.64	6.97	4.15	4.13	0.12 U
Cadmium,Dissolved	115	1360	1370	704	705	0.16 U
Calcium,Dissolved	191000	46100	46600	148000	148000	46 U
Chromium,Dissolved	0.54 U	0.54 U	0.54 U	0.54 U	0.54 U	0.54 U
Cobalt,Dissolved	33.2	78.8	79.4	142	140	0.26 U
Copper,Dissolved	24.4	1940	1990	1090	1070	2.62 J
Iron,Dissolved	3100	15300	14800	673	659	15 U
Lead,Dissolved	1310 J-	2000 J-	2220 J-	1460 J-	1450 J-	2.28
Magnesium,Dissolved	12900	8970	9000	22600	22200	100 U
Manganese,Dissolved	15100	10800	10400	67600	67400	36.8
Mercury,Dissolved	0.049 U	0.059 J	0.0577 J	0.049 U	0.049 U	0.049 U
Nickel,Dissolved	12.9	31.1	31.2	67.3	67.1	0.35 U
Potassium,Dissolved	5110	16400	16400	11400	11200	37 U
Selenium,Dissolved	2.79	2.57	2.66	5.7	5.1	0.38 U
Silver,Dissolved	0.386 J	1.42 J	0.324 J	0.821 J	0.859 J	0.31 U
Sodium,Dissolved	53100	22700	22600	51500	50300	110 U
Thallium,Dissolved	3.44	12.4	12.6	15	15.2	0.19 U
Vanadium,Dissolved	0.18 U	0.18 U	0.18 U	0.18 U	0.18 U	0.18 U
Zinc,Dissolved	47800	110000	119000	229000	228000	183
Anions (ug/L)						
Chloride	1060	1400	1580	1410	1390	201 J
Sulfate	617000	409000	404000	908000	922000	77.4 U
pH (su) / Alkalinity (ug/L)						
pH	4.08 T8	3.64 T8	3.63 T8	3.48 T8	3.48 T8	5.12 T8
Alkalinity	2710 U	2710 U	2710 U	2710 U	2710 U	2710 U

Notes:

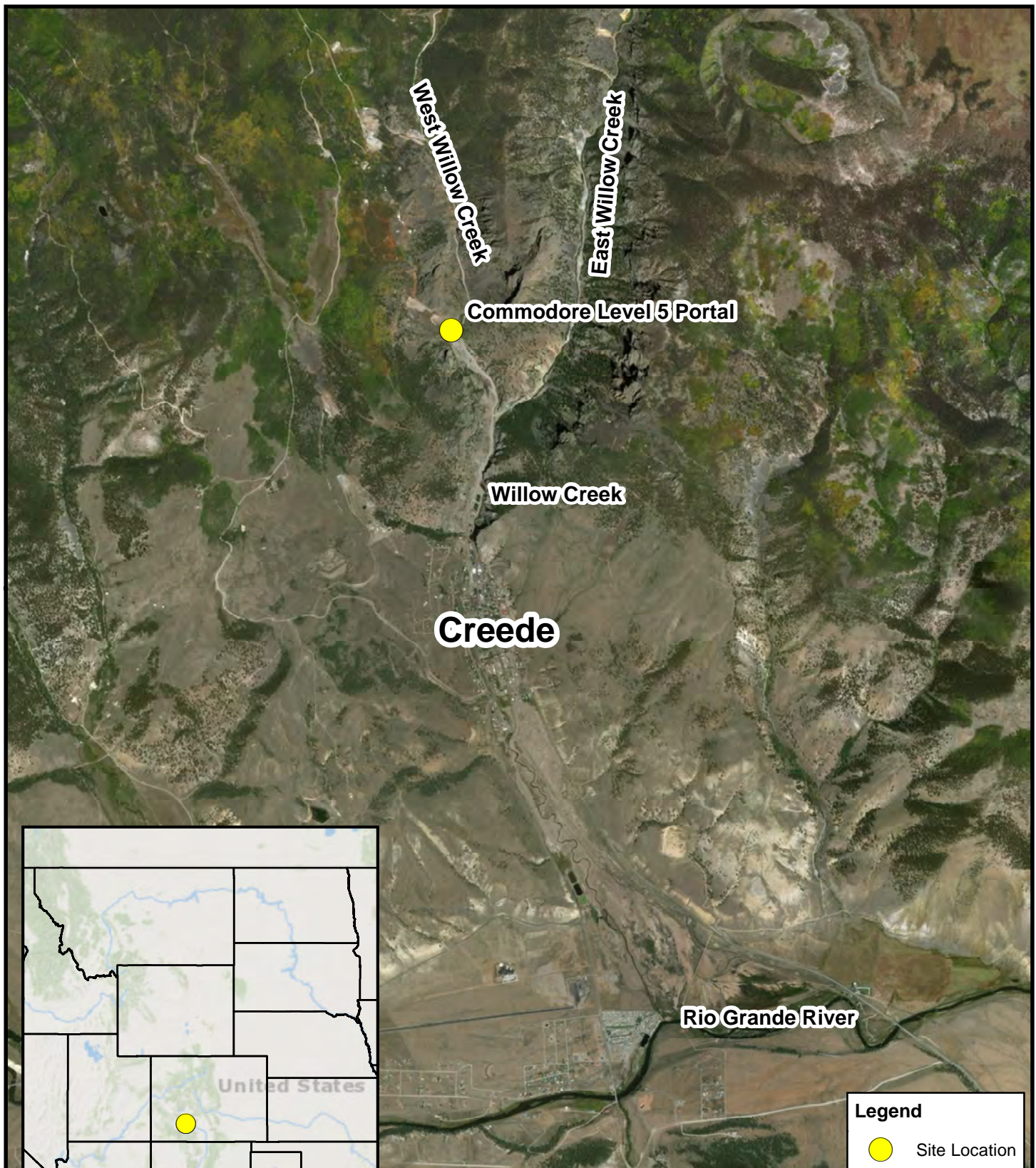
Lab Qualifiers:	B - The same analyte is found in the associated blank. J - The identification of the analyte is acceptable; the reported value is an estimate. T8 - Sample(s) received past/too close to holding time expiration. U - Analyte is undetected. V - The sample concentration is too high to evaluate accurate spike recoveries.
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su: Standard Unit
ug/L: micrograms/liter

Figures

Figure 1: Site Location map

Figure 2: Site Vicinity Map



Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
 Projection: Mercator Auxiliary Sphere
 Datum: WGS 1984

Source:

Site Boundary: Georeferenced Aerial (Google Earth 2017)
 Background: ESRI USA Topo Maps (2017)

0 0.45 0.9 1.8 Miles



Prepared for:
 U.S. EPA - Region 8

Contract: EP-S8-13-01
 TO/TDD: 0001/1801-01

Prepared By:
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FIGURE 1
SITE LOCATION MAP
COMMODORE LEVEL 5 PORTAL
CREEDE
MINERAL COUNTY,
COLORADO

Date: 2/14/2018



Coordinate System: WGS 1984 Web Mercator Auxiliary Sphere
 Projection: Mercator Auxiliary Sphere
 Datum: WGS 1984

Source:
 Site Boundary: Georeferenced Aerial (Google Earth 2017)
 Background: ESRI USA Topo Maps (2017)

0 0.0125 0.025 0.05 Miles



Prepared for:
 U.S. EPA - Region 8



Contract: EP-S8-13-01
 TO/TDD: 0001/1801-01

Prepared By:
 Weston Solutions, Inc.
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FIGURE 2
SITE VICINITY MAP
COMMODORE LEVEL 5 PORTAL
CREEDE
MINERAL COUNTY,
COLORADO

Date: 1/24/2018

Attachment A

Photographic Log

Project Name: Commodore Level 5: January 2018 Site Walk	Site Location: Creede, Mineral County, Colorado	Project No. TDD 0001/1801-01
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Photo No. 1	Date: 01/30/2018
Photo Coordinates	
Lat	--
Long	--
Direction Photo Taken: East	
Description: Commodore Level 5 Portal, the Nelson Tunnel Collapsed. Portal is off to the left of the photo.	



Photo No. 2	Date: 01/30/2018
Photo Coordinates	
Lat	--
Long	--
Direction Photo Taken: East	
Description: Lower portion of the Commodore Level 5 Waste Dump, Nelson Tunnel Collapsed Portal is in the center of the photo at the base of the slope. Note flow from collapsed portal.	



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Photo No. 3	Date: 01/31/2018
Photo Coordinates	
Lat	--
Long	--
Direction Photo Taken: East	
Description: Nelson Tunnel Collapsed Portal. Note flow through the collapse.	



Photo No. 4	Date: 01/30/2018
Photo Coordinates	
Lat	--
Long	--
Direction Photo Taken: North	
Description: Historic buildings to the north of the Commodore Level 5 portal. Note access bridge across West Willow Creek.	



Project Name:
Commodore Level 5: January 2018 Site Walk

Site Location:
Creede, Mineral County, Colorado

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Photo No. 5	Date: 01/30/2018
Photo Coordinates	
Lat	--
Long	--
Direction Photo Taken: East	
Description: Site walk entry led by DRMS, EPA, CDPHE, HDR, START, ERRS, and Deere and Ault in attendance.	



Photo No. 6	Date: 01/30/2018
Photo Coordinates	
Lat	--
Long	--
Direction Photo Taken: East	
Description: Tunnel floor conditions. Minor roof sluff, track rusted but operable, timbers need some replacement.	



Project Name: Commodore Level 5: January 2018 Site Walk	Site Location: Creede, Mineral County, Colorado	Project No. TDD 0001/1801-01
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Photo No. 7	Date: 01/30/2018	
Photo Coordinates		
Lat	--	
Long	--	
Direction Photo Taken: East		
Description: Initial tunnel length is a straight run from the portal to ~2200 feet inby to "Daylight Corner".		

Photo No. 8	Date: 01/30/2018	
Photo Coordinates		
Lat	--	
Long	--	
Direction Photo Taken: South		
Description: Bachelor Shaft off the first intersection. First access to the Nelson tunnel. To access the Nelson tunnel, descend this ladder then travel eastward approximately 50 to 100 feet to see the Nelson tunnel. This is the access point closest to the Nelson Tunnel portal collapse.		

Photo Credit: Deere and Ault: January 30, 2018

Project Name: Commodore Level 5: January 2018 Site Walk	Site Location: Creede, Mineral County, Colorado	Project No. TDD 0001/1801-01
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Photo No. 9	Date: 01/30/2018
Photo Coordinates	
Lat	--
Long	--
Direction Photo Taken: East	
Description: Daylight Winze. Furthest outby connection to Nelson tunnel. Timbers are dry rotted, and the ladder is dry rotted. Will need replacement to access further inby.	



Photo No. 10	Date: 01/30/2018
Photo Coordinates	
Lat	--
Long	--
Direction Photo Taken: Down	
Description: Looking through timber crossing into Daylight Winze.	



Project Name:
Commodore Level 5: January 2018 Site Walk

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Creede, Mineral County, Colorado

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Photo No. 11	Date: 01/30/2018
Photo Coordinates	
Lat	--
Long	--
Direction Photo Taken: Northeast	
Description: Steel sets beyond Daylight Winze. Note sets on the right are beginning to show signs of delamination.	



Photo No. 12	Date: 01/30/2018
Photo Coordinates	
Lat	--
Long	--
Direction Photo Taken: Up	
Description: Looking up a stope from the Commodore Level 5. These are areas that can begin to collapse or drop large rocks into the tunnel.	



Project Name:
Commodore Level 5: January 2018 Site Walk

Site Location:
Creede, Mineral County, Colorado

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Photo No. 13	Date: 01/30/2018
Photo Coordinates	
Lat	--
Long	--
Direction Photo Taken: Northeast	
Description: Roof fall material in the tunnel. DRMS noted that this is fresh material since the last entry in November 2017.	



Photo No. 14	Date: 01/30/2018
Photo Coordinates	
Lat	--
Long	--
Direction Photo Taken: Southeast	
Description: Looking back at fresh roof fall material. Note small amount of water retained behind roof fall.	



Project Name: Commodore Level 5: January 2018 Site Walk	Site Location: Creede, Mineral County, Colorado	Project No. TDD 0001/1801-01
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Photo No. 15	Date: 01/30/2018	
Photo Coordinates		
Lat	--	
Long	--	
Direction Photo Taken: Northeast / Up		
Description: Stope timbers that have fallen and large rocks that are in position to fall.		

Photo No. 16	Date: 01/31/2018	
Photo Coordinates		
Lat	--	
Long	--	
Direction Photo Taken: North		
Description: Commodore Shaft access and hoist room. Commodore Shaft is visible in the tunnel on the right side of the tunnel. Inby is to the left side of the photo.		

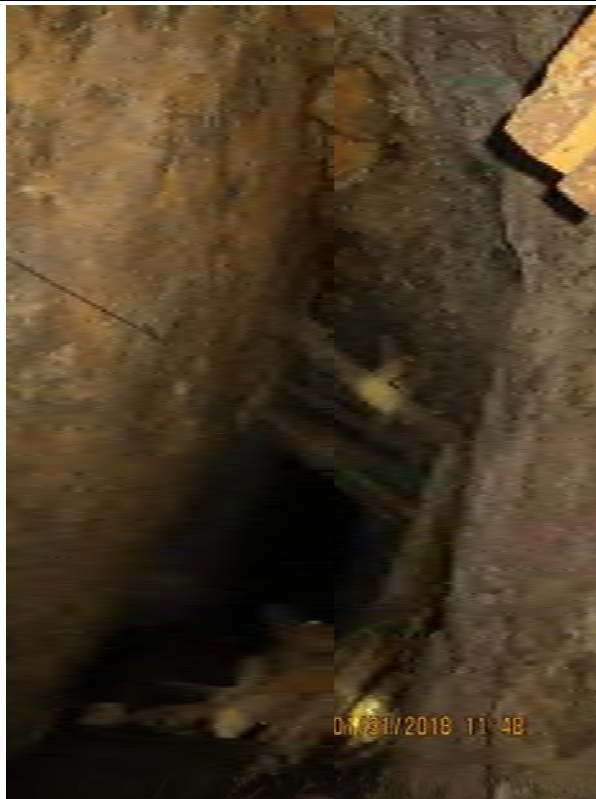
Photo Credit: Deere and Ault, January 31, 2018

Project Name: Commodore Level 5: January 2018 Site Walk	Site Location: Creede, Mineral County, Colorado	Project No. TDD 0001/1801-01
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Photo No. 17	Date: 01/30/2018
Photo Coordinates	
Lat	--
Long	--
Direction Photo Taken: Northeast	
Description: In tunnel roof fall at the 44 Raise. This fall is acting as a coffer dam and is holding back water. If this were be removed the water would flow outby to the Daylight Winze, and back into the Nelson Tunnel.	



Photo No. 18	Date: 01/30/2018
Photo Coordinates	
Lat	--
Long	--
Direction Photo Taken: Up	
Description: Looking up the 44 Raise.	



Project Name:
Commodore Level 5: January 2018 Site Walk

Site Location:
Creede, Mineral County, Colorado

Project No.
TDD 0001/1801-01

Photo No. 19	Date: 01/31/2018
Photo Coordinates	
Lat	--
Long	--
Direction Photo Taken: Southeast	
Description: Looking outby at the roof fall at the 44 Raise. Note the water built up behind the roof fall.	



Photo No. 20	Date: 01/30/2018
Photo Coordinates	
Lat	--
Long	--
Direction Photo Taken: Southeast	
Description: Area inby the 44 Raise where stope timbers and roof fall have occurred.	



Project Name: Commodore Level 5: January 2018 Site Walk	Site Location: Creede, Mineral County, Colorado	Project No. TDD 0001/1801-01
---	---	--



Photo No. 21	Date: 01/30/2018
Photo Coordinates	
Lat	--
Long	--
Direction Photo Taken: East	
Description: Looking at the No Name / Y02 Winze. This is the second connection to the Nelson Tunnel directly on the Commodore Level 5 tunnel. This would allow access to the Middle mine pool if ladders and platforms were replaced.	



Photo No. 22	Date: 01/31/2018
Photo Coordinates	
Lat	--
Long	--
Direction Photo Taken: Down	
Description: Looking through the grate at the No Name / Y02 Winze.	



Project Name: Commodore Level 5: January 2018 Site Walk	Site Location: Creede, Mineral County, Colorado	Project No. TDD 0001/1801-01
---	---	--

Photo No. 23	Date: 01/31/2018	
Photo Coordinates		
Lat	--	
Long	--	
Direction Photo Taken: Northeast		
Description: Rotting timber sets. Note the presence of white mold. For disturbance/removal of timber sets, mold speciation may be a consideration.		
Photo No. 24	Date: 01/31/2018	
Photo Coordinates		
Lat	--	
Long	--	
Direction Photo Taken: Up		
Description: Looking past end of supporting steel for the timbers, extensive raise.		

Project Name:
Commodore Level 5: January 2018 Site Walk

Site Location:
Creede, Mineral County, Colorado

Project No.
TDD 0001/1801-01

Photo No. 25	Date: 01/31/2018
Photo Coordinates	
Lat	--
Long	--
Direction Photo Taken: Northwest	
Description: Dry rotted rail timbers. If the rail is to be used for rehab, portions of rail and timbers will need to be replaced and maintained.	



Photo No. 26	Date: 01/31/2018
Photo Coordinates	
Lat	--
Long	--
Direction Photo Taken: Northwest	
Description: Stressed timber and steel sets between the No Name / Y02 Winze and the Del Monte Raise.	



Project Name:
Commodore Level 5: January 2018 Site Walk

Site Location:
Creede, Mineral County, Colorado

Project No.
TDD 0001/1801-01

Photo No. 27	Date: 01/30/2018
Photo Coordinates	
Lat	--
Long	--
Direction Photo Taken: Southeast	
Description: Stressed timber and steel sets between the No Name / Y02 Winze and the Del Monte Raise. Same as photo 26, looking outby as opposed to inby.	



Photo No. 28	Date: 01/30/2018
Photo Coordinates	
Lat	--
Long	--
Direction Photo Taken: North	
Description: The Del Monte Raise. Note water level is approximately 2 feet below the collar of the raise / floor of the tunnel.	



Project Name: Commodore Level 5: January 2018 Site Walk	Site Location: Creede, Mineral County, Colorado	Project No. TDD 0001/1801-01
---	---	--

Photo No. 29	Date: 01/30/2018
Photo Coordinates	
Lat	--
Long	--
Direction Photo Taken: Northwest	
Description: Inby the Del Monte Raise at the inby side of the mechanical room (approximately 7000 feet inby). An air door is installed denoting a Civil Defense field hospital/ refuge area.	



Photo Credit: Deere and Ault; January 30, 2018

Photo No. 30	Date: 01/30/2018	
Photo Coordinates		
Lat	--	
Long	--	
Direction Photo Taken: Northwest		
Description: Berkshire shaft area. Previous DRMS efforts pumped water from the Del Monte Raise to the Berkshire shaft. This area is inby the area of concern, but may need to be accessed pending future plans.		

Attachment B

**Deere and Ault Technical Memorandum: *Commodore 5 Tunnel Rehabilitation Concept;*
*Creede, Colorado. December 13, 2017***

MEMORANDUM

TO: Joe Shields P.E., HDR
Joy Jenkins Ph.D., P.E, US EPA

FROM: Christoph Goss, Ph.D., P.E.

DATE: December 13, 2017

RE: Commodore 5 Tunnel Rehabilitation Concept; Creede, Colorado;
D&A Job No. CG-0547.002.00

This memorandum is in response to your request of November 29, 2017 to briefly describe a rehabilitation concept for the Commodore 5 Tunnel near Creede, Colorado which could be implemented as a time critical removal action (TCRA). This rehabilitation would complement the implementation of Alternative 4 in the report: *Focused Feasibility Study for Flow Control; Nelson Tunnel/Commodore Waste Rock Pile NPL Site* by HDR and Deere & Ault Consultants Inc. dated March 27, 2017. The goal of this rehabilitation would be to maintain access to the Del Monte Shaft, secure the ground to keep material from impounding water in the Commodore 5, and maintain access to the Nelson Tunnel until the longer-term remediation is implemented (assumed to be within 15 years). This memo is intended to be the first step in developing plans for the rehabilitation of the Commodore 5 Tunnel as a TCRA. We understand the next step will be to conduct a site visit to refine the understanding of current conditions. Information collected from the site visit can then be used to develop more detailed plans for the TCRA.

