LOGAN WASH MINE
ANNUAL REPORT

Mine Permit No. M-1977-424
Anniversary Date: March 28, 2019

Prepared for

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WWL Project No. 10202.01

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1.0 Introduction

This annual report has been prepared in accordance with regulations of the State of Colorado Division of Reclamation, Mining and Safety (DRMS) and the regulations promulgated by the Colorado Mined Land Reclamation Board. The information presented in this report pertains to the period March 28, 2018 to March 27, 2019 (reporting period). Projected reclamation activities for the following year are also presented.

The Logan Wash Mine, located approximately 12 miles northeast of De Beque, Colorado, is managed by Glenn Springs Holdings, Inc. (GSHI) for Occidental Oil Shale, Inc. (OOSI). The main mine portals are located in Section 25, Township 7 South, Range 97 West. A general site location map for the Logan Wash Mine is presented in Figure 1.

This annual report summarizes the reclamation status of the Logan Wash Mine. The Logan Wash Mine is currently under closure and reclamation status. During the reporting period reclamation and maintenance work was conducted on the OOSI property. GSHI anticipates reclamation maintenance activities to continue in 2019.

In 2006, at the request of DRMS, OOSI prepared and submitted Amendment No. 1: Retort Water Pipeline and Evaporation Pond. Although these structures were constructed in 1984 after receiving permits from the U.S. Bureau of Land Management (BLM) and Garfield County, for unknown reasons the structures were not incorporated into the existing mine permit. On August 5th, 2008, DRMS approved the amendment and granted OOSI a 10-year extension of the reclamation period for Logan Wash Mine. This extension will allow for the potential further attenuation of solutes in the retort discharge water and allow OOSI to evaluate viable alternatives for final mine closure. The extension granted in 2008 has since expired. An extension request for the reclamation period for the Logan Wash Mine will be submitted in 2019.

The remainder of this annual report is organized as follows:

- Section 2: Disturbed Acreage Status
- Section 3: Monitoring Activities in 2018
- Section 4: Reclamation Activities in 2018
- Section 5: Maintenance Activities in 2018
- Section 6: Anticipated Reclamation in the Year 2019
- Section 7: Anticipated Disturbance in the Year 2019
- Section 8: Threatened Species Designation

Please refer to Figure 1, the Logan Wash Mine Location Map, Figure 2, Logan Wash Mine Facilities, and Figure 3, the Logan Wash Mine Monitoring Wells for features discussed in this report. This report also refers to Exhibit E, the original reclamation plan, and Exhibit F, the reclamation map. Please see Exhibit E in the permit document files; a copy of Exhibit F is attached. In the report text, all acreage amounts have been rounded to the nearest tenth of an acre. Due to different interpretations of actual disturbed areas, measurement methods that have evolved over the years, and rounding, the interpreted total disturbed acreage, estimated acres reclaimed, acres released, and acres under reclamation may not sum perfectly.

2.0 Disturbed Acreage Status

During the reporting period no additional acreage was disturbed. According to Exhibit E of the Reclamation Plan (1981) for Logan Wash Mine, 134.7 acres were approved for disturbance within the permit area with an actual disturbance of 113.6 acres. This acreage has been revised to account for subsequent new disturbance and incorporation of the Evaporation Pond (Amendment No. 1) into the permit. See Table 1.0 for a summary of acreage reclamation status.

Annual reports have shown since at least 1985 that Area 23, Evaporation Pond and Pipeline, was initially a 14.8-acre disturbance. The 1985 annual report shows that approximately 5.1 acres of this acreage was reclaimed prior to the report's published date in spring 1986. Table 1.0 shows the Evaporation Pond and Pipeline acreage as Area 23. Table 1.0 also shows the disturbed acreage for the Soil Barrow Area that was added in 2005.

Based on this total acreage and reclamation performed, Table 1.0 shows that the estimated actual disturbed acreage was approximately 135.2 acres and of this amount, 61.7 acres are not to be reclaimed because Logan Wash Road is to remain in place for other users, also a parcel of land was transferred to Chevron. This results in an approximate total of 73.5 acres requiring reclamation.

Historical documentation appears incomplete on the warrantee release of all reclamation areas at the mine. However, site inspections show that some original reclamation areas would readily qualify for warranty release and, in fact, may have been released. Documented releases are discussed in Section 2.4. In a DRMS warrantee release letter of January, 2006, DRMS stated that areas remaining as not reclaimed and not released are Areas 1, 2, 3, 4, 10, portions of Area 13, and the Soil Barrow Area. DRMS stated that the total adjusted remaining acreage for roads was estimated to be 10 acres, including road fill sidecast material areas; and that the total remaining acreage requiring reclamation (affected area) was 38.25 acres, including the Evaporation Pond. Calculations for this report indicate a slightly greater unreclaimed acreage of approximately 42.5 acres.

Figures 4A and 4B illustrate the current reclamation status of disturbed areas and roads. The reclamation status of previously disturbed areas is discussed below.