The Nelson Tunnel is a National Priorities List (Superfund) site located in the Creede Mining District in Mineral County, Colorado (**Figure 1**). A primary feature within the Creede Mining District is the Nelson Tunnel, which was constructed to access and dewater the underground mines along the highly productive Amethyst vein and to provide a haulage route for ore from mines operating on the Amethyst vein complex (**Figures 2, 3, and 4**). The Nelson Tunnel (including the Wooster and Humphries extensions) is approximately two miles long and was constructed between 1893 and 1902. The Nelson Tunnel is the lowest tunnel constructed along the Amethyst vein system and functions as a drain for the underground workings that are connected via winzes and raises. The collapsed tunnel portal is located on the west side of West Willow Creek about one-mile north of the City of Creede.

There are three known and primary collapses within the Nelson Tunnel, forming three distinct mine pools, referred to as the Nelson Portal Pool, Lower Mine Pool, and Upper Mine Pool (**Figures 3 and 4**). Volumes of water stored behind collapses and in each of these pools are conservatively estimated by DRMS to be 1.2 million gallons (MG), 1.4 MG, and 19.5 MG, respectively.

At present, access to the Nelson Tunnel is through the Commodore 5 Tunnel, which was driven above the Nelson Tunnel to intersect the Amethyst vein complex and allow development of mines farther north. The portal of the Commodore 5 lies approximately 45 feet above and to the northeast of the Nelson Tunnel. The Nelson Tunnel was driven at varying gradients between one-half and one percent while the Commodore Level 5 was driven at a quarter percent or less, resulting in eventual junction at the Park Regent Mine (**Figure 4**). The Commodore 5 was rehabilitated by DRMS between 2002 and 2004. Some of these repairs now require maintenance or replacement.

Along with providing access to the Nelson Tunnel, the Commodore 5 serves the critical function as a water bypass or “relief valve” for the Nelson Upper mine pool. When the pool level rises above the collar of the Del Monte Raise, the water flows along the floor of the Commodore and dumps back into the Nelson at the No Name/Y02 Winze. If there were additional collapses in the Nelson Tunnel, the Commodore could serve a similar bypass function through the Daylight Winze. Hence, it is critical to keep the Commodore 5 open and accessible.

At this point, our rehabilitation concept includes the following tasks. **The rough costs are based on the March 27, 2017 report (Table C-1 attached for reference) and do NOT include overhead, profit, contingency, project management, design, construction management, health & safety, and mine rescue costs.

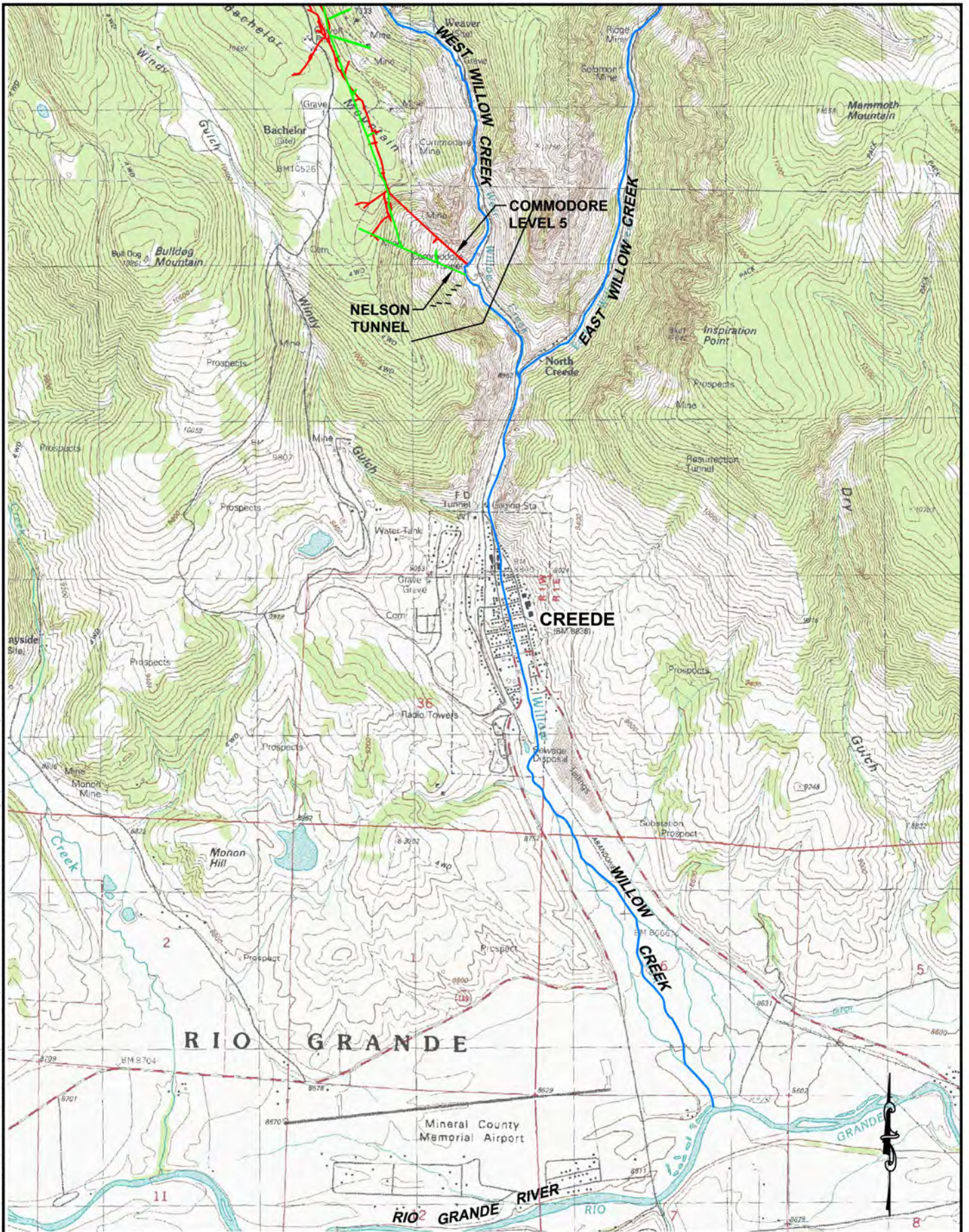
Description	Rough Cost Estimate	Expected Duration
Mobilization/Demobilization	\$140,000	1 week
Setup	\$80,000	1 week
Develop temporary equipment access across West Willow Creek	\$35,000	1 week
Muck rock fall, clean invert for drainage and construction activities	\$60,000	1 week
Check ventilation, maintain/repair air doors as needed	\$20,000	2 days
Install new DRMS security gates	\$10,000	2 days
Rehabilitate rail tracks 4000' (limited effort)	\$300,000	1 month
Replace ladders at Bachelor Shaft	\$12,000	2 days
Install walkway to Nelson flume	\$20,000	1 week
Replace flume in Nelson	\$10,000	1 day
Replace cover over openings for safety and inflow		
Daylight Winze	\$30,000	3 days
No Name/Y02 Winze	\$2,000	1 day
Del Monte Raise	\$2,000	1 day
Ground Support Portal to Daylight Winze 0+00-22+97		
Local scaling as needed	\$10,000	2 days
Ground Support Daylight Winze to Blacksmith Shop 22+97-33+18		
Local scaling as needed	\$10,000	2 days
Local spot bolting as needed	\$10,000	2 days
Replace Loose timbers with steel	\$50,000	2 days
Ground Support Blacksmith to Commodore Shaft 33+18-35+22		
Local scaling as needed	\$10,000	2 days

Local spot bolting as needed	\$10,000	2 days
Install steel sets to replace failing timbers 100'	\$100,000	10 days
Install steel sets at unstable raises	\$200,000	8 days
Ground Support Commodore Shaft to NoName 35+22-44+60		
Local scaling as needed	\$10,000	2 days
Local spot bolting as needed	\$10,000	2 days
Install steel sets to replace failing timbers 100'	\$100,000	10 days
Install steel sets and foam at unstable 44 Raise	\$200,000	8 days
Ground Support NoName to Del Monte 44+60-53+00		
Local scaling as needed	\$10,000	2 days
Local spot bolting as needed	\$10,000	2 days
Install perforated pipe on floor for bypass after collapse (900')	\$90,000	4 days
Clear debris, install/replace ladders, support connections to Nelson		
Daylight Winze	\$30,000	3 days
No Name/Y02 Winze	\$30,000	3 days
Conduct pump test from Daylight Winze	\$100,000	5 days
Total**	\$1,711,000	142

The final task of conducting a pump test from the Daylight winze would involve dropping a pump into the rehabilitated Daylight Winze and pumping it to the Bachelor shaft, returning it to the Nelson Tunnel downstream of the flume. The intent of this test would be to determine if construction dewatering could be carried out from there instead of the Bachelor shaft.

U:\0547 HDR\002 Nelson Tunnel\Rehabilitation\Commodore 5 Rehabilitation Concept.Mem.Docx

Thursday, January 26, 2017 3:59:16 PM DRAWING: U:\0547 HDR\002 Nelson Tunnel\CAD\DAC Drawings\Nelson-mine pools.DWG



DEERE & AULT
CONSULTANTS, INC.

NELSON TUNNEL

VICINITY MAP

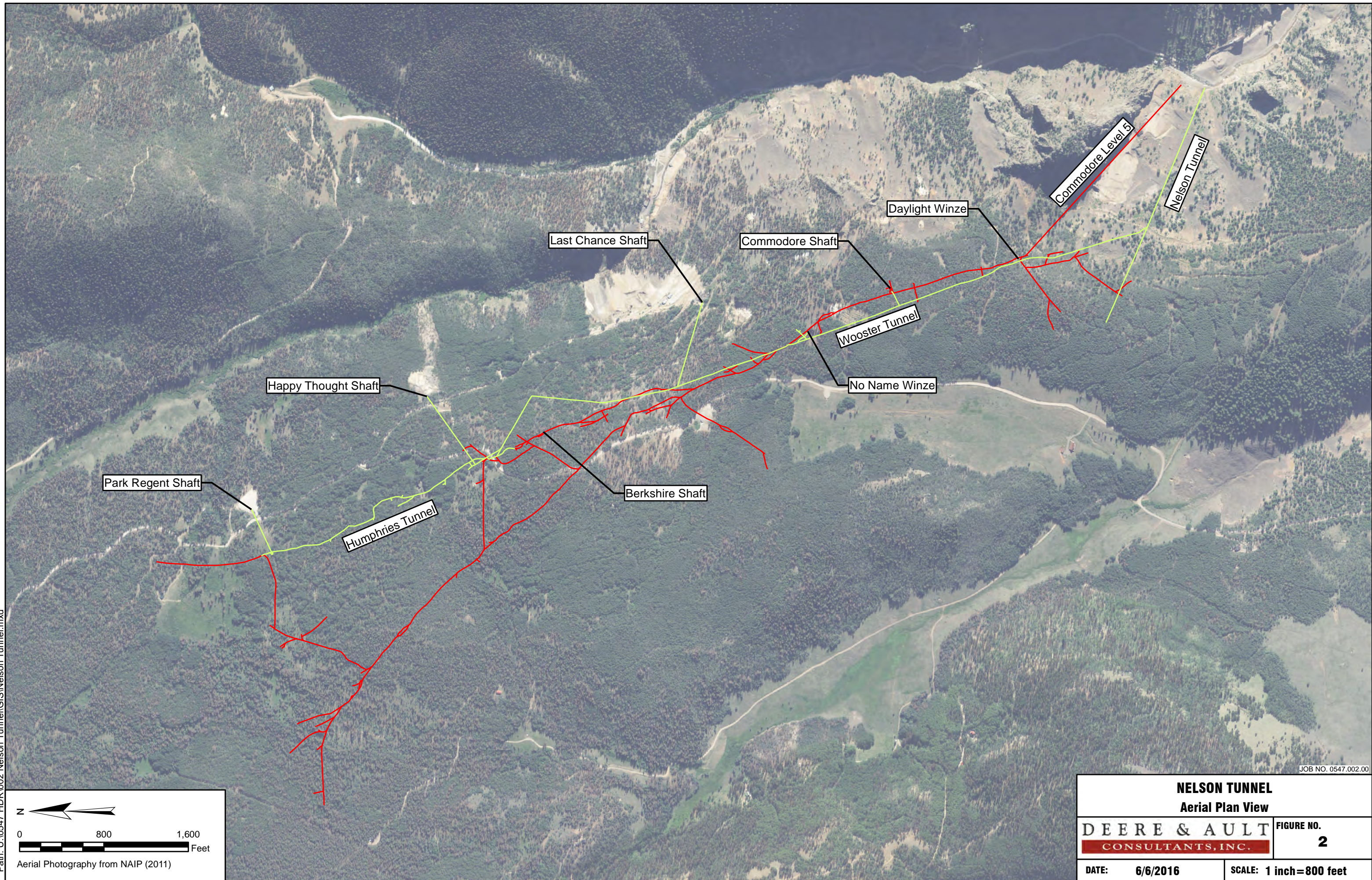
JOB NO. 0547.002.00

SCALE: None

FIGURE NO.

1

Path: U:\0547 HDR\002 Nelson Tunnel\GIS\Nelson Tunnel.mxd



JOB NO. 0547.002.00

NELSON TUNNEL

Aerial Plan View

DEERE & AULT
CONSULTANTS, INC.

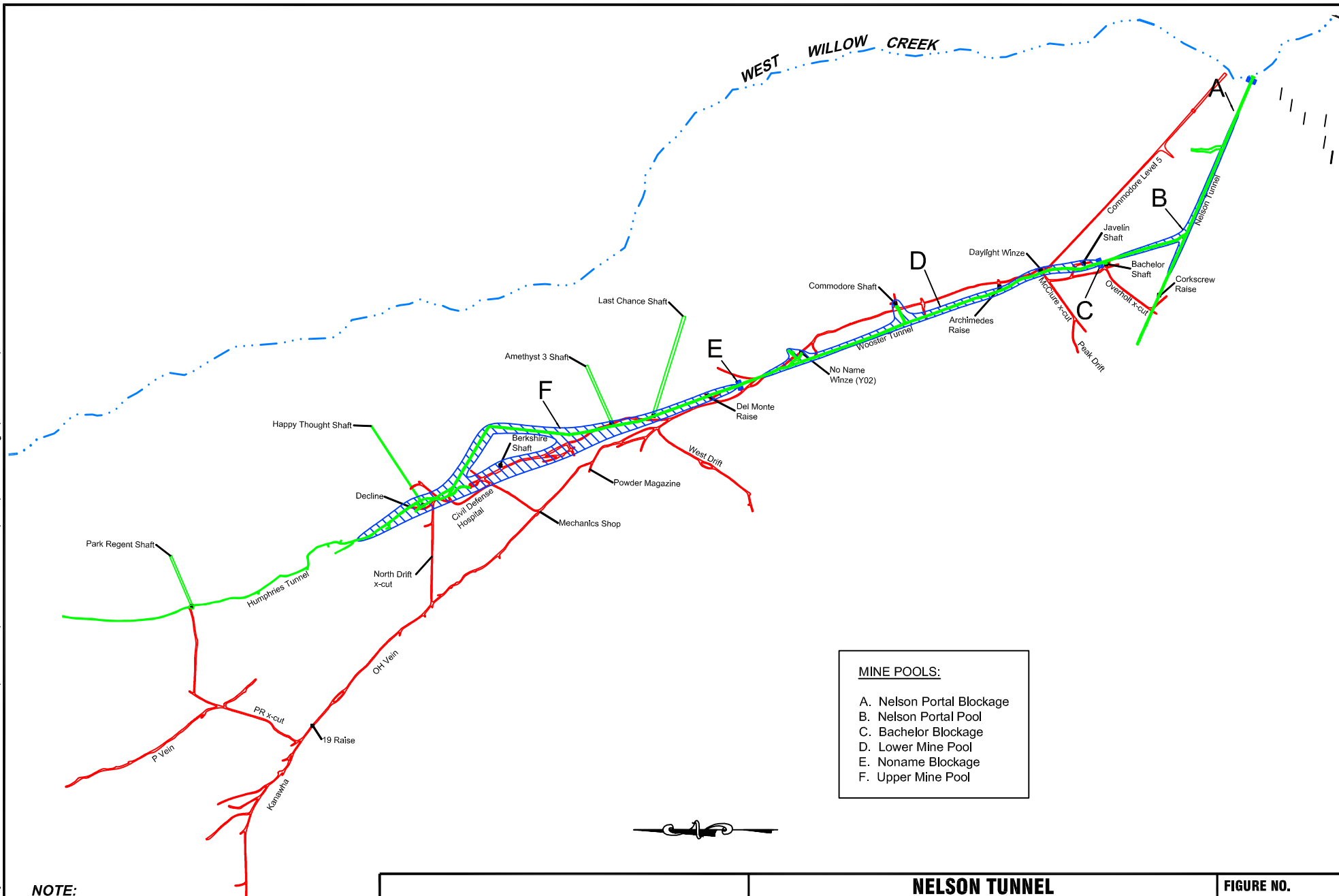
FIGURE NO.

2

DATE: 6/6/2016

SCALE: 1 inch=800 feet

Thursday, January 26, 2017 4:01:23 PM DRAWING: U:\0547 HDR\002 Nelson Tunnel\CAD Drawings\Nelson-mine pools.DWG



NOTE:
MINE MAP BY CDRMS

DEERE & AULT
CONSULTANTS, INC.

NELSON TUNNEL

MINE POOL LOCATIONS

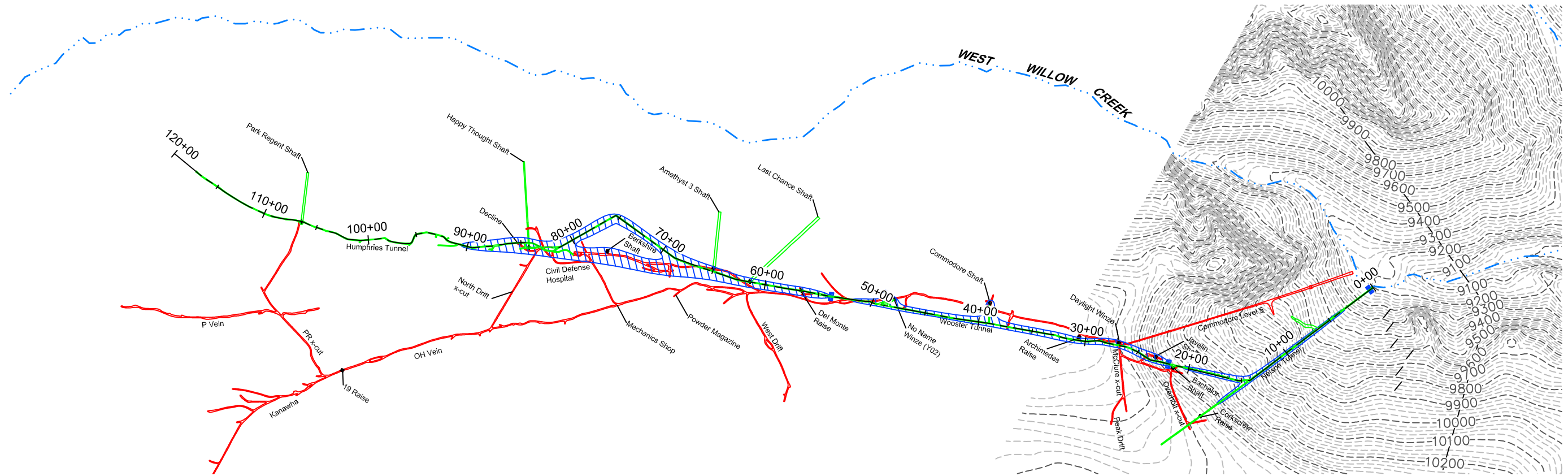
FIGURE NO.

3

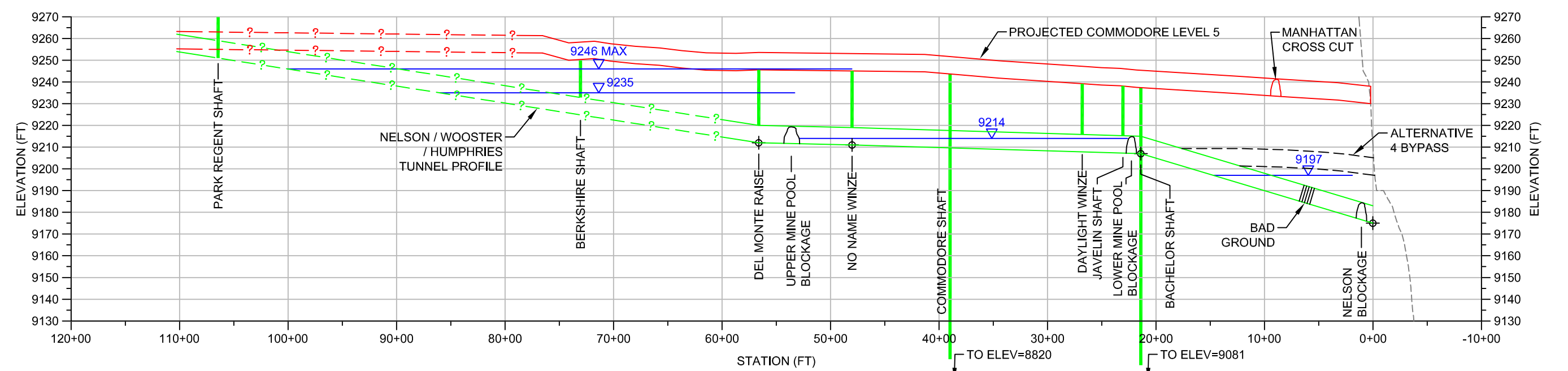
JOB NO. 0547.002.00

SCALE: None

Thursday, January 26, 2017 4:02:19 PM DRAWING: U:\0547 HDR\002 Nelson Tunnel\CAD Drawings\Nelson-mine_pools.DWG



NELSON / COMMODORE TUNNEL PLAN



NELSON / COMMODORE TUNNEL PROFILE

NOTES:

BASE MAP BY CDRMS

⊕ ELEVATION SURVEY POINTS

DOWNSTREAM OF BACHELOR SHAFT WATER FLOWS 1 TO 2 FEET DEEP

JOB NO. 0547.002.00

NELSON TUNNEL	
PLAN & PROFILE	
DEERE & AULT CONSULTANTS, INC.	FIGURE NO. 4
DATE: JANUARY 2017	SCALE: AS NOTED

Attachment C

Analytical Results Reports

MECx Validation Report

Laboratory Report



DATA VALIDATION REPORT

Commodore Level 5

SAMPLE DELIVERY GROUP: L967354

Prepared by

MEC^X
12269 East Vassar Drive
Aurora, CO 80014



I. INTRODUCTION

Task Order Title: Commodore Level 5
Contract Task Order: 20408.012.001.0562.00
Sample Delivery Group: L967354
Weston Project Manager: Elliot Petri
Project Manager: Craig Myers
TDD No.: 0001/1801-01
Matrix: water
QC Level: Stage 2A
No. of Samples: 6
No. of Reanalyses/Dilutions: 0
Laboratory: ESC Lab Sciences

Table 1. Sample Identification

<i>Sample No.</i>	<i>Lab Sample Name</i>	<i>Matrix Type</i>	<i>Collection Date</i>	<i>Method</i>
CM-FB-01-20180131	L967354-06	W	01/31/2018 15:00	2320 B-2011, 6020, 7470A, 9040C, 9056C
CM-GW-44R-20180131-01	L967354-01	W	01/31/2018 12:15	2320 B-2011, 6020, 7470A, 9040C, 9056C
CM-GW-44R-20180131-02	L967354-02	W	01/31/2018 12:20	2320 B-2011, 6020, 7470A, 9040C, 9056C
CM-GW-NTU-20180131	L967354-04	W	01/31/2018 13:30	2320 B-2011, 6020, 7470A, 9040C, 9056C
CM-GW-NTU-20180131A	L967354-05	W	01/31/2018 13:30	2320 B-2011, 6020, 7470A, 9040C, 9056C
CM-ME-NT-20180131	L967354-03	W	01/31/2018 14:20	2320 B-2011, 6020, 7470A, 9040C, 9056C



II. Sample Management

According to the Sample Receipt Forms and Chain of Custody (COC) the samples were received within the control limits of $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$, intact and properly preserved. Custody seals were present and intact. The COC was signed and dated by field and/or laboratory personnel.

The following issues with sample management were noted:

- Corrections to the COC were not initialed and dated.
- Although identified by the client as a DI water field blank, the matrix for sample CM-FB-01-20180131 was listed as groundwater on the COC.

Data Qualifier Reference Table

Qualifier	Organics	Inorganics
U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit. The associated value is the quantitation limit or the estimated detection limit for dioxins or PCB congeners.	The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit. The associated value is the sample detection limit or the quantitation limit for perchlorate only.
J	The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.	The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
J+	Not applicable	The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample, and may have a potential positive bias.
J-	Not applicable	The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample, and may have a potential negative bias.
UJ	The analyte was not deemed above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.	The material was analyzed for, but was not detected. The associated value is an estimate and may be inaccurate or imprecise.
N	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification."	Not applicable.



Qualifier	Organics	Inorganics
NJ	The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration.	Not applicable.
R	The data are unusable. The sample results are rejected due to serious deficiencies in the ability to analyze the sample and to meet quality control criteria. The presence or absence of the analyte cannot be verified.	The data are unusable. The sample results are rejected due to serious deficiencies in the ability to analyze the sample and to meet quality control criteria. The presence or absence of the analyte cannot be verified.

Qualification Code Reference Table

Qualifier	Organics	Inorganics
H	Holding times were exceeded.	Holding times were exceeded.
S	Surrogate recovery was outside QC limits.	The sequence or number of standards used for the calibration was incorrect
C	Calibration %RSD or %D was noncompliant.	Correlation coefficient is <0.995 or calibration was noncompliant.
R	Calibration RRF was <0.05.	%R for calibration is not within control limits.
B	Presumed contamination as indicated by the preparation (method) blank results.	Presumed contamination as indicated by the preparation (method) or calibration blank results.
L	Laboratory Blank Spike/Blank Spike Duplicate %R was not within control limits.	Laboratory Control Sample %R was not within control limits.
L1	LCS/LCSD RPD was outside control limits.	LCS/LCSD RPD was outside control limits.
Q	MS/MSD recovery was poor.	MS recovery was poor.
Q1	MS/MSD RPD was outside control limits.	MS/MSD RPD was outside control limits.
E	Not applicable.	Duplicates showed poor agreement.
I	Internal standard performance was unsatisfactory.	ICP ICS results were unsatisfactory.
A	Not applicable.	ICP Serial Dilution %D were not within control limits.
M	Tuning (BFB or DFTPP) was noncompliant.	ICPMS tune was not compliant.
T	Presumed contamination as indicated by the trip blank results.	Not applicable.
+	False positive – reported compound was not present.	Not applicable.
-	False negative – compound was present but not reported.	Not applicable.
F	Presumed contamination as indicated by the FB or ER results.	Presumed contamination as indicated by the FB or ER results.
F1	Field duplicate results were outside the control limit.	Field duplicate results were outside the control limit.
\$	Reported result or other information was incorrect.	Reported result or other information was incorrect.
?	TIC identity or reported retention time has been changed.	Not applicable.



Qualifier	Organics	Inorganics
D	The analysis with this flag should not be used because another more technically sound analysis is available.	The analysis with this flag should not be used because another more technically sound analysis is available.
P	Instrument performance for pesticides was poor.	Post Digestion Spike recovery was not within control limits.
*II, *III	Unusual problems found with the data that have been described in Section II, "Sample Management," or Section III, "Method Analyses." The number following the asterisk (*) will indicate the report section where a description of the problem can be found.	Unusual problems found with the data that have been described in Section II, "Sample Management," or Section III, "Method Analyses." The number following the asterisk (*) will indicate the report section where a description of the problem can be found.

III. Method Analyses

A. Methods 6020 and 7470A—Metals and Mercury

Reviewed By: M. Hilchey

Date Reviewed: February 27, 2018

The samples listed in Table 1 for these analyses were validated based on the guidelines outlined in the *Quality Assurance Project Plan for U. S. EPA Region 8 CERCLA Site Assessment* (Rev. 2015); EPA Methods 6020 and 7470A; and the *National Functional Guidelines for Inorganic Superfund Methods Data Review* (January 2017).

- Holding Times: The analytical holding times, 28 days for mercury and six months for the metals, were met.
- Instrument tune: Instrument tune is not evaluated at a Stage 2A validation.
- Calibration: Instrument calibration is not evaluated at a Stage 2A validation.
- Method Blanks: No target analytes were reported in the method blanks of sufficient concentration to qualify site sample results except as noted in the table below. Associated detected sample results that were below the reporting limit (RL) were qualified as nondetect (U) at the RL. Associated detected sample results that were below the RL and >10x the blank concentration were not qualified, based on professional judgment. Associated detected results that were greater than RL and <5x the blank concentration were qualified as estimated with high bias (J+).

Analyte	Lab batch	Method blank concentration (µg/L)	Qualified Samples
total lead	WG1069310	1.04	CM-FB-01-20180131
total manganese		0.419	
total vanadium		0.195	CM-GW-44R-20180131-01
total aluminum	WG1070311	12.1	CM-FB-01-20180131
total beryllium		0.743	CM-ME-NT-20180131
total selenium		0.899	
total thallium		0.759	

- Interference Check Samples (ICSA/B): ICS data is not evaluated at a Stage 2A validation.
- Laboratory Control Samples (LCS): The LCS and LCSD recoveries were within 80-120% and all LCS/LCSD RPDs were ≤20%.
- Laboratory Duplicates: Laboratory duplicate analyses were not reported.

- Matrix Spike: Matrix spike (MS) and matrix spike duplicate (MSD) analyses were performed on sample CM-ME-NT-20190131 for both methods. MS recoveries were not assessed when the parent sample concentrations were more than 4× the spike amount. Recoveries for all target analytes met control limits of 75-125% with the exception of dissolved lead (72%) in the MSD. All site sample dissolved lead results were qualified as estimated with a low bias (J-). All MS/MSD RPDs were ≤20%.
- Post Digestion Spike: Post digestion spike (PDS) analyses were not reported.
- Serial Dilution: Serial dilution analyses were not reported.
- Internal Standards: Internal standards are not evaluated at a Stage 2A validation.
- Sample Result Verification: Sample result verification is not performed at a Stage 2A validation. Detects below the reporting limit were qualified as estimated (J). Nondetects are valid to the method detection limit.

Several samples were diluted for several ICPMS analytes. Reporting limits were appropriately adjusted.

- Field QC Samples: MEC^x evaluated field QC samples, and if necessary, qualified based on method blanks and other laboratory QC results affecting the usability of the field QC data. MEC^x used the remaining detects to evaluate the associated site samples. Findings associated with field QC samples are summarized below.
 - Field Blanks and Equipment Blanks: Sample CM-FB-01-20180131 was identified as a field blank for SDG. No target analytes were detected in the field blank of sufficient concentration to qualify site sample results except as noted in the table below. Associated detected sample results that were below the reporting limit (RL) were qualified as nondetect (U) at the RL. Associated detected results that were greater than RL and <5× the blank concentration were qualified as estimated with high bias (J+). No equipment blank samples were identified for this SDG.

Analyte	Field blank concentration (µg/L)	Qualified Samples
total arsenic	0.51	CM-GW-NTU-20180131
dissolved arsenic	0.495	CM-GW-NTU-20180131, CM-GW-NTU-20180131a

- Field Duplicates: Samples CM-GW-NTU-20180131 and CM-GW-NTU-20180131A were identified as a field duplicate pair. The control limits of ≤30% for all target analytes greater than RL and ±RL for all results <RL were met with the exception of total iron (33%). Associated results in the FD pair were qualified as estimated (J).

B. METHODS 2320 B-2011, 9040C, and 9056A—Alkalinity, pH and Anions

Reviewed By: M. Hilchey

Date Reviewed: February 27, 2018

The samples listed in Table 1 for these analyses were validated based on the guidelines outlined in the *Quality Assurance Project Plan for U. S. EPA Region 8 CERCLA Site Assessment* (Rev. 2015), the *National Functional Guidelines for Inorganic Superfund Methods Data Review* (2017), and *Methods 2320 B-2011, 9040C, and 9056A*.

- Holding Times: The analytical hold time for pH (immediately upon collection) was exceeded by 2 days for all samples. All results for pH were qualified as estimated with unknown bias (J). The remaining analytical holding times, as listed below, were met.
 - Alkalinity (2320 B-2011) – 14 days from collection
 - Chloride, sulfate (9056A) – 28 days from collection
- Calibration: Calibration is not evaluated at a Level 2A validation.
- Blanks: No target analytes were reported in the method blank for Method 9056A. Method blanks are not applicable to the other methods.
- Laboratory Control Samples: The LCS/LCSD recoveries and RPDs were within the laboratory control limits.
- Laboratory Duplicates: Laboratory duplicate analyses were not performed on a sample from this SDG.
- Matrix Spike/Matrix Spike Duplicate: MS/MSD analyses were performed on sample CM-ME-NT-20180131 for Method 9056A. All sample results were >4x the spike concentration; therefore, MS/MSD data were not evaluated. MS/MSD analyses were not reported or applicable for the remaining methods.
- Sample Result Verification: Quantification was not verified at a Level 2A validation. Detects below the reporting limit were qualified as estimated (J). Nondetects are valid to the MDL.

All samples except the field blank were diluted for sulfate analysis. Detection limits were appropriately adjusted.

- Field QC Samples: MEC^x evaluated field QC samples, and if necessary, qualified based on method blanks and other laboratory QC results affecting the usability of the field QC data. MEC^x used the remaining detects to evaluate the associated site sample. Findings associated with field QC samples are summarized below.
 - Field Blanks and Equipment Blanks: Sample CM-FB-01-20180131 was identified as a field blank for SDG. No target analytes were detected in the field blank of sufficient concentration to qualify site sample results. No samples were identified as equipment blanks in this SDG.
 - Field Duplicates: Samples CM-GW-NTU-20180131 and CM-GW-NTU-20180131A were



identified as a field duplicate pair. The control limits of $\leq 30\%$ for all target analytes greater than RL were met and the pair was considered in good agreement.

Validated Sample Result Forms: L967354

Analysis Method 2320 B-2011

Sample Name		CM-GW-44R-20180131-01					Matrix Type: W		
Lab Sample Name:		L967354-01		Sample Date: 01/31/2018 12:15					
Analyte	Total/Dissolved	CAS No	Result Value	Reporting Limit	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Comments
Alkalinity	U		2710	20000	2710	ug/l	U	U	

Sample Name		CM-GW-44R-20180131-02					Matrix Type: W		
Lab Sample Name:		L967354-02		Sample Date: 01/31/2018 12:20					
Analyte	Total/Dissolved	CAS No	Result Value	Reporting Limit	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Comments
Alkalinity	U		2710	20000	2710	ug/l	U	U	

Sample Name		CM-ME-NT-20180131					Matrix Type: W		
Lab Sample Name:		L967354-03		Sample Date: 01/31/2018 14:20					
Analyte	Total/Dissolved	CAS No	Result Value	Reporting Limit	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Comments
Alkalinity	U		2710	20000	2710	ug/l	U	U	

Sample Name		CM-GW-NTU-20180131					Matrix Type: W		
Lab Sample Name:		L967354-04		Sample Date: 01/31/2018 13:30					
Analyte	Total/Dissolved	CAS No	Result Value	Reporting Limit	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Comments
Alkalinity	U		2710	20000	2710	ug/l	U	U	

Sample Name		CM-GW-NTU-20180131A					Matrix Type: W		
Lab Sample Name:		L967354-05		Sample Date: 01/31/2018 13:30					
Analyte	Total/Dissolved	CAS No	Result Value	Reporting Limit	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Comments
Alkalinity	U		2710	20000	2710	ug/l	U	U	

Sample Name		CM-FB-01-20180131					Matrix Type: W		
Lab Sample Name:		L967354-06		Sample Date: 01/31/2018 15:00					
Analyte	Total/Dissolved	CAS No	Result Value	Reporting Limit	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Comments
Alkalinity	U		2710	20000	2710	ug/l	U	U	

Analysis Method 6020

Sample Name		CM-GW-44R-20180131-01					Matrix Type: W		
Lab Sample Name:		L967354-01		Sample Date: 01/31/2018 12:15					
Analyte	Total/Dissolved	CAS No	Result Value	Reporting Limit	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Comments
Aluminum	U	7429-90-5	7180	100	5.15	ug/l			
Aluminum,Dissolved	U	7429-90-5	7140	100	5.15	ug/l			

Analysis Method 6020

Antimony	U	7440-36-0	0.820	2.00	0.754	ug/l	J	J	
Antimony,Dissolved	U	7440-36-0	0.754	2.00	0.754	ug/l	U	U	
Arsenic	U	7440-38-2	5.94	2.00	0.250	ug/l			
Arsenic,Dissolved	U	7440-38-2	4.14	2.00	0.250	ug/l			
Barium	U	7440-39-3	17.5	5.00	0.360	ug/l			
Barium,Dissolved	U	7440-39-3	14.7	5.00	0.360	ug/l			
Beryllium	U	7440-41-7	6.29	2.00	0.120	ug/l			
Beryllium,Dissolved	U	7440-41-7	6.64	2.00	0.120	ug/l			
Cadmium	U	7440-43-9	1360	1.00	0.160	ug/l			
Cadmium,Dissolved	U	7440-43-9	1360	1.00	0.160	ug/l			
Calcium	U	7440-70-2	46300	1000	46.0	ug/l			
Calcium,Dissolved	U	7440-70-2	46100	1000	46.0	ug/l			
Chromium	U	7440-47-3	0.597	2.00	0.540	ug/l	J	J	
Chromium,Dissolved	U	7440-47-3	0.540	2.00	0.540	ug/l	U	U	
Cobalt	U	7440-48-4	78.5	2.00	0.260	ug/l			
Cobalt,Dissolved	U	7440-48-4	78.8	2.00	0.260	ug/l			
Copper	U	7440-50-8	2350	25.0	2.60	ug/l			
Copper,Dissolved	U	7440-50-8	1940	25.0	2.60	ug/l			
Iron	U	7439-89-6	15100	100	15.0	ug/l			
Iron,Dissolved	U	7439-89-6	15300	100	15.0	ug/l			
Lead	U	7439-92-1	2020	2.00	0.240	ug/l			
Lead,Dissolved	U	7439-92-1	2000	2.00	0.240	ug/l		J-	Q
Magnesium	U	7439-95-4	8530	1000	100	ug/l			
Magnesium,Dissolved	U	7439-95-4	8970	1000	100	ug/l			
Manganese	U	7439-96-5	12600	25.0	1.25	ug/l			
Manganese,Dissolved	U	7439-96-5	10800	25.0	1.25	ug/l			
Nickel	U	7440-02-0	31.5	2.00	0.350	ug/l			
Nickel,Dissolved	U	7440-02-0	31.1	2.00	0.350	ug/l			
Potassium	U	7440-09-7	16400	1000	37.0	ug/l			
Potassium,Dissolved	U	7440-09-7	16400	1000	37.0	ug/l			
Selenium	U	7782-49-2	0.851	2.00	0.380	ug/l	J	J	
Selenium,Dissolved	U	7782-49-2	2.57	2.00	0.380	ug/l			
Silver	U	7440-22-4	5.90	2.00	0.310	ug/l			
Silver,Dissolved	U	7440-22-4	1.42	2.00	0.310	ug/l	J	J	
Sodium	U	7440-23-5	22600	1000	110	ug/l			
Sodium,Dissolved	U	7440-23-5	22700	1000	110	ug/l			
Thallium	U	7440-28-0	11.9	2.00	0.190	ug/l			
Thallium,Dissolved	U	7440-28-0	12.4	2.00	0.190	ug/l			
Vanadium	U	7440-62-2	0.762	5.00	0.180	ug/l	BJ	U	B
Vanadium,Dissolved	U	7440-62-2	0.180	5.00	0.180	ug/l	U	U	
Zinc	U	7440-66-6	103000	1250	128	ug/l			
Zinc,Dissolved	U	7440-66-6	110000	1250	128	ug/l			