2.1 Mine Areas

Other than roads and the Evaporation Pond and associated retort pipeline, the Lower Bench is the only remaining mine area (Area 1) that is not reclaimed. This area consists of 2.1 acres and is currently being used as mine access to monitor hydrological stations and general revegetation progress at other parts of the mine property.

2.2 Roads

2.2.1 Area 18: Logan Wash Access Road

Disturbed acreage associated with the Logan Wash Road or the "tramroad" was originally shown in the mine permit to be 53.4 acres. This road extends from its intersection with Road 45 up Logan Wash to and beyond the mine property. BLM records indicate that the original Logan

Wash Road right-of-way (COC-223027) was 58.6 acres and includes all of the Upper Access Road up to the BLM-OOSI property boundary near the intersection of the Upper and Lower Bench Roads. However, the OOSI reclamation plan included the Upper Access Road in Area 13, Miscellaneous Access Roads.

A number of road turn-outs or cut and fill areas were constructed along Logan Wash Road and these areas were included in revised versions of the mine permit. These areas are shown as "B1-B-10" in Table 1. Reclamation of the main Logan Wash Road is not planned as this road is used by the public and for energy industry access.

In the early 1980's OOSI realigned portions of the Logan Wash Road. The realignment took place at several road segments, B1 through B10. The estimated acreage disturbance was approximately 6.0 acres. All of these segments, except B2, B3, B7, and B8 were released in 1986. Areas B2, B3, B7 and B8 have revegetated completely and will be submitted for warranty release in the near future.

It is anticipated that the Upper Access Road will be reclaimed at the appropriate time. The Upper Access Road extends from the main Logan Wash Road to the Research Mine and beyond to the intersection with the Upper Bench Road and Lower Bench Road; it is estimated to consist of 4.8 acres.

2.1.2 Area 13: Miscellaneous Access Roads

Documentation that defines the locations of the Miscellaneous Access Roads (Area 13) in detail in the original reclamation plan is limited (see Table 2). Based on field observations, a number of older roads have been reclaimed and are no longer used. These roads are located on the slope above the Upper Bench and on the slope between the Upper Access Road and the Lower Access Road (see Figure 4A). It is uncertain what portions of these roads have been released from warranty, but it is assumed that some were released in 1986 because of their association with other areas released at that time.

The remaining and existing roads that may have been included in Area 13 are: 1) Upper Access Road, 4.8 acres; 2) Lower Access Road, 1.8 acres; 3) Upper Bench Road, 1.4 acres; 4) Lower Bench Road, 1.5 acres; and 5) Evaporation Pond Road, 1.3 acres. The lower portion of the Lower Access Road (approximately 1.36 acres) was associated with the Heater/Treater reclamation area (Table 2). These acreages have been estimated using GIS methods and assuming an average road width of 24 feet. Of these roads, the Upper Bench Road and a portion of the Lower Access road were revegetated in 2005 and will be submitted for warranty release in the near future. All other unreclaimed roads shall remain open for use in 2019. Therefore, the total estimated unreleased acreage for Area 13, Miscellaneous Access Roads, is 10.8 acres. This acreage is close to the acreage estimated by DRMS in January 2006 (10 acres).

2.3 Structures

2.3.1 Vaults, Pipelines, and Evaporation Pond

Structures that remain at the mine site include two vault structures, one on the Lower Bench and one on the Research Mine Bench, one sealed ventilation shaft, and one capped and vented ventilation shaft. Pipelines include 1) the retort water pipeline which conveys retort mine water from the sealed L-1 portal at the mine site to the Evaporation Pond; 2) the Logan Wash Mine mine water drainage pipeline (LW-001) which extends from the sealed L1 portal to the Lower

Bench Vault and then to an infiltration gallery on the Lower Bench; and 3) the Research Mine mine water drainage pipeline (LW-002) which extends from the sealed Research Mine portal through the Research Mine Vault to the Lower Bench Vault and on to Lower Bench discharge point. See Figure 2 for the locations of these structures. The retort water (LW-Retort) and mine water (LW-001) and sampled for water quality at the Lower Bench Vault on a semi-annual basis.

The two bench vaults are administered as confined space concrete structures with surface access-ways constructed just above grade. Depending on the final mine closure method, these structures may remain as permanent structures on the mine site to manage and monitor mine water drainage.

The retort water pipeline was constructed with manhole clean-outs approximately every 600 feet; two manholes, the Upper Manhole and Lower Manhole, are accessed periodically to measure retort water discharge rates. The Upper Manhole is located in the vicinity of the former Heater Treater (Area 15), in the upper part of Logan Wash near the confluence with Dry Gulch. The Lower Manhole is located immediately north of the Evaporation Pond, approximately 40 feet from the pond gate. Other manholes exist on the retort water pipeline that are buried by shallow road fill, colluvium, and vegetative litter, and have not been accessed in recent years.

2.3.2 Monitoring Wells

Monitoring wells associated with the Logan Wash Mine were constructed within and outside of the immediate mine area. Past reconnaissance has been conducted to locate and confirm the existence of these well sites. Eight wells were located and identified within the mine area and within Logan Wash. Several other wells were located at some distance from the mine (see Figure 3 and Table 3). Of the 8 identified wells in the mine area, two wells, Well LWCW-1A and Well LW-22A, will remain in place as monitoring wells until final permit closure. Well LWCW-1A and LW-22A are sampled for water quality on a semi-annual basis.

Wells LW-108, LW-112, and LW-242 were abandoned in 2005 in accordance with Colorado Division of Water Resources rules. The other 4 wells, LW-32, LW-45, and LW-116, remain in place in the case they may be of value in the evaluation of mine closure investigations. Casing access and downhole conditions are unknown for wells LW-32, LW-45, and LW-116. Reconnaissance to date has not revealed any other monitoring wells within the permit area and the Logan Wash drainage.

Reconnaissance for wells located outside the permitted area in distant drainages was conducted in past reporting periods. Wells LW-102 and LW-243 were located in Smith Gulch, Well LW-103 was located in Kelly Gulch, and Well LW-104 was located in Riley Gulch. Well LW-121, apparently constructed in Bowdish Gulch, was not located after a thorough search and is assumed abandoned. Wells LW-102, LW-104 and LW-243 were abandoned in 2007. Table 3 shows the status of well abandonment as of this reporting period.

2.4 Status Summary

2.4.1 Areas Released of Warranty

Reclamation areas released of warranty by DRMS include: Areas 5, 7, 21, and 22, and areas A5, A7, A21, A22, B1, B4, B6, B9, B10, and B11. A areas have not been located on historical documents. B areas refer to Logan Wash Road realignments and other cut and fill areas that were released on September 30th, 1986. Areas 6, 8, 9, 12, 14, 15, 16, 17, 19, 20 and a portion of Area 13 (roads) (12.64 acres) were released on January 12th, 2006. A total of approximately 29.4 acres

have been released of warranty. A summary of the estimated unreclaimed acreage at Logan Wash Mine is shown in Table 4.

2.4.2 Areas Under Reclamation

Areas in a state of reclamation (revegetation in progress) but not submitted for release to DRMS in the permit include Areas 1, 2, 3, 4, 10, and the 0.65-acre Soil Barrow Area, portions of Area 13, and road Areas B2, B3, B7 and B8. Areas 1 through 4 include the Upper and Lower Mine Dumps (face areas), Upper Mine Bench, Lower Mine Bench, and the Research Mine Bench and Dump, respectively. Area 10 is the former Helo Pad. Area 13 is Miscellaneous Access Roads. Areas under reclamation at this time total approximately 21.4 acres (see Table 5). Area 11, the Guard Gate, and Area 18, Logan Wash Road will not be reclaimed.

The Lower Access Road (1.8 acres) of Area 13 was initially revegetated in the fall of 2005. However, cattle grazing and dry conditions prevented the lower portion of the Lower Access Road from revegetating (approximately 1.4 acres). This was not reseeded as the road is now being used to access the Upper Manhole and monitor Well LWCW-1A on a regular basis. The road is not considered under reclamation at this time.

Area 23 is the Evaporation Pond and Pipeline. The portion of Area 23 that has been revegetated is limited to the retort water pipeline. The portion of Area 23 not revegetated or reclaimed is the Settling Pond and Evaporation Pond. According to the 1985 annual report, the original disturbed acreage of Area 23 was 14.9 acres, 5.1 acres of which was reclaimed before 1985, leaving 9.8 acres remaining to be reclaimed. Because the pond was not formally added to the permit until 2008, no reclaimed acreage has been released.

Area 13, Miscellaneous Access Roads (Table 2), includes a number of older roads that have been reclaimed. In this report, the Mine Bench and Portal roads referred to in Table 2 consist of the Lower Access Road (1.8 acres), Upper Access Road (4.8 acres), Upper Bench Road (1.4 acres not including bench), and Lower Bench Road (1.5 acres not including bench).

The upper segment of the Lower Access Road, which had been impacted from a debris flow off the Lower Dump in 2004, was successfully revegetated in 2005, whereas the lower segment of the Lower Access Road (approximately 1.4 acres) has not shown significant plant growth. This is partially due to damage from seasonal cattle grazing.

2.4.3 Areas Not Under Reclamation

Areas currently not expected to be submitted for reclamation release in the near future are the Lower Bench (Area 3, 2.1 acres), the Lower Bench Road (Area 13, 1.5 acres), the Upper Access Road (4.8 acres), the Evaporation Pond Access Road (1.3 acres), and the Evaporation Pond and Pipeline (Area 23, 10.2 acres).