Analysis Method 6020

Sample Name		CM-GW-44R-20180131-02				Matrix Type: W			
Lab Sample Name:		L967354-02		Sample Date: 01/31/2018 12:20					
Analyte	Total/Dissolved	CAS No	Result Value	Reporting Limit	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Comments
Aluminum	U	7429-90-5	7820	100	5.15	ug/l			
Aluminum,Dissolved	U	7429-90-5	7310	100	5.15	ug/l			
Antimony	U	7440-36-0	14.0	2.00	0.754	ug/l			
Antimony,Dissolved	U	7440-36-0	0.758	2.00	0.754	ug/l	J	J	
Arsenic	U	7440-38-2	101	2.00	0.250	ug/l			
Arsenic,Dissolved	U	7440-38-2	4.77	2.00	0.250	ug/l			
Barium	U	7440-39-3	297	5.00	0.360	ug/l			
Barium,Dissolved	U	7440-39-3	15.8	5.00	0.360	ug/l			
Beryllium	U	7440-41-7	6.35	2.00	0.120	ug/l			
Beryllium,Dissolved	U	7440-41-7	6.97	2.00	0.120	ug/l			
Cadmium	U	7440-43-9	1400	1.00	0.160	ug/l			
Cadmium,Dissolved	U	7440-43-9	1370	1.00	0.160	ug/l			
Calcium	U	7440-70-2	46500	1000	46.0	ug/l			
Calcium,Dissolved	U	7440-70-2	46600	1000	46.0	ug/l			
Chromium	U	7440-47-3	1.45	2.00	0.540	ug/l	J	J	
Chromium,Dissolved	U	7440-47-3	0.540	2.00	0.540	ug/l	U	U	
Cobalt	U	7440-48-4	77.8	2.00	0.260	ug/l			
Cobalt,Dissolved	U	7440-48-4	79.4	2.00	0.260	ug/l			
Copper	U	7440-50-8	2570	25.0	2.60	ug/l			
Copper,Dissolved	U	7440-50-8	1990	25.0	2.60	ug/l			
Iron	U	7439-89-6	22500	100	15.0	ug/l			
Iron,Dissolved	U	7439-89-6	14800	100	15.0	ug/l			
Lead	U	7439-92-1	3760	2.00	0.240	ug/l			
Lead,Dissolved	U	7439-92-1	2220	2.00	0.240	ug/l		J-	Q
Magnesium	U	7439-95-4	8530	1000	100	ug/l			
Magnesium,Dissolved	U	7439-95-4	9000	1000	100	ug/l			
Manganese	U	7439-96-5	11800	25.0	1.25	ug/l			
Manganese,Dissolved	U	7439-96-5	10400	25.0	1.25	ug/l			
Nickel	U	7440-02-0	31.5	2.00	0.350	ug/l			
Nickel,Dissolved	U	7440-02-0	31.2	2.00	0.350	ug/l			
Potassium	U	7440-09-7	16700	1000	37.0	ug/l			
Potassium,Dissolved	U	7440-09-7	16400	1000	37.0	ug/l			
Selenium	U	7782-49-2	1.35	2.00	0.380	ug/l	J	J	
Selenium,Dissolved	U	7782-49-2	2.66	2.00	0.380	ug/l			
Silver	U	7440-22-4	58.6	2.00	0.310	ug/l			
Silver,Dissolved	U	7440-22-4	0.324	2.00	0.310	ug/l	J	J	
Sodium	U	7440-23-5	22400	1000	110	ug/l			
Sodium,Dissolved	U	7440-23-5	22600	1000	110	ug/l			

Analysis Method 6020

Thallium	U	7440-28-0	12.9	2.00	0.190	ug/l		
Thallium,Dissolved	U	7440-28-0	12.6	2.00	0.190	ug/l		
Vanadium	U	7440-62-2	4.60	5.00	0.180	ug/l	J	J
Vanadium,Dissolved	U	7440-62-2	0.180	5.00	0.180	ug/l	U	U
Zinc	U	7440-66-6	104000	1250	128	ug/l		
Zinc,Dissolved	U	7440-66-6	119000	2500	256	ug/l		

Sample Name CM-ME-NT-20180131

Matrix Type: W

Lab Sample Name: L967354-03

Sample Date: 01/31/2018 14:20

Analyte	Total/Dissolved	CAS No	Result Value	Reporting Limit	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Comments
Aluminum	U	7429-90-5	407	100	5.15	ug/l			
Aluminum,Dissolved	U	7429-90-5	415	100	5.15	ug/l			
Antimony	U	7440-36-0	0.754	2.00	0.754	ug/l	U	U	
Antimony,Dissolved	U	7440-36-0	0.754	2.00	0.754	ug/l	U	U	
Arsenic	U	7440-38-2	8.06	2.00	0.250	ug/l			
Arsenic,Dissolved	U	7440-38-2	8.52	2.00	0.250	ug/l			
Barium	U	7440-39-3	14.9	5.00	0.360	ug/l			
Barium,Dissolved	U	7440-39-3	15.0	5.00	0.360	ug/l			
Beryllium	U	7440-41-7	3.62	2.00	0.120	ug/l	B	J+	B
Beryllium,Dissolved	U	7440-41-7	3.76	2.00	0.120	ug/l			
Cadmium	U	7440-43-9	113	1.00	0.160	ug/l			
Cadmium,Dissolved	U	7440-43-9	115	1.00	0.160	ug/l			
Calcium	U	7440-70-2	192000	1000	46.0	ug/l	V		
Calcium,Dissolved	U	7440-70-2	191000	1000	46.0	ug/l			
Chromium	U	7440-47-3	0.540	2.00	0.540	ug/l	U	U	
Chromium,Dissolved	U	7440-47-3	0.540	2.00	0.540	ug/l	U	U	
Cobalt	U	7440-48-4	31.9	2.00	0.260	ug/l			
Cobalt,Dissolved	U	7440-48-4	33.2	2.00	0.260	ug/l			
Copper	U	7440-50-8	24.4	5.00	0.520	ug/l			
Copper,Dissolved	U	7440-50-8	24.4	5.00	0.520	ug/l			
Iron	U	7439-89-6	2910	100	15.0	ug/l			
Iron,Dissolved	U	7439-89-6	3100	100	15.0	ug/l			
Lead	U	7439-92-1	1260	2.00	0.240	ug/l			
Lead,Dissolved	U	7439-92-1	1310	2.00	0.240	ug/l	V	J-	Q
Magnesium	U	7439-95-4	12600	1000	100	ug/l			
Magnesium,Dissolved	U	7439-95-4	12900	1000	100	ug/l			
Manganese	U	7439-96-5	14600	50.0	2.50	ug/l			
Manganese,Dissolved	U	7439-96-5	15100	25.0	1.25	ug/l			
Nickel	U	7440-02-0	12.6	2.00	0.350	ug/l			
Nickel,Dissolved	U	7440-02-0	12.9	2.00	0.350	ug/l			
Potassium	U	7440-09-7	4890	1000	37.0	ug/l	B		
Potassium,Dissolved	U	7440-09-7	5110	1000	37.0	ug/l			

Analysis Method 6020

Selenium	U	7782-49-2	2.83	2.00	0.380	ug/l	B	J+	B
Selenium,Dissolved	U	7782-49-2	2.79	2.00	0.380	ug/l			
Silver	U	7440-22-4	0.310	2.00	0.310	ug/l	U	U	
Silver,Dissolved	U	7440-22-4	0.386	2.00	0.310	ug/l	J	J	
Sodium	U	7440-23-5	53100	1000	110	ug/l			
Sodium,Dissolved	U	7440-23-5	53100	1000	110	ug/l			
Thallium	U	7440-28-0	3.38	2.00	0.190	ug/l	B	J+	B
Thallium,Dissolved	U	7440-28-0	3.44	2.00	0.190	ug/l			
Vanadium	U	7440-62-2	0.180	5.00	0.180	ug/l	U	U	
Vanadium,Dissolved	U	7440-62-2	0.180	5.00	0.180	ug/l	U	U	
Zinc	U	7440-66-6	47600	250	25.6	ug/l			
Zinc,Dissolved	U	7440-66-6	47800	500	51.2	ug/l			

Sample Name CM-GW-NTU-20180131

Matrix Type: W

Lab Sample Name: L967354-04

Sample Date: 01/31/2018 13:30

Analyte	Total/Dissolved	CAS No	Result Value	Reporting Limit	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Comments
Aluminum	U	7429-90-5	9120	100	5.15	ug/l			
Aluminum,Dissolved	U	7429-90-5	9270	100	5.15	ug/l			
Antimony	U	7440-36-0	0.774	2.00	0.754	ug/l	J	J	
Antimony,Dissolved	U	7440-36-0	0.754	2.00	0.754	ug/l	U	U	
Arsenic	U	7440-38-2	2.29	2.00	0.250	ug/l		J+	F
Arsenic,Dissolved	U	7440-38-2	1.79	2.00	0.250	ug/l	J	U	F
Barium	U	7440-39-3	6.59	5.00	0.360	ug/l	B		
Barium,Dissolved	U	7440-39-3	6.82	5.00	0.360	ug/l			
Beryllium	U	7440-41-7	3.81	2.00	0.120	ug/l			
Beryllium,Dissolved	U	7440-41-7	4.15	2.00	0.120	ug/l			
Cadmium	U	7440-43-9	703	1.00	0.160	ug/l			
Cadmium,Dissolved	U	7440-43-9	704	1.00	0.160	ug/l			
Calcium	U	7440-70-2	147000	1000	46.0	ug/l			
Calcium,Dissolved	U	7440-70-2	148000	1000	46.0	ug/l			
Chromium	U	7440-47-3	0.540	2.00	0.540	ug/l	U	U	
Chromium,Dissolved	U	7440-47-3	0.540	2.00	0.540	ug/l	U	U	
Cobalt	U	7440-48-4	137	2.00	0.260	ug/l			
Cobalt,Dissolved	U	7440-48-4	142	2.00	0.260	ug/l			
Copper	U	7440-50-8	1080	5.00	0.520	ug/l			
Copper,Dissolved	U	7440-50-8	1090	5.00	0.520	ug/l			
Iron	U	7439-89-6	861	100	15.0	ug/l		J	F1
Iron,Dissolved	U	7439-89-6	673	100	15.0	ug/l			
Lead	U	7439-92-1	1420	2.00	0.240	ug/l			
Lead,Dissolved	U	7439-92-1	1460	2.00	0.240	ug/l		J-	Q
Magnesium	U	7439-95-4	21300	1000	100	ug/l			
Magnesium,Dissolved	U	7439-95-4	22600	1000	100	ug/l			

Analysis Method 6020

Manganese	U	7439-96-5	70100	50.0	2.50	ug/l		
Manganese,Dissolved	U	7439-96-5	67600	1000	50.0	ug/l		
Nickel	U	7440-02-0	66.2	2.00	0.350	ug/l		
Nickel,Dissolved	U	7440-02-0	67.3	2.00	0.350	ug/l		
Potassium	U	7440-09-7	11000	1000	37.0	ug/l		
Potassium,Dissolved	U	7440-09-7	11400	1000	37.0	ug/l		
Selenium	U	7782-49-2	2.04	2.00	0.380	ug/l		
Selenium,Dissolved	U	7782-49-2	5.70	2.00	0.380	ug/l		
Silver	U	7440-22-4	1.59	2.00	0.310	ug/l	J	J
Silver,Dissolved	U	7440-22-4	0.821	2.00	0.310	ug/l	J	J
Sodium	U	7440-23-5	54500	1000	110	ug/l		
Sodium,Dissolved	U	7440-23-5	51500	1000	110	ug/l		
Thallium	U	7440-28-0	14.1	2.00	0.190	ug/l		
Thallium,Dissolved	U	7440-28-0	15.0	2.00	0.190	ug/l		
Vanadium	U	7440-62-2	0.180	5.00	0.180	ug/l	U	U
Vanadium,Dissolved	U	7440-62-2	0.180	5.00	0.180	ug/l	U	U
Zinc	U	7440-66-6	218000	1250	128	ug/l		
Zinc,Dissolved	U	7440-66-6	229000	5000	512	ug/l		

Sample Name CM-GW-NTU-20180131A

Matrix Type: W

Lab Sample Name: L967354-05

Sample Date: 01/31/2018 13:30

Analyte	Total/Dissolved	CAS No	Result Value	Reporting Limit	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Comments
Aluminum	U	7429-90-5	9170	100	5.15	ug/l			
Aluminum,Dissolved	U	7429-90-5	9060	100	5.15	ug/l			
Antimony	U	7440-36-0	0.754	2.00	0.754	ug/l	U	U	
Antimony,Dissolved	U	7440-36-0	0.754	2.00	0.754	ug/l	U	U	
Arsenic	U	7440-38-2	3.44	2.00	0.250	ug/l			
Arsenic,Dissolved	U	7440-38-2	1.45	2.00	0.250	ug/l	J	U	F
Barium	U	7440-39-3	8.42	5.00	0.360	ug/l			
Barium,Dissolved	U	7440-39-3	6.96	5.00	0.360	ug/l			
Beryllium	U	7440-41-7	3.90	2.00	0.120	ug/l			
Beryllium,Dissolved	U	7440-41-7	4.13	2.00	0.120	ug/l			
Cadmium	U	7440-43-9	705	1.00	0.160	ug/l			
Cadmium,Dissolved	U	7440-43-9	705	1.00	0.160	ug/l			
Calcium	U	7440-70-2	146000	1000	46.0	ug/l			
Calcium,Dissolved	U	7440-70-2	148000	1000	46.0	ug/l			
Chromium	U	7440-47-3	0.540	2.00	0.540	ug/l	U	U	
Chromium,Dissolved	U	7440-47-3	0.540	2.00	0.540	ug/l	U	U	
Cobalt	U	7440-48-4	139	2.00	0.260	ug/l			
Cobalt,Dissolved	U	7440-48-4	140	2.00	0.260	ug/l			
Copper	U	7440-50-8	1100	5.00	0.520	ug/l			
Copper,Dissolved	U	7440-50-8	1070	5.00	0.520	ug/l			

Analysis Method 6020

Iron	U	7439-89-6	1200	100	15.0	ug/l	J	F1
Iron,Dissolved	U	7439-89-6	659	100	15.0	ug/l		
Lead	U	7439-92-1	1450	2.00	0.240	ug/l		
Lead,Dissolved	U	7439-92-1	1450	2.00	0.240	ug/l	J-	Q
Magnesium	U	7439-95-4	21000	1000	100	ug/l		
Magnesium,Dissolved	U	7439-95-4	22200	1000	100	ug/l		
Manganese	U	7439-96-5	66600	50.0	2.50	ug/l		
Manganese,Dissolved	U	7439-96-5	67400	1000	50.0	ug/l		
Nickel	U	7440-02-0	64.1	2.00	0.350	ug/l		
Nickel,Dissolved	U	7440-02-0	67.1	2.00	0.350	ug/l		
Potassium	U	7440-09-7	10800	1000	37.0	ug/l		
Potassium,Dissolved	U	7440-09-7	11200	1000	37.0	ug/l		
Selenium	U	7782-49-2	1.72	2.00	0.380	ug/l	J	J
Selenium,Dissolved	U	7782-49-2	5.10	2.00	0.380	ug/l		
Silver	U	7440-22-4	1.81	2.00	0.310	ug/l	J	J
Silver,Dissolved	U	7440-22-4	0.859	2.00	0.310	ug/l	J	J
Sodium	U	7440-23-5	52900	1000	110	ug/l		
Sodium,Dissolved	U	7440-23-5	50300	1000	110	ug/l		
Thallium	U	7440-28-0	14.5	2.00	0.190	ug/l		
Thallium,Dissolved	U	7440-28-0	15.2	2.00	0.190	ug/l		
Vanadium	U	7440-62-2	0.180	5.00	0.180	ug/l	U	U
Vanadium,Dissolved	U	7440-62-2	0.180	5.00	0.180	ug/l	U	U
Zinc	U	7440-66-6	213000	1250	128	ug/l		
Zinc,Dissolved	U	7440-66-6	228000	5000	512	ug/l		

Sample Name CM-FB-01-20180131

Matrix Type: W

Lab Sample Name: L967354-06

Sample Date: 01/31/2018 15:00

Analyte	Total/Dissolved	CAS No	Result Value	Reporting Limit	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Comments
Aluminum	U	7429-90-5	13.7	100	5.15	ug/l	BJ	U	B
Aluminum,Dissolved	U	7429-90-5	16.2	100	5.15	ug/l	J	J	
Antimony	U	7440-36-0	0.754	2.00	0.754	ug/l	U	U	
Antimony,Dissolved	U	7440-36-0	0.754	2.00	0.754	ug/l	U	U	
Arsenic	U	7440-38-2	0.510	2.00	0.250	ug/l	J	J	
Arsenic,Dissolved	U	7440-38-2	0.495	2.00	0.250	ug/l	J	J	
Barium	U	7440-39-3	0.360	5.00	0.360	ug/l	U	U	
Barium,Dissolved	U	7440-39-3	0.730	5.00	0.360	ug/l	J	J	
Beryllium	U	7440-41-7	0.120	2.00	0.120	ug/l	U	U	
Beryllium,Dissolved	U	7440-41-7	0.120	2.00	0.120	ug/l	U	U	
Cadmium	U	7440-43-9	0.160	1.00	0.160	ug/l	U	U	
Cadmium,Dissolved	U	7440-43-9	0.160	1.00	0.160	ug/l	U	U	
Calcium	U	7440-70-2	46.0	1000	46.0	ug/l	U	U	
Calcium,Dissolved	U	7440-70-2	46.0	1000	46.0	ug/l	U	U	

Analysis Method 6020

Chromium	U	7440-47-3	0.540	2.00	0.540	ug/l	U	U	
Chromium,Dissolved	U	7440-47-3	0.540	2.00	0.540	ug/l	U	U	
Cobalt	U	7440-48-4	0.260	2.00	0.260	ug/l	U	U	
Cobalt,Dissolved	U	7440-48-4	0.260	2.00	0.260	ug/l	U	U	
Copper	U	7440-50-8	0.927	5.00	0.520	ug/l	J	J	
Copper,Dissolved	U	7440-50-8	2.62	5.00	0.520	ug/l	J	J	
Iron	U	7439-89-6	15.0	100	15.0	ug/l	U	U	
Iron,Dissolved	U	7439-89-6	15.0	100	15.0	ug/l	U	U	
Lead	U	7439-92-1	0.959	2.00	0.240	ug/l	BJ	U	B
Lead,Dissolved	U	7439-92-1	2.28	2.00	0.240	ug/l			
Magnesium	U	7439-95-4	100	1000	100	ug/l	U	U	
Magnesium,Dissolved	U	7439-95-4	100	1000	100	ug/l	U	U	
Manganese	U	7439-96-5	3.88	5.00	0.250	ug/l	BJ	U	B
Manganese,Dissolved	U	7439-96-5	36.8	5.00	0.250	ug/l			
Nickel	U	7440-02-0	0.379	2.00	0.350	ug/l	J	J	
Nickel,Dissolved	U	7440-02-0	0.350	2.00	0.350	ug/l	U	U	
Potassium	U	7440-09-7	37.0	1000	37.0	ug/l	U	U	
Potassium,Dissolved	U	7440-09-7	37.0	1000	37.0	ug/l	U	U	
Selenium	U	7782-49-2	0.380	2.00	0.380	ug/l	U	U	
Selenium,Dissolved	U	7782-49-2	0.380	2.00	0.380	ug/l	U	U	
Silver	U	7440-22-4	0.310	2.00	0.310	ug/l	U	U	
Silver,Dissolved	U	7440-22-4	0.310	2.00	0.310	ug/l	U	U	
Sodium	U	7440-23-5	295	1000	110	ug/l	J	J	
Sodium,Dissolved	U	7440-23-5	110	1000	110	ug/l	U	U	
Thallium	U	7440-28-0	0.190	2.00	0.190	ug/l	U	U	
Thallium,Dissolved	U	7440-28-0	0.190	2.00	0.190	ug/l	U	U	
Vanadium	U	7440-62-2	0.180	5.00	0.180	ug/l	U	U	
Vanadium,Dissolved	U	7440-62-2	0.180	5.00	0.180	ug/l	U	U	
Zinc	U	7440-66-6	28.9	25.0	2.56	ug/l			
Zinc,Dissolved	U	7440-66-6	183	25.0	2.56	ug/l			