In addition, the lower segment of the Lower Access Road has not revegetated as a result of cattle grazing and dry conditions. The road is also being used to access Well LWCW-1A and the Upper Manhole monitoring locations. This road (1.8 acres) will be reclaimed after final mine closure. These unreclaimed surface areas comprise an approximate total of 21.7 acres (see Table 6).

2.4.4 Areas to Be Requested for Release

Table 1.0 shows that the estimated actual disturbed acreage was 135.2 acres and of this amount, 61.7 acres was not to be reclaimed because Logan Wash Road is to remain in place for other users, and a parcel of land was transferred to Chevron (Guard Gate, Area 11). Therefore, the total estimated acreage requiring reclamation is 73.5 acres.

OOSI anticipates requesting release of warranty for portions of Areas 1 (13.4 acres), Area 2 (0.7 acres), and Areas 4 (4.3 acres), and 10 (0.2 acres), the revegetated portions of Area 13 (Upper Bench Road, 1.4 acres,, and the Soil Barrow Area (0.7 acres) in the near future. These revegetated areas total approximately 20.7 acres.

As of this reporting period, approximately 31.3 acres have been released of warranty, 21.4 acres are under reclamation, and 21.7 acres are not currently under reclamation. Therefore, a total of approximately 43.1 acres require release at this time. It is anticipated that most of the acres under reclamation will be submitted for warranty release in the near future (see Table 5).

Table 7 summarizes reclamation status at Logan Wash Mine.

3.0 Monitoring Activities in 2018

Monitoring activities at the Logan Wash Mine during the reporting period consisted of periodic monitoring of mine water discharge and related sampling activities. These activities included: 1) discharge measurement of the mine water at LW-001 (former Colorado Discharge Permit System [CDPS] Outfall 001) and retort water; 2) semi-annual water quality sampling of the mine-water discharge (LW-001) and retort-water discharge (LW-Retort and LW-LM), groundwater at Wells LWCW-1A and LW-22A, and surface water at the Big Seep sample location; 3) measurement of the manometer installed in the Research Mine Vault (LW-002); 4) precipitation; and 5) monitoring of the Evaporation Pond leak detection system. Monitoring data for the reporting period are shown in Table 8.

3.1 CDPS (NPDES) Permit Termination

The former CDPS permit for Logan Wash Mine (permit no. CO0048816) that permitted two outfalls, Outfall 001 (Logan Wash Mine, main lower portal [L1 Portal] discharge) and Outfall 002 (Research Mine discharge), was terminated on July 1, 2014. Any mine discharge from the former Outfalls 001 and 002 is being infiltrated into the Lower Mine Bench. For more information regarding the Research Mine portal closure and management of the Research Mine drainage see TR No. 4 and TR No. 6, which present significant revisions to Exhibit E, the Reclamation Plan for Logan Wash Mine.

3.2 Mine-Water and Retort-Water Discharge

Long-term monitoring of retort water and mine water discharge is necessary to assess mine drainage behavior from the mine. The trend in discharge rates combined with water quality has implications for the future fate of this mine drainage water. A sudden change in mine drainage rates may require other actions to adequately avoid costly environmental situations. Discharge measurements of mine water (former Outfall 001) and retort water discharge and were conducted on a quarterly or more frequent basis when access allowed. Continuous flow (meter) monitoring of Outfall 001 water came on line in August, 2011 as part of a requirement of the former CDPS

permit. These data were collected by OOSI to assess and evaluate mine closure effectiveness, to support operation and maintenance of the Evaporation Pond and future water management options and to meet state requirements. The flow meter is still operating and data are periodically recorded and data logger downloaded per the schedule described above. Retort water discharge is measured manually at the Upper Manhole location. Table 8 shows the results of monitoring data collected at the mine in 2018, and Figure 5 shows the results for the 001 flow meter (LW-001 mine water discharge) and the measured discharge for retort water at the Upper Manhole. The figure shows that the 001 discharge has steadily decreased since 2011.

3.3 Water Quality Monitoring

Water quality monitoring continued at the mine site on a semi-annual schedule. As mentioned in the above section, knowledge of the water quality of mine drainage waters and its potential change over time is needed to assess the long-term fate of this water and final mine closure options. Sampling of groundwater (two wells and one seep) is conducted to similarly track background water quality with time.

Sampling was conducted of mine discharge waters (mine water and retort water), groundwater at two monitoring well locations, and one spring site in May and October/November, 2018. The mine drainage samples were collected from the retort water and mine water drainage pipelines inside the Lower Bench Vault.

Historical and 2018 analytical results for mine water (LW-001), and retort water (LW-Retort and LW-LM), are shown in Tables 9 and 10, respectively. The LW-LM site represents samples of the retort water at the Lower Manhole (LW-LM). The analytical results for samples collected during the reporting period do not indicate a significant improvement of retort water quality compared to past sampling events.