Analysis Method 7470A

Sample Name		CM-GW-44R-20180131-01					Matrix Type: W		
Lab Sample Name:		L967354-01		Sample Date: 01/31/2018 12:15					
Analyte	Total/Dissolved	CAS No	Result Value	Reporting Limit	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Comments
Mercury	U	7439-97-6	0.160	0.200	0.0490	ug/l	J	J	
Mercury,Dissolved	U	7439-97-6	0.0590	0.200	0.0490	ug/l	J	J	
Sample Name		CM-GW-44R-20180131-02					Matrix Type: W		
Lab Sample Name:		L967354-02		Sample Date: 01/31/2018 12:20					
Analyte	Total/Dissolved	CAS No	Result Value	Reporting Limit	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Comments

Analysis Method 7470A

Mercury	U	7439-97-6	2.10	0.200	0.0490	ug/l			
Mercury,Dissolved	U	7439-97-6	0.0577	0.200	0.0490	ug/l	J	J	
Sample Name	CM-ME-NT-20180131						Matrix Type: W		
Lab Sample Name:	L967354-03		Sample Date: 01/31/2018 14:20						
Analyte	Total/Dissolved	CAS No	Result Value	Reporting Limit	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Comments
Mercury	U	7439-97-6	0.0490	0.200	0.0490	ug/l	U	U	
Mercury,Dissolved	U	7439-97-6	0.0490	0.200	0.0490	ug/l	U	U	
Sample Name	CM-GW-NTU-20180131						Matrix Type: W		
Lab Sample Name:	L967354-04		Sample Date: 01/31/2018 13:30						
Analyte	Total/Dissolved	CAS No	Result Value	Reporting Limit	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Comments
Mercury	U	7439-97-6	0.0490	0.200	0.0490	ug/l	U	U	
Mercury,Dissolved	U	7439-97-6	0.0490	0.200	0.0490	ug/l	U	U	
Sample Name	CM-GW-NTU-20180131A						Matrix Type: W		
Lab Sample Name:	L967354-05		Sample Date: 01/31/2018 13:30						
Analyte	Total/Dissolved	CAS No	Result Value	Reporting Limit	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Comments
Mercury	U	7439-97-6	0.0502	0.200	0.0490	ug/l	J	J	
Mercury,Dissolved	U	7439-97-6	0.0490	0.200	0.0490	ug/l	U	U	
Sample Name	CM-FB-01-20180131						Matrix Type: W		
Lab Sample Name:	L967354-06		Sample Date: 01/31/2018 15:00						
Analyte	Total/Dissolved	CAS No	Result Value	Reporting Limit	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Comments
Mercury	U	7439-97-6	0.0490	0.200	0.0490	ug/l	U	U	
Mercury,Dissolved	U	7439-97-6	0.0490	0.200	0.0490	ug/l	U	U	

Analysis Method 9040C

Sample Name		CM-GW-44R-20180131-01					Matrix Type: W		
Lab Sample Name:		L967354-01		Sample Date: 01/31/2018 12:15					
Analyte	Total/Dissolved	CAS No	Result Value	Reporting Limit	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Comments
pH	U	00010-29-7	3.64			su	T8	J	H
Sample Name		CM-GW-44R-20180131-02					Matrix Type: W		
Lab Sample Name:		L967354-02		Sample Date: 01/31/2018 12:20					
Analyte	Total/Dissolved	CAS No	Result Value	Reporting Limit	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Comments
pH	U	00010-29-7	3.63			su	T8	J	H

Analysis Method 9040C

Sample Name		CM-ME-NT-20180131					Matrix Type: W		
Lab Sample Name:		L967354-03		Sample Date: 01/31/2018 14:20					
Analyte	Total/Dissolved	CAS No	Result Value	Reporting Limit	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Comments
pH	U	00010-29-7	4.08			su	T8	J	H
Sample Name		CM-GW-NTU-20180131					Matrix Type: W		
Lab Sample Name:		L967354-04		Sample Date: 01/31/2018 13:30					
Analyte	Total/Dissolved	CAS No	Result Value	Reporting Limit	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Comments
pH	U	00010-29-7	3.48			su	T8	J	H
Sample Name		CM-GW-NTU-20180131A					Matrix Type: W		
Lab Sample Name:		L967354-05		Sample Date: 01/31/2018 13:30					
Analyte	Total/Dissolved	CAS No	Result Value	Reporting Limit	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Comments
pH	U	00010-29-7	3.48			su	T8	J	H
Sample Name		CM-FB-01-20180131					Matrix Type: W		
Lab Sample Name:		L967354-06		Sample Date: 01/31/2018 15:00					
Analyte	Total/Dissolved	CAS No	Result Value	Reporting Limit	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Comments
pH	U	00010-29-7	5.12			su	T8	J	H

Analysis Method 9056A

Sample Name		CM-GW-44R-20180131-01					Matrix Type: W		
Lab Sample Name:		L967354-01		Sample Date: 01/31/2018 12:15					
Analyte	Total/Dissolved	CAS No	Result Value	Reporting Limit	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Comments
Chloride	U	16887-00-6	1400	1000	51.9	ug/l			
Sulfate	U	14808-79-8	409000	25000	387	ug/l			
Sample Name		CM-GW-44R-20180131-02					Matrix Type: W		
Lab Sample Name:		L967354-02		Sample Date: 01/31/2018 12:20					
Analyte	Total/Dissolved	CAS No	Result Value	Reporting Limit	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Comments
Chloride	U	16887-00-6	1580	1000	51.9	ug/l			
Sulfate	U	14808-79-8	404000	25000	387	ug/l			
Sample Name		CM-ME-NT-20180131					Matrix Type: W		
Lab Sample Name:		L967354-03		Sample Date: 01/31/2018 14:20					
Analyte	Total/Dissolved	CAS No	Result Value	Reporting Limit	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Comments
Chloride	U	16887-00-6	1060	1000	51.9	ug/l			
Sulfate	U	14808-79-8	617000	100000	1550	ug/l			

Analysis Method 9056A

Sample Name		CM-GW-NTU-20180131					Matrix Type: W		
Lab Sample Name:		L967354-04		Sample Date: 01/31/2018 13:30					
Analyte	Total/Dissolved	CAS No	Result Value	Reporting Limit	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Comments
Chloride	U	16887-00-6	1410	1000	51.9	ug/l			
Sulfate	U	14808-79-8	908000	100000	1550	ug/l			
Sample Name		CM-GW-NTU-20180131A					Matrix Type: W		
Lab Sample Name:		L967354-05		Sample Date: 01/31/2018 13:30					
Analyte	Total/Dissolved	CAS No	Result Value	Reporting Limit	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Comments
Chloride	U	16887-00-6	1390	1000	51.9	ug/l			
Sulfate	U	14808-79-8	922000	100000	1550	ug/l			
Sample Name		CM-FB-01-20180131					Matrix Type: W		
Lab Sample Name:		L967354-06		Sample Date: 01/31/2018 15:00					
Analyte	Total/Dissolved	CAS No	Result Value	Reporting Limit	MDL	Result Units	Lab Qualifier	Validation Qualifier	Validation Qualifier Comments
Chloride	U	16887-00-6	201	1000	51.9	ug/l	J	J	
Sulfate	U	14808-79-8	77.4	5000	77.4	ug/l	U	U	

February 12, 2018

Weston Solutions - CO

Sample Delivery Group: L967354
Samples Received: 02/02/2018
Project Number: 0001/1801-01
Description: Commodore Level 5

Report To: Elliot Petri
1435 Garrison St., Ste 100
Lakewood, CO 80215

Entire Report Reviewed By:



Shane Gambill
Technical Service Representative

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by ESC is performed per guidance provided in laboratory standard operating procedures: 060302, 060303, and 060304.



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SAMPLE SUMMARY

ONE LAB. NATIONWIDE.



CM-GW-44R-20180131-01 L967354-01 GW

Collected by
Elliot Petri

Collected date/time
01/31/18 12:15

Received date/time
02/02/18 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Wet Chemistry by Method 2320 B-2011	WG1070084	1	02/06/18 18:48	02/06/18 18:48	MCG
Wet Chemistry by Method 9040C	WG1069332	1	02/02/18 16:55	02/02/18 16:55	EEM
Wet Chemistry by Method 9056A	WG1069496	1	02/02/18 21:46	02/02/18 21:46	MAJ
Wet Chemistry by Method 9056A	WG1069496	5	02/02/18 21:56	02/02/18 21:56	MAJ
Mercury by Method 7470A	WG1069856	1	02/04/18 14:53	02/05/18 16:06	EL
Mercury by Method 7470A	WG1069857	1	02/04/18 14:39	02/05/18 09:49	ABL
Metals (ICPMS) by Method 6020	WG1069310	1	02/03/18 13:23	02/05/18 09:20	LAT
Metals (ICPMS) by Method 6020	WG1069310	5	02/03/18 13:23	02/05/18 15:08	LAT
Metals (ICPMS) by Method 6020	WG1069510	1	02/05/18 14:24	02/05/18 19:06	LAT
Metals (ICPMS) by Method 6020	WG1069510	5	02/05/18 14:24	02/06/18 14:57	JPD
Metals (ICPMS) by Method 6020	WG1069510	50	02/05/18 14:24	02/06/18 15:01	JPD
Metals (ICPMS) by Method 6020	WG1070311	1	02/06/18 10:38	02/06/18 15:16	LD
Metals (ICPMS) by Method 6020	WG1070311	50	02/06/18 10:38	02/06/18 17:22	LD

¹Cp

²Tc

³Ss

⁴Cn

⁵Sr

⁶Qc

⁷Gl

⁸Al

⁹Sc

CM-GW-44R-20180131-02 L967354-02 GW

Collected by
Elliot Petri

Collected date/time
01/31/18 12:20

Received date/time
02/02/18 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Wet Chemistry by Method 2320 B-2011	WG1070084	1	02/06/18 18:55	02/06/18 18:55	MCG
Wet Chemistry by Method 9040C	WG1069332	1	02/02/18 16:55	02/02/18 16:55	EEM
Wet Chemistry by Method 9056A	WG1069496	1	02/02/18 22:07	02/02/18 22:07	MAJ
Wet Chemistry by Method 9056A	WG1069496	5	02/02/18 22:18	02/02/18 22:18	MAJ
Mercury by Method 7470A	WG1069856	1	02/04/18 14:53	02/05/18 16:08	EL
Mercury by Method 7470A	WG1069857	1	02/04/18 14:39	02/05/18 09:56	ABL
Metals (ICPMS) by Method 6020	WG1069310	1	02/03/18 13:23	02/05/18 09:24	LAT
Metals (ICPMS) by Method 6020	WG1069310	5	02/03/18 13:23	02/05/18 15:12	LAT
Metals (ICPMS) by Method 6020	WG1069510	1	02/05/18 14:24	02/05/18 20:02	LAT
Metals (ICPMS) by Method 6020	WG1069510	100	02/05/18 14:24	02/06/18 15:08	JPD
Metals (ICPMS) by Method 6020	WG1069510	5	02/05/18 14:24	02/06/18 15:04	JPD
Metals (ICPMS) by Method 6020	WG1070311	1	02/06/18 10:38	02/06/18 15:19	LD
Metals (ICPMS) by Method 6020	WG1070311	50	02/06/18 10:38	02/06/18 17:26	LD

CM-ME-NT-20180131 L967354-03 GW

Collected by
Elliot Petri

Collected date/time
01/31/18 14:20

Received date/time
02/02/18 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Wet Chemistry by Method 2320 B-2011	WG1070084	1	02/06/18 19:02	02/06/18 19:02	MCG
Wet Chemistry by Method 9040C	WG1069332	1	02/02/18 16:55	02/02/18 16:55	EEM
Wet Chemistry by Method 9056A	WG1069496	1	02/02/18 22:28	02/02/18 22:28	MAJ
Wet Chemistry by Method 9056A	WG1069496	20	02/02/18 22:39	02/02/18 22:39	MAJ
Mercury by Method 7470A	WG1069856	1	02/04/18 14:53	02/05/18 15:35	EL
Mercury by Method 7470A	WG1069857	1	02/04/18 14:39	02/05/18 09:13	ABL
Metals (ICPMS) by Method 6020	WG1069310	1	02/03/18 13:23	02/05/18 09:28	LAT
Metals (ICPMS) by Method 6020	WG1069510	1	02/05/18 14:24	02/05/18 18:40	RDS
Metals (ICPMS) by Method 6020	WG1069510	1	02/05/18 14:24	02/06/18 13:20	JPD
Metals (ICPMS) by Method 6020	WG1069510	20	02/05/18 14:24	02/06/18 14:53	JPD
Metals (ICPMS) by Method 6020	WG1069510	5	02/05/18 14:24	02/06/18 14:49	JPD
Metals (ICPMS) by Method 6020	WG1070311	1	02/06/18 10:38	02/06/18 14:08	LD
Metals (ICPMS) by Method 6020	WG1070311	10	02/06/18 10:38	02/06/18 16:30	LD

SAMPLE SUMMARY

ONE LAB. NATIONWIDE.



CM-GW-NTU-20180131 L967354-04 GW

Collected by
Elliot Petri

Collected date/time
01/31/18 13:30

Received date/time
02/02/18 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Wet Chemistry by Method 2320 B-2011	WG1070084	1	02/06/18 19:09	02/06/18 19:09	MCG
Wet Chemistry by Method 9040C	WG1069332	1	02/02/18 16:55	02/02/18 16:55	EEM
Wet Chemistry by Method 9056A	WG1069496	1	02/02/18 23:32	02/02/18 23:32	MAJ
Wet Chemistry by Method 9056A	WG1069496	20	02/02/18 23:43	02/02/18 23:43	MAJ
Mercury by Method 7470A	WG1069856	1	02/04/18 14:53	02/05/18 16:10	EL
Mercury by Method 7470A	WG1069857	1	02/04/18 14:39	02/05/18 09:59	ABL
Metals (ICPMS) by Method 6020	WG1069310	1	02/03/18 13:23	02/05/18 09:32	LAT
Metals (ICPMS) by Method 6020	WG1069310	10	02/03/18 13:23	02/05/18 15:16	LAT
Metals (ICPMS) by Method 6020	WG1069510	1	02/05/18 14:24	02/05/18 20:06	LAT
Metals (ICPMS) by Method 6020	WG1069510	200	02/05/18 14:24	02/06/18 15:37	RDS
Metals (ICPMS) by Method 6020	WG1070311	1	02/06/18 10:38	02/06/18 15:23	LD
Metals (ICPMS) by Method 6020	WG1070311	50	02/06/18 10:38	02/06/18 16:41	LD

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

CM-GW-NTU-20180131A L967354-05 GW

Collected by
Elliot Petri

Collected date/time
01/31/18 13:30

Received date/time
02/02/18 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Wet Chemistry by Method 2320 B-2011	WG1070084	1	02/06/18 19:27	02/06/18 19:27	MCG
Wet Chemistry by Method 9040C	WG1069332	1	02/02/18 16:55	02/02/18 16:55	EEM
Wet Chemistry by Method 9056A	WG1069496	1	02/02/18 23:53	02/02/18 23:53	MAJ
Wet Chemistry by Method 9056A	WG1069496	20	02/03/18 00:04	02/03/18 00:04	MAJ
Mercury by Method 7470A	WG1069856	1	02/04/18 14:53	02/05/18 16:12	EL
Mercury by Method 7470A	WG1069857	1	02/04/18 14:39	02/05/18 10:01	ABL
Metals (ICPMS) by Method 6020	WG1069310	1	02/03/18 13:23	02/05/18 09:36	LAT
Metals (ICPMS) by Method 6020	WG1069310	10	02/03/18 13:23	02/05/18 15:20	LAT
Metals (ICPMS) by Method 6020	WG1069510	1	02/05/18 14:24	02/05/18 20:10	LAT
Metals (ICPMS) by Method 6020	WG1069510	200	02/05/18 14:24	02/06/18 15:45	RDS
Metals (ICPMS) by Method 6020	WG1070311	1	02/06/18 10:38	02/06/18 15:27	LD
Metals (ICPMS) by Method 6020	WG1070311	50	02/06/18 10:38	02/06/18 16:45	LD

CM-FB-01-20180131 L967354-06 GW

Collected by
Elliot Petri

Collected date/time
01/31/18 15:00

Received date/time
02/02/18 08:45

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst
Wet Chemistry by Method 2320 B-2011	WG1070084	1	02/06/18 19:35	02/06/18 19:35	MCG
Wet Chemistry by Method 9040C	WG1069332	1	02/02/18 16:55	02/02/18 16:55	EEM
Wet Chemistry by Method 9056A	WG1069496	1	02/03/18 00:15	02/03/18 00:15	MAJ
Mercury by Method 7470A	WG1069856	1	02/04/18 14:53	02/05/18 16:19	EL
Mercury by Method 7470A	WG1069857	1	02/04/18 14:39	02/05/18 10:03	ABL
Metals (ICPMS) by Method 6020	WG1069310	1	02/03/18 13:23	02/05/18 09:40	LAT
Metals (ICPMS) by Method 6020	WG1069510	1	02/05/18 14:24	02/05/18 20:15	RDS
Metals (ICPMS) by Method 6020	WG1069510	1	02/05/18 14:24	02/06/18 14:46	JPD
Metals (ICPMS) by Method 6020	WG1070311	1	02/06/18 10:38	02/06/18 15:30	LD



All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times, unless qualified or notated within the report. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All radiochemical sample results for solids are reported on a dry weight basis with the exception of tritium, carbon-14 and radon, unless wet weight was requested by the client. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.