The “Big Seep” location is considered to be a potential source water of mine water discharge and may represent background conditions. “Big Seep” emanates from the rock wall above the Daylight Portal and was sampled in May and October of 2018. In addition, samples were collected from two wells. Well LWCW-1A is located in Dry Gulch near the toe of the Lower Bench Mine Dump, and well LW-22A is located in Logan Wash approximately 2.25 miles downstream from the mine. Both wells are completed primarily in alluvium and colluvium, with a small interval in bedrock. Locations sampled during the 2018 semi-annual sampling events are shown in Figure 6. Analytical data for these samples are shown in Table 11.

In 2019, under stipulations for the Evaporation Pond BLM right-of-way, OOSI will also be sampling water quality of the Evaporation Pond on a biannual basis.

3.4 Research Mine Manometer Monitoring

The manometer installed in the Research Mine Vault is monitored and recorded on a monthly basis and on a more frequent basis in the spring months of April and May, or until the peak level begins to subside. If manometer measurements were to indicate a very high ($\geq$ 36 inches) reading for more than a week’s time, the water in the mine can be released and allowed to infiltrate at the Lower Bench. The manometer readings did not indicate a rise in water level within the Research Mine workings in 2018. All manometer measurements made during the reporting period are shown in Table 8.

3.5 Evaporation Pond Leak Detection System

Monitoring of the Evaporation Pond Leak Detection Vault is conducted by continuous measurement of water pressure (depth) in the vault sump using an installed pressure transducer. On-site monitoring is conducted monthly as access conditions allow. Figure 7 shows the depth of water in the detection vault during the reporting period. Water levels within the vault sump did not fluctuate significantly during the reporting period, and there was no indication of a leak reporting to the vault (rain water may have caused some fluctuation as the vault is not water tight on the surface).

3.6 Precipitation

Precipitation was monitored on the Lower Bench and at the Evaporation Pond through the use of Novalynx Corporation Model 260-2101SK-P rain gauge instruments. The Lower Bench gauge is typically operational from April through December, depending on access to the bench. The Evaporation Pond gauge was installed for the first time in May, 2015. The Evaporation Pond gauge is not equipped with a wind screen. Each gauge measures precipitation with an automated logger that is downloaded annually. Precipitation data collected in 2018 showed a total precipitation of 8.29 and 7.74 inches, for the Lower Bench and Evaporation Pond, respectively (see Figure 8). Both rain gauges recorded from April 12, 2018 to November 30, 2018. The NWS Cooperative Network Altenburn, CO station (Coop # 050214, elevation 5,690 feet AMSL) recorded total precipitation of 8.78 inches for April 2018 through November 2018.

3.7 Daylight Bench Slope Stability Monitoring

The Daylight Bench was constructed to support sealing of the Daylight Portal in 2004. Tension cracks and minor subsidence was first observed in 2009 on the small bench. The contractor Geo-Smith Engineering has continued to survey the Daylight Bench for slope movement since May, 2011.

Prior to the October, 2013 survey, no significant movement of the survey monuments was observed. The October 2013 survey noted that 2 of 6 survey points have shown minor to small (0.42 ft.) amounts of movement. The June 2014 survey also noted that 2 of 5 extension stake sets have shown minor (0.07 ft.) amounts of movement. Throughout 2015 minor movement was detected in 1 of 6 survey points. This movement is localized as no movement has been detected in the other extension stakes or survey monuments. Due to deteriorating weather during the May 2016 survey, incomplete observation prevented error analysis of the data. The 2016 survey results from extension stake measurement suggests ongoing localized movement at 2 of the 5 extension stake sets. Physical observations of the Daylight Bench do not indicate ongoing slope failure. No further surveying will be conducted at the Daylight Bench.

4.0 Reclamation Activities in 2018

Monitoring activities described in Section 3 are considered activities that contribute to successful overall mine reclamation. Other reclamation activities conducted at the Logan Wash Mine in 2018 are discussed in the following sections.

4.1 Revegetation Maintenance

Areas seeded during past revegetation work are self-sustaining; it is anticipated that the irrigation system used during early revegetation will not be used in the future.

Areas within the designated Evaporation Pond area were disturbed during pond relining construction in 2018 (see Section 5.2). These areas were seeded with a native seed mix and biodegradable erosion blankets were placed on the steeper, more vulnerable slopes.

4.2 Well Abandonment

No monitoring wells were abandoned during the reporting period.

5.0 Maintenance Activities

Maintenance activities included periodic inspections of mine roads, benches, portals, high walls, mine water drainage systems associated with the retorts and general mine workings, as well as the inspection of Evaporation Pond facilities including the pond's liner, security fencing, operation, and leak detection system. Maintenance activities conducted at the mine and Evaporation Pond are summarized in the following sections.

5.1 Mine Maintenance

During the reporting period, inspections of the Logan Wash Mine site occurred on a weekly to monthly basis depending on site access conditions. Inspections focused on mine roads, headwalls, portal closures, bench surfaces, dump faces, road conditions, and constructed storm drainage and rip-rap channels. Mine water discharge rates and Evaporation Pond water levels were periodically monitored and recorded (Section 3.2). No other mine maintenance was required during the reporting period.

5.2 Evaporation Pond Maintenance

Maintenance of the Evaporation Pond (pond) included inspection of: 1) discharge rates to the pond from the mine retort water plumbing system; 2) the leak detection vault; 3) wildlife security fence; 4) stormwater drainage ditches; and 5) general conditions of the pond, liner, and egress ladders.

In 2018, OOSI implemented relining of the Settling Pond and Evaporation Pond. This project was planned as the original liner had reached its 30-year life expectancy and periodic leaks were being detected in the Leak Detection Vault. In 2017, at BLM's request, OOSI conducted soil sampling under the liner and also excavated, inspected, and jet-cleaned the three leak detection pipes that underlie the liner. Analytical results of this work were provided in the 2017 annual report. The BLM subsequently approved this work land OOSI's proposed relining design letter of (September 22, 2017). The BLM also stipulated that bird netting be installed on the Settling Pond and that the Evaporation Pond be sampled semi-annually in the spring and fall. The purpose of the sampling is to monitor salinity over time. If the sample results begin to show elevated salinity levels, OOSI may be required to install bird netting on the Evaporation Pond (BLM, 2017).

Preparation for relining of the Settling Pond and Evaporation Pond work began in July with earthwork to widen the Settling Pond perimeter road. Retort water was diverted to onsite storage

tanks on September 15, 2018. Retort water was transported to the Greenleaf Environmental Services, LLC facility south of De Beque. Greenleaf is a licensed waste disposal facility. The lining installation subcontractor began work on September 26th and lining materials arrived a day later on September 27, 2018. The project underwent a three-week delay due to significant rain events, but was completed on November 16, 2018.

The relining design included a secondary liner (bottom liner) of 60-mil HDPE, an overlying layer of geocomposite that consisted of 200 mil HDPE geonet bonded to 6-oz nonwoven geotextile, and a primary (top) liner of 80-mil HDPE. Even though the Evaporation Pond is flat-bottomed, two sumps were constructed on the east and west sides of the pond. The geocomposite material provides a transmissive layer that would allow for leakage from the primary liner to potentially be detected at the sump locations. Each sump has a leak detection pipe installed from the sump (located at the toe of the pond slope) to the top of the pond slope. The leak detection pipe can be monitored for the presence of retort water, which would indicate a leak in the primary liner. The same design was constructed at the Settling Pond; one leak detection sump and pipe was constructed on the west end of the pond. Figure 9 is a schematic of the pond lining system that was constructed at the pond facility. Figure 10 shows the layout of as-built features of the pond after relining was completed. Appendix A contains a summary report of the pond relining project.

6.0 Anticipated Reclamation in the Year 2019

Because the fate of retort water discharge is currently being assessed under Amendment No. 1, OOSI does not anticipate revegetation or reclamation of any unreclaimed roads or disturbed surface areas at the mine site in 2019, with exception of previously disturbed areas at the Evaporation Pond site.

Saplings that were planted on the mine dump faces will be assessed for overall health and mortality. No mechanical irrigation of these saplings is anticipated. Roads not reclaimed will be maintained. Transplanting of P. debilis will be conducted if deemed necessary for plants located on the Lower Bench Road; plants will be moved to the fill slope area adjacent to the road (see Section 8.0).

Evaporation Pond maintenance will include access road and stormwater control maintenance, weed and brush control, leak detection sump pump maintenance, liner repair, and other maintenance as needed.

OOSI anticipates submittal of several revegetated areas for reclamation (warranty) release in 2019.

7.0 Anticipated Disturbance in the Year 2019

OOSI is in the process of evaluating final mine closure alternatives, focusing on mine water management. No new disturbance is anticipated to occur in 2019 at this time within the mine permit area associated with OOSI mine permit activities. Minor ground disturbance may occur on the Lower Bench Road which is currently not under reclamation, during transplanting of P. debilis species (see Section 8.0). Maintenance of mine roads and stormwater control features will be conducted as necessary.