Shane Gambill
Technical Service Representative

¹ Cp

² Tc

³ Ss

⁴ Cn

⁵ Sr

⁶ Qc

⁷ Gl

⁸ Al

⁹ Sc



Wet Chemistry by Method 2320 B-2011

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Alkalinity	U		2710	20000	1	02/06/2018 18:48	WG1070084

Sample Narrative:

L967354-01 WG1070084: Endpoint pH 4.5

Wet Chemistry by Method 9040C

Analyte	Result	Qualifier	Dilution	Analysis	Batch
	su			date / time	
pH	3.64	T8	1	02/02/2018 16:55	WG1069332

Sample Narrative:

L967354-01 WG1069332: 3.64 at 11.5C

Wet Chemistry by Method 9056A

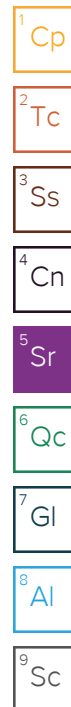
Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Chloride	1400		51.9	1000	1	02/02/2018 21:46	WG1069496
Sulfate	409000		387	25000	5	02/02/2018 21:56	WG1069496

Mercury by Method 7470A

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Mercury	0.160	J	0.0490	0.200	1	02/05/2018 16:06	WG1069856
Mercury,Dissolved	0.0590	J	0.0490	0.200	1	02/05/2018 09:49	WG1069857

Metals (ICPMS) by Method 6020

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Aluminum	7180		5.15	100	1	02/06/2018 15:16	WG1070311
Aluminum,Dissolved	7140		5.15	100	1	02/05/2018 19:06	WG1069510
Antimony	0.820	J	0.754	2.00	1	02/05/2018 09:20	WG1069310
Antimony,Dissolved	U		0.754	2.00	1	02/05/2018 19:06	WG1069510
Arsenic	5.94		0.250	2.00	1	02/05/2018 09:20	WG1069310
Arsenic,Dissolved	4.14		0.250	2.00	1	02/05/2018 19:06	WG1069510
Barium	17.5		0.360	5.00	1	02/05/2018 09:20	WG1069310
Barium,Dissolved	14.7		0.360	5.00	1	02/05/2018 19:06	WG1069510
Beryllium	6.29		0.120	2.00	1	02/05/2018 09:20	WG1069310
Beryllium,Dissolved	6.64		0.120	2.00	1	02/05/2018 19:06	WG1069510
Cadmium	1360		0.160	1.00	1	02/05/2018 09:20	WG1069310
Cadmium,Dissolved	1360		0.160	1.00	1	02/05/2018 19:06	WG1069510
Calcium	46300		46.0	1000	1	02/06/2018 15:16	WG1070311
Calcium,Dissolved	46100		46.0	1000	1	02/05/2018 19:06	WG1069510
Chromium	0.597	J	0.540	2.00	1	02/05/2018 09:20	WG1069310
Chromium,Dissolved	U		0.540	2.00	1	02/05/2018 19:06	WG1069510
Copper	2350		2.60	25.0	5	02/05/2018 15:08	WG1069310
Copper,Dissolved	1940		2.60	25.0	5	02/06/2018 14:57	WG1069510
Cobalt	78.5		0.260	2.00	1	02/05/2018 09:20	WG1069310
Cobalt,Dissolved	78.8		0.260	2.00	1	02/05/2018 19:06	WG1069510
Iron	15100		15.0	100	1	02/05/2018 09:20	WG1069310
Iron,Dissolved	15300		15.0	100	1	02/05/2018 19:06	WG1069510
Lead	2020		0.240	2.00	1	02/05/2018 09:20	WG1069310
Lead,Dissolved	2000		0.240	2.00	1	02/05/2018 19:06	WG1069510
Magnesium	8530		100	1000	1	02/05/2018 09:20	WG1069310
Magnesium,Dissolved	8970		100	1000	1	02/05/2018 19:06	WG1069510





Metals (ICPMS) by Method 6020

Analyte	Result ug/l	Qualifier	MDL ug/l	RDL ug/l	Dilution	Analysis date / time	Batch
Manganese	12600		1.25	25.0	5	02/05/2018 15:08	WG1069310
Manganese,Dissolved	10800		1.25	25.0	5	02/06/2018 14:57	WG1069510
Nickel	31.5		0.350	2.00	1	02/05/2018 09:20	WG1069310
Nickel,Dissolved	31.1		0.350	2.00	1	02/05/2018 19:06	WG1069510
Potassium	16400		37.0	1000	1	02/05/2018 09:20	WG1069310
Potassium,Dissolved	16400		37.0	1000	1	02/05/2018 19:06	WG1069510
Selenium	0.851	J	0.380	2.00	1	02/05/2018 09:20	WG1069310
Selenium,Dissolved	2.57		0.380	2.00	1	02/05/2018 19:06	WG1069510
Silver	5.90		0.310	2.00	1	02/05/2018 09:20	WG1069310
Silver,Dissolved	1.42	J	0.310	2.00	1	02/05/2018 19:06	WG1069510
Sodium	22600		110	1000	1	02/05/2018 09:20	WG1069310
Sodium,Dissolved	22700		110	1000	1	02/05/2018 19:06	WG1069510
Thallium	11.9		0.190	2.00	1	02/05/2018 09:20	WG1069310
Thallium,Dissolved	12.4		0.190	2.00	1	02/05/2018 19:06	WG1069510
Vanadium	0.762	B J	0.180	5.00	1	02/05/2018 09:20	WG1069310
Vanadium,Dissolved	U		0.180	5.00	1	02/05/2018 19:06	WG1069510
Zinc	103000		128	1250	50	02/06/2018 17:22	WG1070311
Zinc,Dissolved	110000		128	1250	50	02/06/2018 15:01	WG1069510

1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc



Wet Chemistry by Method 2320 B-2011

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Alkalinity	U		2710	20000	1	02/06/2018 18:55	WG1070084

Sample Narrative:

L967354-02 WG1070084: Endpoint pH 4.5

Wet Chemistry by Method 9040C

Analyte	Result	Qualifier	Dilution	Analysis	Batch
	su			date / time	
pH	3.63	T8	1	02/02/2018 16:55	WG1069332

Sample Narrative:

L967354-02 WG1069332: 3.63 at 11C

Wet Chemistry by Method 9056A

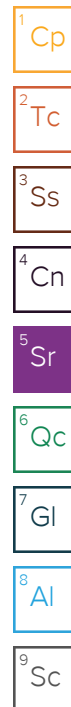
Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Chloride	1580		51.9	1000	1	02/02/2018 22:07	WG1069496
Sulfate	404000		387	25000	5	02/02/2018 22:18	WG1069496

Mercury by Method 7470A

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Mercury	2.10		0.0490	0.200	1	02/05/2018 16:08	WG1069856
Mercury,Dissolved	0.0577	J	0.0490	0.200	1	02/05/2018 09:56	WG1069857

Metals (ICPMS) by Method 6020

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Aluminum	7820		5.15	100	1	02/06/2018 15:19	WG1070311
Aluminum,Dissolved	7310		5.15	100	1	02/05/2018 20:02	WG1069510
Antimony	14.0		0.754	2.00	1	02/05/2018 09:24	WG1069310
Antimony,Dissolved	0.758	J	0.754	2.00	1	02/05/2018 20:02	WG1069510
Arsenic	101		0.250	2.00	1	02/05/2018 09:24	WG1069310
Arsenic,Dissolved	4.77		0.250	2.00	1	02/05/2018 20:02	WG1069510
Barium	297		0.360	5.00	1	02/05/2018 09:24	WG1069310
Barium,Dissolved	15.8		0.360	5.00	1	02/05/2018 20:02	WG1069510
Beryllium	6.35		0.120	2.00	1	02/05/2018 09:24	WG1069310
Beryllium,Dissolved	6.97		0.120	2.00	1	02/05/2018 20:02	WG1069510
Cadmium	1400		0.160	1.00	1	02/05/2018 09:24	WG1069310
Cadmium,Dissolved	1370		0.160	1.00	1	02/05/2018 20:02	WG1069510
Calcium	46500		46.0	1000	1	02/06/2018 15:19	WG1070311
Calcium,Dissolved	46600		46.0	1000	1	02/05/2018 20:02	WG1069510
Chromium	1.45	J	0.540	2.00	1	02/05/2018 09:24	WG1069310
Chromium,Dissolved	U		0.540	2.00	1	02/05/2018 20:02	WG1069510
Copper	2570		2.60	25.0	5	02/05/2018 15:12	WG1069310
Copper,Dissolved	1990		2.60	25.0	5	02/06/2018 15:04	WG1069510
Cobalt	77.8		0.260	2.00	1	02/05/2018 09:24	WG1069310
Cobalt,Dissolved	79.4		0.260	2.00	1	02/05/2018 20:02	WG1069510
Iron	22500		15.0	100	1	02/05/2018 09:24	WG1069310
Iron,Dissolved	14800		15.0	100	1	02/05/2018 20:02	WG1069510
Lead	3760		0.240	2.00	1	02/05/2018 09:24	WG1069310
Lead,Dissolved	2220		0.240	2.00	1	02/05/2018 20:02	WG1069510
Magnesium	8530		100	1000	1	02/05/2018 09:24	WG1069310
Magnesium,Dissolved	9000		100	1000	1	02/05/2018 20:02	WG1069510





Collected date/time: 01/31/18 12:20

L967354

Metals (ICPMS) by Method 6020

Analyte	Result ug/l	Qualifier	MDL ug/l	RDL ug/l	Dilution	Analysis date / time	Batch
Manganese	11800		1.25	25.0	5	02/05/2018 15:12	WG1069310
Manganese,Dissolved	10400		1.25	25.0	5	02/06/2018 15:04	WG1069510
Nickel	31.5		0.350	2.00	1	02/05/2018 09:24	WG1069310
Nickel,Dissolved	31.2		0.350	2.00	1	02/05/2018 20:02	WG1069510
Potassium	16700		37.0	1000	1	02/05/2018 09:24	WG1069310
Potassium,Dissolved	16400		37.0	1000	1	02/05/2018 20:02	WG1069510
Selenium	1.35	L	0.380	2.00	1	02/05/2018 09:24	WG1069310
Selenium,Dissolved	2.66		0.380	2.00	1	02/05/2018 20:02	WG1069510
Silver	58.6		0.310	2.00	1	02/05/2018 09:24	WG1069310
Silver,Dissolved	0.324	L	0.310	2.00	1	02/05/2018 20:02	WG1069510
Sodium	22400		110	1000	1	02/05/2018 09:24	WG1069310
Sodium,Dissolved	22600		110	1000	1	02/05/2018 20:02	WG1069510
Thallium	12.9		0.190	2.00	1	02/05/2018 09:24	WG1069310
Thallium,Dissolved	12.6		0.190	2.00	1	02/05/2018 20:02	WG1069510
Vanadium	4.60	L	0.180	5.00	1	02/05/2018 09:24	WG1069310
Vanadium,Dissolved	U		0.180	5.00	1	02/05/2018 20:02	WG1069510
Zinc	104000		128	1250	50	02/06/2018 17:26	WG1070311
Zinc,Dissolved	119000		256	2500	100	02/06/2018 15:08	WG1069510

¹ Cp² Tc³ Ss⁴ Cn⁵ Sr⁶ Qc⁷ Gl⁸ Al⁹ Sc



Wet Chemistry by Method 2320 B-2011

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Alkalinity	U		2710	20000	1	02/06/2018 19:02	WG1070084

Sample Narrative:

L967354-03 WG1070084: Endpoint pH 4.5

Wet Chemistry by Method 9040C

Analyte	Result	Qualifier	Dilution	Analysis	Batch
	su			date / time	
pH	4.08	T8	1	02/02/2018 16:55	WG1069332

Sample Narrative:

L967354-03 WG1069332: 4.08 at 10.8C

Wet Chemistry by Method 9056A

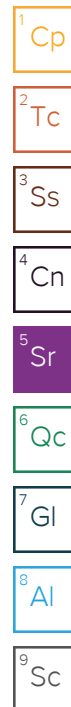
Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Chloride	1060		51.9	1000	1	02/02/2018 22:28	WG1069496
Sulfate	617000		1550	100000	20	02/02/2018 22:39	WG1069496

Mercury by Method 7470A

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Mercury	U		0.0490	0.200	1	02/05/2018 15:35	WG1069856
Mercury,Dissolved	U		0.0490	0.200	1	02/05/2018 09:13	WG1069857

Metals (ICPMS) by Method 6020

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Aluminum	407		5.15	100	1	02/06/2018 14:08	WG1070311
Aluminum,Dissolved	415		5.15	100	1	02/05/2018 18:40	WG1069510
Antimony	U		0.754	2.00	1	02/06/2018 14:08	WG1070311
Antimony,Dissolved	U		0.754	2.00	1	02/05/2018 18:40	WG1069510
Arsenic	8.06		0.250	2.00	1	02/06/2018 14:08	WG1070311
Arsenic,Dissolved	8.52		0.250	2.00	1	02/05/2018 18:40	WG1069510
Barium	14.9		0.360	5.00	1	02/06/2018 14:08	WG1070311
Barium,Dissolved	15.0		0.360	5.00	1	02/05/2018 18:40	WG1069510
Beryllium	3.62	B	0.120	2.00	1	02/06/2018 14:08	WG1070311
Beryllium,Dissolved	3.76		0.120	2.00	1	02/05/2018 18:40	WG1069510
Cadmium	113		0.160	1.00	1	02/06/2018 14:08	WG1070311
Cadmium,Dissolved	115		0.160	1.00	1	02/05/2018 18:40	WG1069510
Calcium	192000	V	46.0	1000	1	02/06/2018 14:08	WG1070311
Calcium,Dissolved	191000		46.0	1000	1	02/05/2018 18:40	WG1069510
Chromium	U		0.540	2.00	1	02/06/2018 14:08	WG1070311
Chromium,Dissolved	U		0.540	2.00	1	02/05/2018 18:40	WG1069510
Copper	24.4		0.520	5.00	1	02/06/2018 14:08	WG1070311
Copper,Dissolved	24.4		0.520	5.00	1	02/06/2018 13:20	WG1069510
Cobalt	31.9		0.260	2.00	1	02/06/2018 14:08	WG1070311
Cobalt,Dissolved	33.2		0.260	2.00	1	02/05/2018 18:40	WG1069510
Iron	2910		15.0	100	1	02/06/2018 14:08	WG1070311
Iron,Dissolved	3100		15.0	100	1	02/05/2018 18:40	WG1069510
Lead	1260		0.240	2.00	1	02/06/2018 14:08	WG1070311
Lead,Dissolved	1310	V	0.240	2.00	1	02/05/2018 18:40	WG1069510
Magnesium	12600		100	1000	1	02/06/2018 14:08	WG1070311
Magnesium,Dissolved	12900		100	1000	1	02/05/2018 18:40	WG1069510





Metals (ICPMS) by Method 6020

Analyte	Result ug/l	Qualifier	MDL ug/l	RDL ug/l	Dilution	Analysis date / time	Batch
Manganese	14600		2.50	50.0	10	02/06/2018 16:30	WG1070311
Manganese,Dissolved	15100		1.25	25.0	5	02/06/2018 14:49	WG1069510
Nickel	12.6		0.350	2.00	1	02/06/2018 14:08	WG1070311
Nickel,Dissolved	12.9		0.350	2.00	1	02/05/2018 18:40	WG1069510
Potassium	4890	B	37.0	1000	1	02/06/2018 14:08	WG1070311
Potassium,Dissolved	5110		37.0	1000	1	02/05/2018 18:40	WG1069510
Selenium	2.83	B	0.380	2.00	1	02/06/2018 14:08	WG1070311
Selenium,Dissolved	2.79		0.380	2.00	1	02/05/2018 18:40	WG1069510
Silver	U		0.310	2.00	1	02/05/2018 09:28	WG1069310
Silver,Dissolved	0.386	J	0.310	2.00	1	02/05/2018 18:40	WG1069510
Sodium	53100		110	1000	1	02/06/2018 14:08	WG1070311
Sodium,Dissolved	53100		110	1000	1	02/05/2018 18:40	WG1069510
Thallium	3.38	B	0.190	2.00	1	02/06/2018 14:08	WG1070311
Thallium,Dissolved	3.44		0.190	2.00	1	02/05/2018 18:40	WG1069510
Vanadium	U		0.180	5.00	1	02/06/2018 14:08	WG1070311
Vanadium,Dissolved	U		0.180	5.00	1	02/05/2018 18:40	WG1069510
Zinc	47600		25.6	250	10	02/06/2018 16:30	WG1070311
Zinc,Dissolved	47800		51.2	500	20	02/06/2018 14:53	WG1069510

1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc



Wet Chemistry by Method 2320 B-2011

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Alkalinity	U		2710	20000	1	02/06/2018 19:09	WG1070084

Sample Narrative:

L967354-04 WG1070084: Endpoint pH 4.5

Wet Chemistry by Method 9040C

Analyte	Result	Qualifier	Dilution	Analysis	Batch
	su			date / time	
pH	3.48	<u>T8</u>	1	02/02/2018 16:55	WG1069332

Sample Narrative:

L967354-04 WG1069332: 3.48 at 11C

Wet Chemistry by Method 9056A

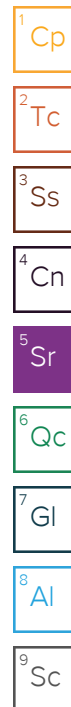
Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Chloride	1410		51.9	1000	1	02/02/2018 23:32	WG1069496
Sulfate	908000		1550	100000	20	02/02/2018 23:43	WG1069496

Mercury by Method 7470A

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Mercury	U		0.0490	0.200	1	02/05/2018 16:10	WG1069856
Mercury,Dissolved	U		0.0490	0.200	1	02/05/2018 09:59	WG1069857

Metals (ICPMS) by Method 6020

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Aluminum	9120		5.15	100	1	02/06/2018 15:23	WG1070311
Aluminum,Dissolved	9270		5.15	100	1	02/05/2018 20:06	WG1069510
Antimony	0.774	<u>J</u>	0.754	2.00	1	02/05/2018 09:32	WG1069310
Antimony,Dissolved	U		0.754	2.00	1	02/05/2018 20:06	WG1069510
Arsenic	2.29		0.250	2.00	1	02/05/2018 09:32	WG1069310
Arsenic,Dissolved	1.79	<u>J</u>	0.250	2.00	1	02/05/2018 20:06	WG1069510
Barium	6.59	<u>B</u>	0.360	5.00	1	02/05/2018 09:32	WG1069310
Barium,Dissolved	6.82		0.360	5.00	1	02/05/2018 20:06	WG1069510
Beryllium	3.81		0.120	2.00	1	02/05/2018 09:32	WG1069310
Beryllium,Dissolved	4.15		0.120	2.00	1	02/05/2018 20:06	WG1069510
Cadmium	703		0.160	1.00	1	02/05/2018 09:32	WG1069310
Cadmium,Dissolved	704		0.160	1.00	1	02/05/2018 20:06	WG1069510
Calcium	147000		46.0	1000	1	02/06/2018 15:23	WG1070311
Calcium,Dissolved	148000		46.0	1000	1	02/05/2018 20:06	WG1069510
Chromium	U		0.540	2.00	1	02/05/2018 09:32	WG1069310
Chromium,Dissolved	U		0.540	2.00	1	02/05/2018 20:06	WG1069510
Copper	1080		0.520	5.00	1	02/05/2018 09:32	WG1069310
Copper,Dissolved	1090		0.520	5.00	1	02/05/2018 20:06	WG1069510
Cobalt	137		0.260	2.00	1	02/05/2018 09:32	WG1069310
Cobalt,Dissolved	142		0.260	2.00	1	02/05/2018 20:06	WG1069510
Iron	861		15.0	100	1	02/05/2018 09:32	WG1069310
Iron,Dissolved	673		15.0	100	1	02/05/2018 20:06	WG1069510
Lead	1420		0.240	2.00	1	02/05/2018 09:32	WG1069310
Lead,Dissolved	1460		0.240	2.00	1	02/05/2018 20:06	WG1069510
Magnesium	21300		100	1000	1	02/05/2018 09:32	WG1069310
Magnesium,Dissolved	22600		100	1000	1	02/05/2018 20:06	WG1069510





Metals (ICPMS) by Method 6020

Analyte	Result ug/l	Qualifier	MDL ug/l	RDL ug/l	Dilution	Analysis date / time	Batch
Manganese	70100		2.50	50.0	10	02/05/2018 15:16	WG1069310
Manganese,Dissolved	67600		50.0	1000	200	02/06/2018 15:37	WG1069510
Nickel	66.2		0.350	2.00	1	02/05/2018 09:32	WG1069310
Nickel,Dissolved	67.3		0.350	2.00	1	02/05/2018 20:06	WG1069510
Potassium	11000		37.0	1000	1	02/05/2018 09:32	WG1069310
Potassium,Dissolved	11400		37.0	1000	1	02/05/2018 20:06	WG1069510
Selenium	2.04		0.380	2.00	1	02/05/2018 09:32	WG1069310
Selenium,Dissolved	5.70		0.380	2.00	1	02/05/2018 20:06	WG1069510
Silver	1.59	U	0.310	2.00	1	02/05/2018 09:32	WG1069310
Silver,Dissolved	0.821	U	0.310	2.00	1	02/05/2018 20:06	WG1069510
Sodium	54500		110	1000	1	02/05/2018 09:32	WG1069310
Sodium,Dissolved	51500		110	1000	1	02/05/2018 20:06	WG1069510
Thallium	14.1		0.190	2.00	1	02/05/2018 09:32	WG1069310
Thallium,Dissolved	15.0		0.190	2.00	1	02/05/2018 20:06	WG1069510
Vanadium	U		0.180	5.00	1	02/05/2018 09:32	WG1069310
Vanadium,Dissolved	U		0.180	5.00	1	02/05/2018 20:06	WG1069510
Zinc	218000		128	1250	50	02/06/2018 16:41	WG1070311
Zinc,Dissolved	229000		512	5000	200	02/06/2018 15:37	WG1069510

¹ Cp² Tc³ Ss⁴ Cn⁵ Sr⁶ Qc⁷ Gl⁸ Al⁹ Sc



Wet Chemistry by Method 2320 B-2011

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Alkalinity	U		2710	20000	1	02/06/2018 19:27	WG1070084

Sample Narrative:

L967354-05 WG1070084: Endpoint pH 4.5

Wet Chemistry by Method 9040C

Analyte	Result	Qualifier	Dilution	Analysis	Batch
	su			date / time	
pH	3.48	T8	1	02/02/2018 16:55	WG1069332

Sample Narrative:

L967354-05 WG1069332: 3.48 at 11.3C

Wet Chemistry by Method 9056A

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Chloride	1390		51.9	1000	1	02/02/2018 23:53	WG1069496
Sulfate	922000		1550	100000	20	02/03/2018 00:04	WG1069496

Mercury by Method 7470A

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Mercury	0.0502	J	0.0490	0.200	1	02/05/2018 16:12	WG1069856
Mercury,Dissolved	U		0.0490	0.200	1	02/05/2018 10:01	WG1069857