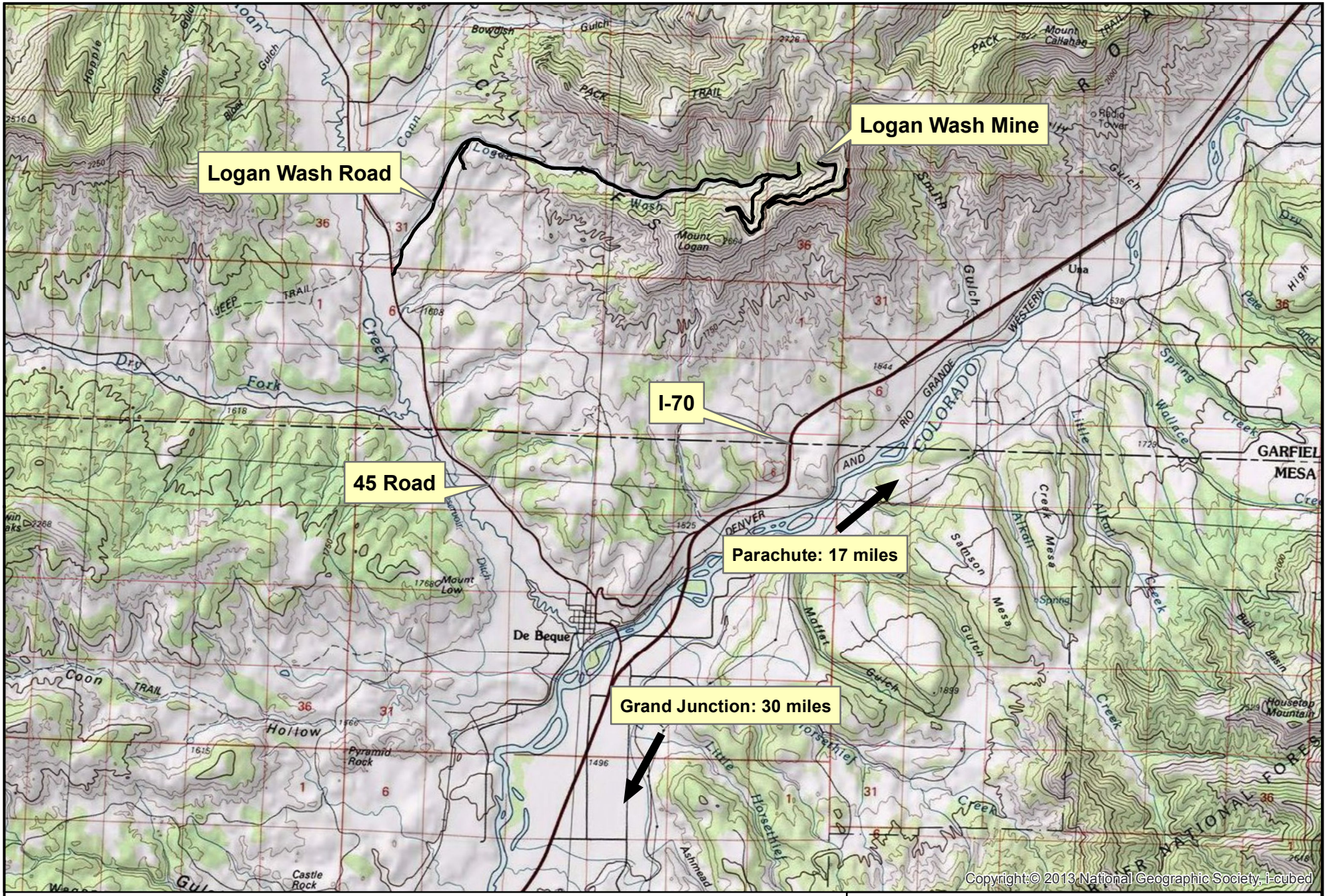
8.0 Threatened Species Designation

On July 27, 2011, the U.S. Department of Interior, Fish and Wildlife Service (USFW), listed the plant *Penstemon debilis* (Parachute beardtongue or *P. debilis*) as "threatened" status under the Endangered Species Act of 1973 (Act). The critical habitat for the plant is in Garfield County and the Logan Wash Mine site falls within this critical habitat. Numerous *P. debilis* plants have been observed growing within and along the flanks of the Upper Access Road from the Research Mine portal area to the north on the Upper Mine Bench Road and Lower Mine Bench Road. An Article of Designation (AOD) was signed by Colorado Parks and Wildlife (CPW), OOSI, and Oxy WTP in early 2015 and finalized on February 3, 2015. The AOD allows for OOSI to mitigate impact to *P. debilis* habitat while conducting reclamation obligations under the DRMS mine permit.

A site plant survey conducted by BLM, USFWS, CPW (Colorado Natural Areas Program [CNAP]), and WWL in September, 2014 resulted in a number of *P. debilis* locations being mapped on both OOSI and BLM lands from the Research Mine to the Lower Bench (Figure 11). On March 25, 2015, 39 P. debilis plants were transplanted from the Lower Bench Road to the nearby road cut slope that is undisturbed by vehicle/equipment traffic (Figure 12). The transplanted P. debilis have been monitored for production and mortality on an annual basis, providing access was achievable and snow cover negligible. Results from monitoring of the transplanted P. debilis indicate a current mortality rate of approximately 33 percent. The table below shows the mortality rate for each year since transplanting in 2015.