Metals (ICPMS) by Method 6020

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Aluminum	9170		5.15	100	1	02/06/2018 15:27	WG1070311
Aluminum,Dissolved	9060		5.15	100	1	02/05/2018 20:10	WG1069510
Antimony	U		0.754	2.00	1	02/05/2018 09:36	WG1069310
Antimony,Dissolved	U		0.754	2.00	1	02/05/2018 20:10	WG1069510
Arsenic	3.44		0.250	2.00	1	02/05/2018 09:36	WG1069310
Arsenic,Dissolved	1.45	J	0.250	2.00	1	02/05/2018 20:10	WG1069510
Barium	8.42		0.360	5.00	1	02/05/2018 09:36	WG1069310
Barium,Dissolved	6.96		0.360	5.00	1	02/05/2018 20:10	WG1069510
Beryllium	3.90		0.120	2.00	1	02/05/2018 09:36	WG1069310
Beryllium,Dissolved	4.13		0.120	2.00	1	02/05/2018 20:10	WG1069510
Cadmium	705		0.160	1.00	1	02/05/2018 09:36	WG1069310
Cadmium,Dissolved	705		0.160	1.00	1	02/05/2018 20:10	WG1069510
Calcium	146000		46.0	1000	1	02/06/2018 15:27	WG1070311
Calcium,Dissolved	148000		46.0	1000	1	02/05/2018 20:10	WG1069510
Chromium	U		0.540	2.00	1	02/05/2018 09:36	WG1069310
Chromium,Dissolved	U		0.540	2.00	1	02/05/2018 20:10	WG1069510
Copper	1100		0.520	5.00	1	02/05/2018 09:36	WG1069310
Copper,Dissolved	1070		0.520	5.00	1	02/05/2018 20:10	WG1069510
Cobalt	139		0.260	2.00	1	02/05/2018 09:36	WG1069310
Cobalt,Dissolved	140		0.260	2.00	1	02/05/2018 20:10	WG1069510
Iron	1200		15.0	100	1	02/05/2018 09:36	WG1069310
Iron,Dissolved	659		15.0	100	1	02/05/2018 20:10	WG1069510
Lead	1450		0.240	2.00	1	02/05/2018 09:36	WG1069310
Lead,Dissolved	1450		0.240	2.00	1	02/05/2018 20:10	WG1069510
Magnesium	21000		100	1000	1	02/05/2018 09:36	WG1069310
Magnesium,Dissolved	22200		100	1000	1	02/05/2018 20:10	WG1069510



Collected date/time: 01/31/18 13:30

L967354

Metals (ICPMS) by Method 6020

Analyte	Result ug/l	Qualifier	MDL ug/l	RDL ug/l	Dilution	Analysis date / time	Batch
Manganese	66600		2.50	50.0	10	02/05/2018 15:20	WG1069310
Manganese,Dissolved	67400		50.0	1000	200	02/06/2018 15:45	WG1069510
Nickel	64.1		0.350	2.00	1	02/05/2018 09:36	WG1069310
Nickel,Dissolved	67.1		0.350	2.00	1	02/05/2018 20:10	WG1069510
Potassium	10800		37.0	1000	1	02/05/2018 09:36	WG1069310
Potassium,Dissolved	11200		37.0	1000	1	02/05/2018 20:10	WG1069510
Selenium	1.72	UL	0.380	2.00	1	02/05/2018 09:36	WG1069310
Selenium,Dissolved	5.10		0.380	2.00	1	02/05/2018 20:10	WG1069510
Silver	1.81	UL	0.310	2.00	1	02/05/2018 09:36	WG1069310
Silver,Dissolved	0.859	UL	0.310	2.00	1	02/05/2018 20:10	WG1069510
Sodium	52900		110	1000	1	02/05/2018 09:36	WG1069310
Sodium,Dissolved	50300		110	1000	1	02/05/2018 20:10	WG1069510
Thallium	14.5		0.190	2.00	1	02/05/2018 09:36	WG1069310
Thallium,Dissolved	15.2		0.190	2.00	1	02/05/2018 20:10	WG1069510
Vanadium	U		0.180	5.00	1	02/05/2018 09:36	WG1069310
Vanadium,Dissolved	U		0.180	5.00	1	02/05/2018 20:10	WG1069510
Zinc	213000		128	1250	50	02/06/2018 16:45	WG1070311
Zinc,Dissolved	228000		512	5000	200	02/06/2018 15:45	WG1069510

¹ Cp² Tc³ Ss⁴ Cn⁵ Sr⁶ Qc⁷ Gl⁸ Al⁹ Sc



Wet Chemistry by Method 2320 B-2011

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Alkalinity	U		2710	20000	1	02/06/2018 19:35	WG1070084

Sample Narrative:

L967354-06 WG1070084: Endpoint pH 4.5

Wet Chemistry by Method 9040C

Analyte	Result	Qualifier	Dilution	Analysis	Batch
	su			date / time	
pH	5.12	<u>T8</u>	1	02/02/2018 16:55	WG1069332

Sample Narrative:

L967354-06 WG1069332: 5.12 at 11.6C

Wet Chemistry by Method 9056A

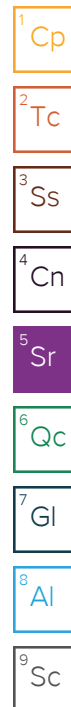
Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Chloride	201	<u>J</u>	51.9	1000	1	02/03/2018 00:15	WG1069496
Sulfate	U		77.4	5000	1	02/03/2018 00:15	WG1069496

Mercury by Method 7470A

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Mercury	U		0.0490	0.200	1	02/05/2018 16:19	WG1069856
Mercury,Dissolved	U		0.0490	0.200	1	02/05/2018 10:03	WG1069857

Metals (ICPMS) by Method 6020

Analyte	Result	Qualifier	MDL	RDL	Dilution	Analysis	Batch
	ug/l		ug/l	ug/l		date / time	
Aluminum	13.7	<u>B J</u>	5.15	100	1	02/06/2018 15:30	WG1070311
Aluminum,Dissolved	16.2	<u>J</u>	5.15	100	1	02/05/2018 20:15	WG1069510
Antimony	U		0.754	2.00	1	02/05/2018 09:40	WG1069310
Antimony,Dissolved	U		0.754	2.00	1	02/05/2018 20:15	WG1069510
Arsenic	0.510	<u>J</u>	0.250	2.00	1	02/05/2018 09:40	WG1069310
Arsenic,Dissolved	0.495	<u>J</u>	0.250	2.00	1	02/05/2018 20:15	WG1069510
Barium	U		0.360	5.00	1	02/05/2018 09:40	WG1069310
Barium,Dissolved	0.730	<u>J</u>	0.360	5.00	1	02/05/2018 20:15	WG1069510
Beryllium	U		0.120	2.00	1	02/05/2018 09:40	WG1069310
Beryllium,Dissolved	U		0.120	2.00	1	02/05/2018 20:15	WG1069510
Cadmium	U		0.160	1.00	1	02/05/2018 09:40	WG1069310
Cadmium,Dissolved	U		0.160	1.00	1	02/05/2018 20:15	WG1069510
Calcium	U		46.0	1000	1	02/06/2018 15:30	WG1070311
Calcium,Dissolved	U		46.0	1000	1	02/05/2018 20:15	WG1069510
Chromium	U		0.540	2.00	1	02/05/2018 09:40	WG1069310
Chromium,Dissolved	U		0.540	2.00	1	02/05/2018 20:15	WG1069510
Copper	0.927	<u>J</u>	0.520	5.00	1	02/05/2018 09:40	WG1069310
Copper,Dissolved	2.62	<u>J</u>	0.520	5.00	1	02/06/2018 14:46	WG1069510
Cobalt	U		0.260	2.00	1	02/05/2018 09:40	WG1069310
Cobalt,Dissolved	U		0.260	2.00	1	02/05/2018 20:15	WG1069510
Iron	U		15.0	100	1	02/05/2018 09:40	WG1069310
Iron,Dissolved	U		15.0	100	1	02/05/2018 20:15	WG1069510
Lead	0.959	<u>B J</u>	0.240	2.00	1	02/05/2018 09:40	WG1069310
Lead,Dissolved	2.28		0.240	2.00	1	02/05/2018 20:15	WG1069510
Magnesium	U		100	1000	1	02/05/2018 09:40	WG1069310
Magnesium,Dissolved	U		100	1000	1	02/05/2018 20:15	WG1069510





Metals (ICPMS) by Method 6020

Analyte	Result ug/l	Qualifier	MDL ug/l	RDL ug/l	Dilution	Analysis date / time	Batch
Manganese	3.88	B J	0.250	5.00	1	02/05/2018 09:40	WG1069310
Manganese,Dissolved	36.8		0.250	5.00	1	02/06/2018 14:46	WG1069510
Nickel	0.379	J	0.350	2.00	1	02/05/2018 09:40	WG1069310
Nickel,Dissolved	U		0.350	2.00	1	02/05/2018 20:15	WG1069510
Potassium	U		37.0	1000	1	02/05/2018 09:40	WG1069310
Potassium,Dissolved	U		37.0	1000	1	02/05/2018 20:15	WG1069510
Selenium	U		0.380	2.00	1	02/05/2018 09:40	WG1069310
Selenium,Dissolved	U		0.380	2.00	1	02/05/2018 20:15	WG1069510
Silver	U		0.310	2.00	1	02/05/2018 09:40	WG1069310
Silver,Dissolved	U		0.310	2.00	1	02/05/2018 20:15	WG1069510
Sodium	295	J	110	1000	1	02/05/2018 09:40	WG1069310
Sodium,Dissolved	U		110	1000	1	02/05/2018 20:15	WG1069510
Thallium	U		0.190	2.00	1	02/05/2018 09:40	WG1069310
Thallium,Dissolved	U		0.190	2.00	1	02/05/2018 20:15	WG1069510
Vanadium	U		0.180	5.00	1	02/05/2018 09:40	WG1069310
Vanadium,Dissolved	U		0.180	5.00	1	02/05/2018 20:15	WG1069510
Zinc	28.9		2.56	25.0	1	02/06/2018 15:30	WG1070311
Zinc,Dissolved	183		2.56	25.0	1	02/06/2018 14:46	WG1069510

1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Qc

7 Gl

8 Al

9 Sc

L967038-05 Original Sample (OS) • Duplicate (DUP)

(OS) L967038-05 02/06/18 18:16 • (DUP) R3284541-1 02/06/18 18:22

	Original Result	DUP Result	Dilution	DUP RPD	DUP Qualifier	DUP RPD Limits
Analyte	ug/l	ug/l		%		%
Alkalinity	256000	255000	1	0.211		20

Sample Narrative:
OS: Endpoint pH 4.5
DUP: Endpoint pH 4.5

L967395-08 Original Sample (OS) • Duplicate (DUP)

(OS) L967395-08 02/07/18 08:05 • (DUP) R3284541-4 02/07/18 08:12

	Original Result	DUP Result	Dilution	DUP RPD	DUP Qualifier	DUP RPD Limits
Analyte	ug/l	ug/l		%		%
Alkalinity	624000	626000	1	0.234		20

Sample Narrative:
OS: Endpoint pH 4.5
DUP: Endpoint pH 4.5

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

(LCS) R3284541-2 02/06/18 19:16 • (LCSD) R3284541-3 02/06/18 20:38

	Spike Amount	LCS Result	LCSD Result	LCS Rec.	LCSD Rec.	Rec. Limits	LCS Qualifier	LCSD Qualifier	RPD	RPD Limits
Analyte	ug/l	ug/l	ug/l	%	%	%			%	%
Alkalinity	100000	95200	105000	95.2	105	85.0-115			9.70	20

Sample Narrative:
LCS: Endpoint pH 4.5
LCSD: Endpoint pH 4.5

1

Cp

2

Tc

3

Ss

4

Cn

5

Sr

6

Qc

7

Gl

8

Al

9

Sc



L966877-01 Original Sample (OS) • Duplicate (DUP)

(OS) L966877-01 02/02/18 16:55 • (DUP) R3283734-3 02/02/18 16:55

	Original Result	DUP Result	Dilution	DUP RPD	DUP Qualifier	DUP RPD Limits
Analyte	su	su		%		%
pH	6.32	6.31	1	0.158		1

Sample Narrative:

OS: 6.32 at 17.7C

DUP: 6.31 at 17.7C

¹Cp

²Tc

³Ss

⁴Cn

⁵Sr

⁶Qc

⁷Gl

⁸Al

⁹Sc

L967182-01 Original Sample (OS) • Duplicate (DUP)

(OS) L967182-01 02/02/18 16:55 • (DUP) R3283734-4 02/02/18 16:55

	Original Result	DUP Result	Dilution	DUP RPD	DUP Qualifier	DUP RPD Limits
Analyte	su	su		%		%
pH	7.49	7.54	1	0.665		1

Sample Narrative:

OS: 7.49 at 15.4C

DUP: 7.54 at 15.4C

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

(LCS) R3283734-1 02/02/18 16:55 • (LCSD) R3283734-2 02/02/18 16:55

	Spike Amount	LCS Result	LCSD Result	LCS Rec.	LCSD Rec.	Rec. Limits	LCS Qualifier	LCSD Qualifier	RPD	RPD Limits
Analyte	su	su	su	%	%	%			%	%
pH	6.38	6.40	6.40	100	100	98.4-102			0.000	1

Sample Narrative:

LCS: 6.4 at 16.5C

LCSD: 6.4 at 16.5C



Method Blank (MB)

(MB) R3283783-1 02/02/18 18:29

	MB Result	MB Qualifier	MB MDL	MB RDL
Analyte	ug/l		ug/l	ug/l
Chloride	U		51.9	1000
Sulfate	U		77.4	5000

L967277-03 Original Sample (OS) • Duplicate (DUP)

(OS) L967277-03 02/02/18 19:59 • (DUP) R3283783-4 02/02/18 20:10

	Original Result	DUP Result	Dilution	DUP RPD	DUP Qualifier	DUP RPD Limits
Analyte	ug/l	ug/l		%		%
Chloride	13100	13500	1	3.13		15
Sulfate	9740	9650	1	0.936		15

L967460-01 Original Sample (OS) • Duplicate (DUP)

(OS) L967460-01 02/03/18 00:25 • (DUP) R3283783-9 02/03/18 00:36

	Original Result	DUP Result	Dilution	DUP RPD	DUP Qualifier	DUP RPD Limits
Analyte	ug/l	ug/l		%		%
Chloride	171	168	1	1.77	J	15
Sulfate	U	231	1	200	J P1	15

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

(LCS) R3283783-2 02/02/18 18:40 • (LCSD) R3283783-3 02/02/18 18:51

	Spike Amount	LCS Result	LCSD Result	LCS Rec.	LCSD Rec.	Rec. Limits	LCS Qualifier	LCSD Qualifier	RPD	RPD Limits
Analyte	ug/l	ug/l	ug/l	%	%	%			%	%
Chloride	40000	39000	38900	97.5	97.3	80-120			0.215	15
Sulfate	40000	38600	38300	96.6	95.7	80-120			0.958	15

L967277-03 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L967277-03 02/02/18 19:59 • (MS) R3283783-5 02/02/18 20:20 • (MSD) R3283783-6 02/02/18 20:31

	Spike Amount	Original Result	MS Result	MSD Result	MS Rec.	MSD Rec.	Dilution	Rec. Limits	MS Qualifier	MSD Qualifier	RPD	RPD Limits
Analyte	ug/l	ug/l	ug/l	ug/l	%	%		%			%	%
Chloride	50000	13100	62000	62500	97.8	98.9	1	80-120			0.902	15
Sulfate	50000	9740	58200	59100	97	98.8	1	80-120			1.56	15

1Cp

2Tc

3Ss

4Cn

5Sr

6Qc

7Gl

8Al

9Sc



[L967354-01,02,03,04,05,06](#)

L967354-03 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L967354-03 02/02/18 22:28 • (MS) R3283783-7 02/02/18 23:11 • (MSD) R3283783-8 02/02/18 23:21

Analyte	Spike Amount ug/l	Original Result ug/l	MS Result ug/l	MSD Result ug/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	<u>MS Qualifier</u>	<u>MSD Qualifier</u>	RPD %	RPD Limits %
Chloride	50000	1060	50100	50800	98.1	99.5	1	80-120			1.45	15
Sulfate	50000	U	643000	631000	1290	1260	1	80-120	E J5	E J5	1.78	15

¹Cp

²Tc

³Ss

⁴Cn

⁵Sr

⁶Qc

⁷Gl

⁸Al

⁹Sc



Method Blank (MB)

(MB) R3284116-1 02/05/18 15:14

	MB Result	MB Qualifier	MB MDL	MB RDL
Analyte	ug/l		ug/l	ug/l
Mercury	U		0.0490	0.200

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

(LCS) R3284116-2 02/05/18 15:23 • (LCSD) R3284116-3 02/05/18 15:26

	Spike Amount	LCS Result	LCSD Result	LCS Rec.	LCSD Rec.	Rec. Limits	LCS Qualifier	LCSD Qualifier	RPD	RPD Limits
Analyte	ug/l	ug/l	ug/l	%	%	%			%	%
Mercury	3.00	3.04	2.99	101	99.7	80-120			1.67	20

L967331-02 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L967331-02 02/05/18 15:28 • (MS) R3284116-4 02/05/18 15:31 • (MSD) R3284116-5 02/05/18 15:33

	Spike Amount	Original Result	MS Result	MSD Result	MS Rec.	MSD Rec.	Dilution	Rec. Limits	MS Qualifier	MSD Qualifier	RPD	RPD Limits
Analyte	ug/l	ug/l	ug/l	ug/l	%	%		%			%	%
Mercury	3.00	0.0786	3.15	3.07	102	99.6	1	75-125			2.74	20

L967354-03 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L967354-03 02/05/18 15:35 • (MS) R3284116-6 02/05/18 15:38 • (MSD) R3284116-7 02/05/18 15:40

	Spike Amount	Original Result	MS Result	MSD Result	MS Rec.	MSD Rec.	Dilution	Rec. Limits	MS Qualifier	MSD Qualifier	RPD	RPD Limits
Analyte	ug/l	ug/l	ug/l	ug/l	%	%		%			%	%
Mercury	3.00	U	3.10	2.96	103	98.6	1	75-125			4.7	20

¹Cp

²Tc

³Ss

⁴Cn

⁵Sr

⁶Qc

⁷Gl

⁸Al

⁹Sc



Method Blank (MB)

(MB) R3283967-1 02/05/18 08:58

	MB Result	MB Qualifier	MB MDL	MB RDL
Analyte	ug/l		ug/l	ug/l
Mercury,Dissolved	U		0.0490	0.200

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

(LCS) R3283967-2 02/05/18 09:01 • (LCSD) R3283967-3 02/05/18 09:03

	Spike Amount	LCS Result	LCSD Result	LCS Rec.	LCSD Rec.	Rec. Limits	LCS Qualifier	LCSD Qualifier	RPD	RPD Limits
Analyte	ug/l	ug/l	ug/l	%	%	%			%	%
Mercury,Dissolved	3.00	2.74	2.60	91.3	86.6	80-120			5.28	20

L967331-02 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L967331-02 02/05/18 09:05 • (MS) R3283967-4 02/05/18 09:08 • (MSD) R3283967-5 02/05/18 09:10

	Spike Amount	Original Result	MS Result	MSD Result	MS Rec.	MSD Rec.	Dilution	Rec. Limits	MS Qualifier	MSD Qualifier	RPD	RPD Limits
Analyte	ug/l	ug/l	ug/l	ug/l	%	%		%			%	%
Mercury,Dissolved	3.00	U	2.65	2.57	88.4	85.6	1	75-125			3.22	20

L967354-03 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L967354-03 02/05/18 09:13 • (MS) R3283967-6 02/05/18 09:15 • (MSD) R3283967-7 02/05/18 09:17

	Spike Amount	Original Result	MS Result	MSD Result	MS Rec.	MSD Rec.	Dilution	Rec. Limits	MS Qualifier	MSD Qualifier	RPD	RPD Limits
Analyte	ug/l	ug/l	ug/l	ug/l	%	%		%			%	%
Mercury,Dissolved	3.00	U	2.66	2.65	88.6	88.4	1	75-125			0.222	20

1Cp

2Tc

3Ss

4Cn

5Sr

6Qc

7Gl

8Al

9Sc



Method Blank (MB)

(MB) R3284023-1 02/05/18 08:01

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Antimony	U		0.754	2.00
Arsenic	U		0.250	2.00
Barium	0.781	U	0.360	5.00
Beryllium	U		0.120	2.00
Cadmium	U		0.160	1.00
Chromium	U		0.540	2.00
Copper	U		0.520	5.00
Cobalt	U		0.260	2.00
Iron	U		15.0	100
Lead	1.04	U	0.240	2.00
Magnesium	U		100	1000
Manganese	0.419	U	0.250	5.00
Nickel	U		0.350	2.00
Potassium	53.0	U	37.0	1000
Selenium	U		0.380	2.00
Silver	U		0.310	2.00
Sodium	U		110	1000
Thallium	U		0.190	2.00
Vanadium	0.195	U	0.180	5.00

1Cp

2Tc

3Ss

4Cn

5Sr

6Qc

7Gl

8Al

9Sc

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

(LCS) R3284023-2 02/05/18 08:05 • (LCSD) R3284023-3 02/05/18 08:09

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Antimony	50.0	50.6	48.4	101	96.8	80-120			4.45	20
Arsenic	50.0	51.3	51.7	103	103	80-120			0.795	20
Barium	50.0	49.5	49.8	99	99.6	80-120			0.599	20
Beryllium	50.0	51.6	50.2	103	100	80-120			2.85	20
Cadmium	50.0	54.1	51.9	108	104	80-120			4.16	20
Chromium	50.0	53.1	54.8	106	110	80-120			3.06	20
Copper	50.0	54.1	53.8	108	108	80-120			0.576	20
Cobalt	50.0	54.2	54.8	108	110	80-120			1.16	20
Iron	5000	5100	5150	102	103	80-120			0.95	20
Lead	50.0	51.8	51.5	104	103	80-120			0.573	20
Magnesium	5000	5360	5230	107	105	80-120			2.58	20
Manganese	50.0	50.7	51.8	101	104	80-120			2.2	20
Nickel	50.0	54.3	56.1	109	112	80-120			3.26	20
Potassium	5000	5530	5160	111	103	80-120			7	20



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

(LCS) R3284023-2 02/05/18 08:05 • (LCSD) R3284023-3 02/05/18 08:09

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	<u>LCS Qualifier</u>	<u>LCSD Qualifier</u>	RPD %	RPD Limits %
Selenium	50.0	51.8	54.8	104	110	80-120			5.68	20
Silver	50.0	52.6	52.5	105	105	80-120			0.0515	20
Sodium	5000	5410	5300	108	106	80-120			1.95	20
Thallium	50.0	51.0	50.9	102	102	80-120			0.218	20
Vanadium	50.0	51.8	52.6	104	105	80-120			1.66	20

L967487-06 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L967487-06 02/05/18 08:13 • (MS) R3284023-5 02/05/18 08:20 • (MSD) R3284023-6 02/05/18 08:24

Analyte	Spike Amount ug/l	Original Result ug/l	MS Result ug/l	MSD Result ug/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	<u>MS Qualifier</u>	<u>MSD Qualifier</u>	RPD %	RPD Limits %
Antimony	50.0	ND	51.0	50.0	102	100	1	75-125			1.9	20
Arsenic	50.0	ND	52.5	53.1	103	104	1	75-125			1.1	20
Barium	50.0	27.3	74.7	77.9	94.9	101	1	75-125			4.14	20
Beryllium	50.0	ND	49.6	51.5	99.2	103	1	75-125			3.72	20
Cadmium	50.0	ND	53.1	54.7	104	108	1	75-125			3.05	20
Chromium	50.0	ND	53.5	54.4	103	105	1	75-125			1.72	20
Copper	50.0	ND	53.2	54.2	104	106	1	75-125			1.92	20
Cobalt	50.0	50.2	104	105	107	110	1	75-125			1.76	20
Potassium	5000	2250	7320	7420	102	103	1	75-125			1.25	20
Iron	5000	ND	5120	5180	101	102	1	75-125			1.21	20
Lead	50.0	3.37	51.2	54.9	95.7	103	1	75-125			6.85	20
Magnesium	5000	2060	7120	7390	101	106	1	75-125			3.73	20
Manganese	50.0	3690	3710	3670	31.3	0	1	75-125	V	V	1.04	20
Nickel	50.0	7.37	61.3	62.1	108	109	1	75-125			1.24	20
Selenium	50.0	ND	53.0	52.8	105	105	1	75-125			0.286	20
Silver	50.0	ND	51.9	53.1	104	106	1	75-125			2.15	20
Sodium	5000	5530	10500	10700	99.3	104	1	75-125			2.13	20
Thallium	50.0	ND	51.2	51.8	101	103	1	75-125			1.24	20
Vanadium	50.0	ND	51.0	51.2	101	102	1	75-125			0.501	20

1Cp

2Tc

3Ss

4Cn

5Sr

6Qc

7Gl

8Al

9Sc

Method Blank (MB)

(MB) R3284170-1 02/05/18 18:27

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Aluminum,Dissolved	U		5.15	100
Antimony,Dissolved	U		0.754	2.00
Arsenic,Dissolved	U		0.250	2.00
Barium,Dissolved	U		0.360	5.00
Beryllium,Dissolved	U		0.120	2.00
Cadmium,Dissolved	U		0.160	1.00
Calcium,Dissolved	U		46.0	1000
Chromium,Dissolved	U		0.540	2.00
Cobalt,Dissolved	U		0.260	2.00
Iron,Dissolved	U		15.0	100
Lead,Dissolved	U		0.240	2.00
Magnesium,Dissolved	U		100	1000
Nickel,Dissolved	U		0.350	2.00
Potassium,Dissolved	U		37.0	1000
Selenium,Dissolved	U		0.380	2.00
Silver,Dissolved	U		0.310	2.00
Sodium,Dissolved	U		110	1000
Thallium,Dissolved	U		0.190	2.00
Vanadium,Dissolved	U		0.180	5.00

¹Cp

²Tc

³Ss

⁴Cn

⁵Sr

⁶Qc

⁷Gl

⁸Al

⁹Sc

Method Blank (MB)

(MB) R3284403-1 02/06/18 13:09

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Copper,Dissolved	U		0.520	5.00
Manganese,Dissolved	U		0.250	5.00
Zinc,Dissolved	U		2.56	25.0

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

(LCS) R3284170-2 02/05/18 18:31 • (LCSD) R3284170-3 02/05/18 18:36

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Aluminum,Dissolved	5000	5170	5160	103	103	80-120			0.357	20
Antimony,Dissolved	50.0	48.6	48.3	97.2	96.5	80-120			0.692	20
Arsenic,Dissolved	50.0	51.6	51.0	103	102	80-120			1.07	20
Barium,Dissolved	50.0	47.8	47.2	95.6	94.4	80-120			1.3	20
Beryllium,Dissolved	50.0	50.8	50.8	102	102	80-120			0.13	20

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

(LCS) R3284170-2 02/05/18 18:31 • (LCSD) R3284170-3 02/05/18 18:36

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	<u>LCS Qualifier</u>	<u>LCSD Qualifier</u>	RPD %	RPD Limits %
Cadmium,Dissolved	50.0	52.8	53.2	106	106	80-120			0.74	20
Calcium,Dissolved	5000	5110	5230	102	105	80-120			2.33	20
Chromium,Dissolved	50.0	53.4	53.3	107	107	80-120			0.32	20
Cobalt,Dissolved	50.0	54.5	54.4	109	109	80-120			0.251	20
Iron,Dissolved	5000	5540	5450	111	109	80-120			1.7	20
Lead,Dissolved	50.0	51.2	51.3	102	103	80-120			0.0451	20
Magnesium,Dissolved	5000	5460	5450	109	109	80-120			0.296	20
Nickel,Dissolved	50.0	54.1	54.1	108	108	80-120			0.16	20
Potassium,Dissolved	5000	5240	5220	105	104	80-120			0.313	20
Selenium,Dissolved	50.0	52.1	51.9	104	104	80-120			0.392	20
Silver,Dissolved	50.0	52.0	52.2	104	104	80-120			0.372	20
Sodium,Dissolved	5000	5170	5190	103	104	80-120			0.397	20
Thallium,Dissolved	50.0	52.0	53.0	104	106	80-120			1.91	20
Vanadium,Dissolved	50.0	52.2	51.9	104	104	80-120			0.679	20

1

Cp

2

Tc

3

Ss

4

Cn

5

Sr

6

Qc

7

Gl

8

Al

9

Sc

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

(LCS) R3284403-2 02/06/18 13:12 • (LCSD) R3284403-3 02/06/18 13:16

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	<u>LCS Qualifier</u>	<u>LCSD Qualifier</u>	RPD %	RPD Limits %
Copper,Dissolved	50.0	52.4	52.4	105	105	80-120			0.0908	20
Manganese,Dissolved	50.0	50.4	50.3	101	101	80-120			0.259	20
Zinc,Dissolved	50.0	53.5	54.0	107	108	80-120			0.855	20

L967354-03 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L967354-03 02/05/18 18:40 • (MS) R3284170-5 02/05/18 18:49 • (MSD) R3284170-6 02/05/18 18:53

Analyte	Spike Amount ug/l	Original Result ug/l	MS Result ug/l	MSD Result ug/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	<u>MS Qualifier</u>	<u>MSD Qualifier</u>	RPD %	RPD Limits %
Aluminum,Dissolved	5000	415	5460	5420	101	100	1	75-125			0.735	20
Antimony,Dissolved	50.0	U	49.5	50.9	99	102	1	75-125			2.72	20
Arsenic,Dissolved	50.0	8.52	58.8	59.3	101	102	1	75-125			0.857	20
Barium,Dissolved	50.0	15.0	63.8	64.2	97.5	98.3	1	75-125			0.637	20
Beryllium,Dissolved	50.0	3.76	54.8	55.0	102	102	1	75-125			0.302	20
Cadmium,Dissolved	50.0	115	167	170	104	111	1	75-125			1.98	20
Calcium,Dissolved	5000	191000	195000	195000	80.1	87.3	1	75-125			0.185	20
Chromium,Dissolved	50.0	U	51.3	51.8	103	104	1	75-125			0.901	20
Cobalt,Dissolved	50.0	33.2	84.8	85.7	103	105	1	75-125			1.05	20
Potassium,Dissolved	5000	5110	10400	10300	106	103	1	75-125			1.35	20



[L967354-01,02,03,04,05,06](#)

L967354-03 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L967354-03 02/05/18 18:40 • (MS) R3284170-5 02/05/18 18:49 • (MSD) R3284170-6 02/05/18 18:53

Analyte	Spike Amount ug/l	Original Result ug/l	MS Result ug/l	MSD Result ug/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Iron,Dissolved	5000	3100	8160	8260	101	103	1	75-125			1.26	20
Lead,Dissolved	50.0	1310	1350	1340	82.3	72	1	75-125		V	0.381	20
Magnesium,Dissolved	5000	12900	18000	18000	103	104	1	75-125			0.0591	20
Nickel,Dissolved	50.0	12.9	65.6	65.8	105	106	1	75-125			0.265	20
Selenium,Dissolved	50.0	2.79	56.1	54.4	107	103	1	75-125			3.15	20
Silver,Dissolved	50.0	0.386	51.2	53.0	102	105	1	75-125			3.53	20
Sodium,Dissolved	5000	53100	57900	57900	95.3	95.8	1	75-125			0.0429	20
Thallium,Dissolved	50.0	3.44	54.2	55.2	101	104	1	75-125			1.97	20
Vanadium,Dissolved	50.0	U	51.1	51.6	102	103	1	75-125			1.09	20

L967354-03 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L967354-03 02/06/18 13:20 • (MS) R3284403-5 02/06/18 13:27 • (MSD) R3284403-6 02/06/18 13:31

Analyte	Spike Amount ug/l	Original Result ug/l	MS Result ug/l	MSD Result ug/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	MS Qualifier	MSD Qualifier	RPD %	RPD Limits %
Copper,Dissolved	50.0	24.4	72.6	73.5	96.4	98.3	1	75-125			1.29	20
Manganese,Dissolved	50.0	13900	13700	13700	0	0	1	75-125	E V	E V	0.00277	20
Zinc,Dissolved	50.0	46000	45200	45300	0	0	1	75-125	E V	E V	0.382	20

1Cp

2Tc

3Ss

4Cn

5Sr

6Qc

7Gl

8Al

9Sc



Method Blank (MB)

(MB) R3284425-1 02/06/18 13:57

Analyte	MB Result ug/l	MB Qualifier	MB MDL ug/l	MB RDL ug/l
Aluminum	12.1	⌋	5.15	100
Antimony	U		0.754	2.00
Arsenic	0.784	⌋	0.250	2.00
Barium	0.880	⌋	0.360	5.00
Beryllium	0.743	⌋	0.120	2.00
Cadmium	0.809	⌋	0.160	1.00
Calcium	96.6	⌋	46.0	1000
Chromium	0.862	⌋	0.540	2.00
Copper	1.11	⌋	0.520	5.00
Cobalt	0.772	⌋	0.260	2.00
Iron	15.1	⌋	15.0	100
Lead	0.940	⌋	0.240	2.00
Magnesium	U		100	1000
Manganese	2.28	⌋	0.250	5.00
Nickel	0.833	⌋	0.350	2.00
Potassium	559	⌋	37.0	1000
Selenium	0.899	⌋	0.380	2.00
Sodium	173	⌋	110	1000
Thallium	0.759	⌋	0.190	2.00
Vanadium	0.689	⌋	0.180	5.00
Zinc	U		2.56	25.0

1Cp

2Tc

3Ss

4Cn

5Sr

6Qc

7Gl

8Al

9Sc

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

(LCS) R3284425-2 02/06/18 14:01 • (LCSD) R3284425-3 02/06/18 14:04

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	LCS Qualifier	LCSD Qualifier	RPD %	RPD Limits %
Aluminum	5000	5010	4990	100	99.8	80-120			0.451	20
Antimony	50.0	49.2	48.9	98.5	97.8	80-120			0.736	20
Arsenic	50.0	50.1	50.1	100	100	80-120			0.0303	20
Barium	50.0	49.2	49.2	98.4	98.3	80-120			0.0764	20
Beryllium	50.0	46.9	47.0	93.8	93.9	80-120			0.155	20
Cadmium	50.0	51.5	51.6	103	103	80-120			0.143	20
Calcium	5000	5120	5100	102	102	80-120			0.29	20
Chromium	50.0	51.2	51.0	102	102	80-120			0.385	20
Copper	50.0	52.7	52.1	105	104	80-120			1.18	20
Cobalt	50.0	52.5	52.2	105	104	80-120			0.419	20
Iron	5000	5140	5130	103	103	80-120			0.0414	20
Lead	50.0	49.3	48.4	98.6	96.8	80-120			1.87	20



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

(LCS) R3284425-2 02/06/18 14:01 • (LCSD) R3284425-3 02/06/18 14:04

Analyte	Spike Amount ug/l	LCS Result ug/l	LCSD Result ug/l	LCS Rec. %	LCSD Rec. %	Rec. Limits %	<u>LCS Qualifier</u>	<u>LCSD Qualifier</u>	RPD %	RPD Limits %
Magnesium	5000	5110	5100	102	102	80-120			0.204	20
Manganese	50.0	50.3	49.2	101	98.5	80-120			2.15	20
Nickel	50.0	53.0	52.9	106	106	80-120			0.213	20
Potassium	5000	5610	5820	112	116	80-120			3.68	20
Selenium	50.0	51.6	50.0	103	100	80-120			3.2	20
Sodium	5000	5400	5400	108	108	80-120			0.0702	20
Thallium	50.0	50.4	49.6	101	99.3	80-120			1.61	20
Vanadium	50.0	49.9	49.8	99.8	99.6	80-120			0.139	20
Zinc	50.0	52.8	53.1	106	106	80-120			0.577	20

L967354-03 Original Sample (OS) • Matrix Spike (MS) • Matrix Spike Duplicate (MSD)

(OS) L967354-03 02/06/18 14:08 • (MS) R3284425-5 02/06/18 14:15 • (MSD) R3284425-6 02/06/18 14:19

Analyte	Spike Amount ug/l	Original Result ug/l	MS Result ug/l	MSD Result ug/l	MS Rec. %	MSD Rec. %	Dilution	Rec. Limits %	<u>MS Qualifier</u>	<u>MSD Qualifier</u>	RPD %	RPD Limits %
Aluminum	5000	407	5440	5440	101	101	1	75-125			0.0987	20
Antimony	50.0	U	50.4	50.9	101	102	1	75-125			1.04	20
Arsenic	50.0	8.06	56.3	57.3	96.5	98.4	1	75-125			1.68	20
Barium	50.0	14.9	63.8	64.9	97.9	100	1	75-125			1.75	20
Beryllium	50.0	3.62	49.8	49.9	92.3	92.7	1	75-125			0.37	20
Cadmium	50.0	113	165	167	103	107	1	75-125			1.23	20
Calcium	5000	192000	196000	196000	69.8	66.2	1	75-125	V	V	0.0907	20
Chromium	50.0	U	49.2	50.2	98.4	100	1	75-125			1.98	20
Copper	50.0	24.4	74.7	75.7	101	103	1	75-125			1.3	20
Cobalt	50.0	31.9	82.1	83.8	100	104	1	75-125			2.05	20
Potassium	5000	4890	10500	10500	113	112	1	75-125			0.617	20
Iron	5000	2910	7840	8020	98.5	102	1	75-125			2.3	20
Lead	50.0	1260	1300	1310	92.7	96.4	1	75-125			0.14	20
Magnesium	5000	12600	18100	18000	109	108	1	75-125			0.358	20
Manganese	50.0	13700	13400	13500	0	0	1	75-125	EV	EV	0.965	20
Nickel	50.0	12.6	63.9	64.1	103	103	1	75-125			0.292	20
Selenium	50.0	2.83	52.9	53.5	100	101	1	75-125			1.09	20
Sodium	5000	53100	58800	58400	114	107	1	75-125			0.587	20
Thallium	50.0	3.38	52.6	53.7	98.5	101	1	75-125			2.01	20
Vanadium	50.0	U	49.3	50.0	98.6	100	1	75-125			1.4	20
Zinc	50.0	45200	44800	44600	0	0	1	75-125	EV	EV	0.664	20

1Cp

2Tc

3Ss

4Cn

5Sr

6Qc

7Gl

8Al

9Sc



Guide to Reading and Understanding Your Laboratory Report

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

Abbreviations and Definitions

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

Qualifier Description

B	The same analyte is found in the associated blank.
E	The analyte concentration exceeds the upper limit of the calibration range of the instrument established by the initial calibration (ICAL).
J	The identification of the analyte is acceptable; the reported value is an estimate.
J5	The sample matrix interfered with the ability to make any accurate determination; spike value is high.
P1	RPD value not applicable for sample concentrations less than 5 times the reporting limit.
T8	Sample(s) received past/too close to holding time expiration.
V	The sample concentration is too high to evaluate accurate spike recoveries.

1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Qc

7 GI

8 AI

9 Sc



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

State Accreditations

Alabama	40660	Nevada	TN-03-2002-34
Alaska	UST-080	New Hampshire	2975
Arizona	AZ0612	New Jersey-NELAP	TN002
Arkansas	88-0469	New Mexico	TN00003
California	01157CA	New York	11742
Colorado	TN00003	North Carolina	Env375
Connecticut	PH-0197	North Carolina ¹	DW21704
Florida	E87487	North Carolina ²	41
Georgia	NELAP	North Dakota	R-140
Georgia ¹	923	Ohio-VAP	CL0069
Idaho	TN00003	Oklahoma	9915
Illinois	200008	Oregon	TN200002
Indiana	C-TN-01	Pennsylvania	68-02979
Iowa	364	Rhode Island	221
Kansas	E-10277	South Carolina	84004
Kentucky ¹	90010	South Dakota	n/a
Kentucky ²	16	Tennessee ¹⁴	2006
Louisiana	AI30792	Texas	T 104704245-07-TX
Maine	TN0002	Texas ⁵	LAB0152
Maryland	324	Utah	6157585858
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	109
Minnesota	047-999-395	Washington	C1915
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	9980939910
Montana	CERT0086	Wyoming	A2LA
Nebraska	NE-OS-15-05		

Third Party Federal Accreditations

A2LA – ISO 17025	1461.01	AIHA-LAP, LLC	100789
A2LA – ISO 17025 ⁵	1461.02	DOD	1461.01
Canada	1461.01	USDA	S-67674
EPA-Crypto	TN00003		

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

Our Locations

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