Year	New Mortality (2018 Calendar Year)	Mortality (2015 to Date)
2015	15%	15%
2016	10%	26%
2017	7%	33%
2018	Insufficient Data to Determine	33%

On June 26, 2018, five state personnel along with WWL Staff Scientist, Shelby Goodwin, visited Logan Wash Mine to conduct quantitative monitoring on a population of *P. debilis* near the Lower Bench Road. Attendees included the following: Jill Handwerk, Delia Malone, Lisa Tasker, Olivia Rautiainen, and Colleen Hurst of Colorado Natural Heritage Program (CNHP). The mortality rate for 2018 was not determined due to limited data from only one monitoring event in 2018 (normally several monitoring events are conducted and are needed to account for all plants previously present at the site).



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Miles

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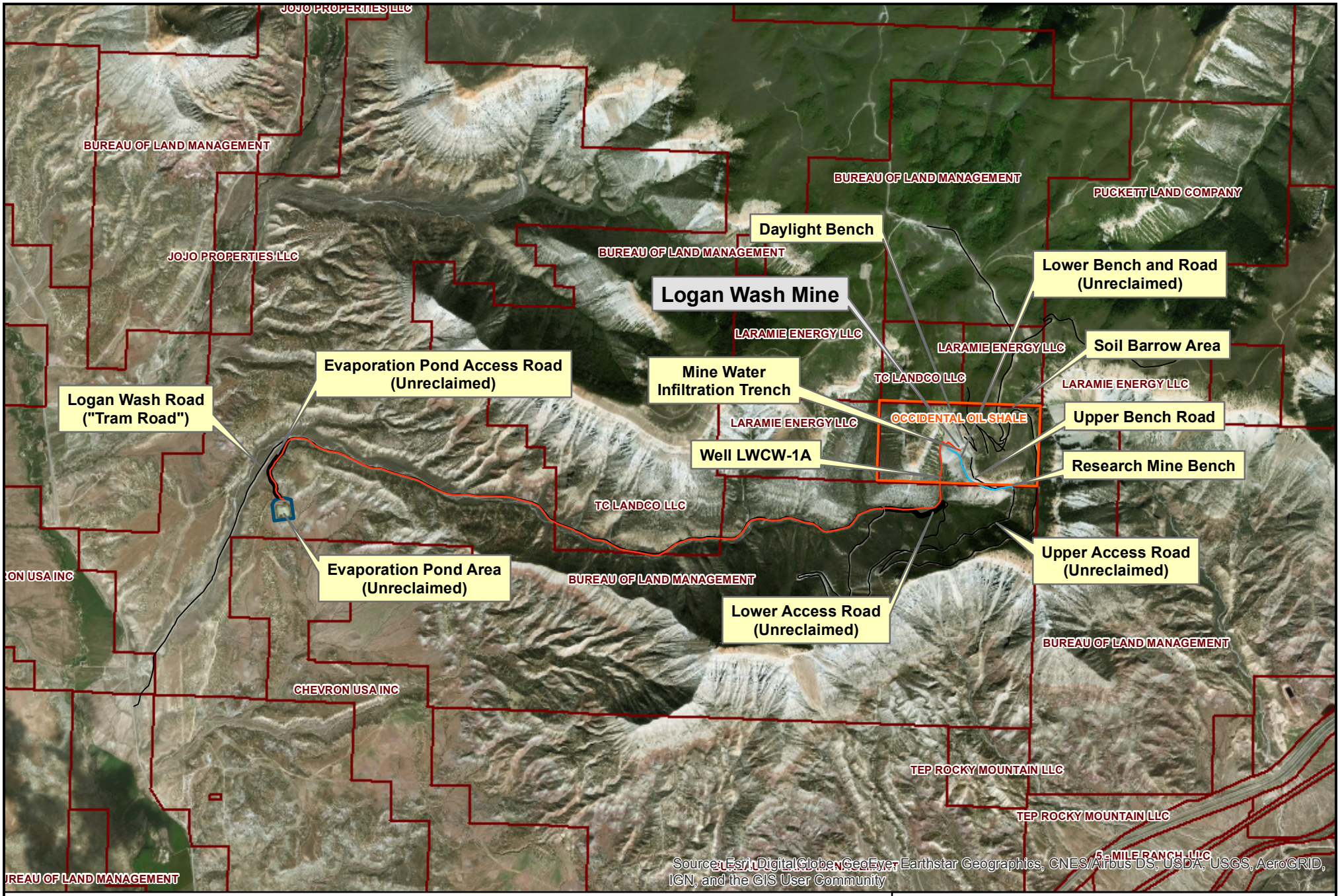
Base Map Source: USGS and NGS 2007(C) and Esri Arc GIS Online Maps

Figure 1. Logan Wash Mine Location Map

N1/2, S 25, T 7S, R 97W, 6 P.M.
Garfield County, Colorado

Western Water & Land, Inc.
Applications in Earth Science



Legend

- Retort Water Pipeline
- Research Mine Water Pipeline

Miles

0 0.5 1 2

1:50,000

N

Figure 2. Logan Wash Mine Facilities (Unreclaimed areas noted)

Garfield County, Colorado

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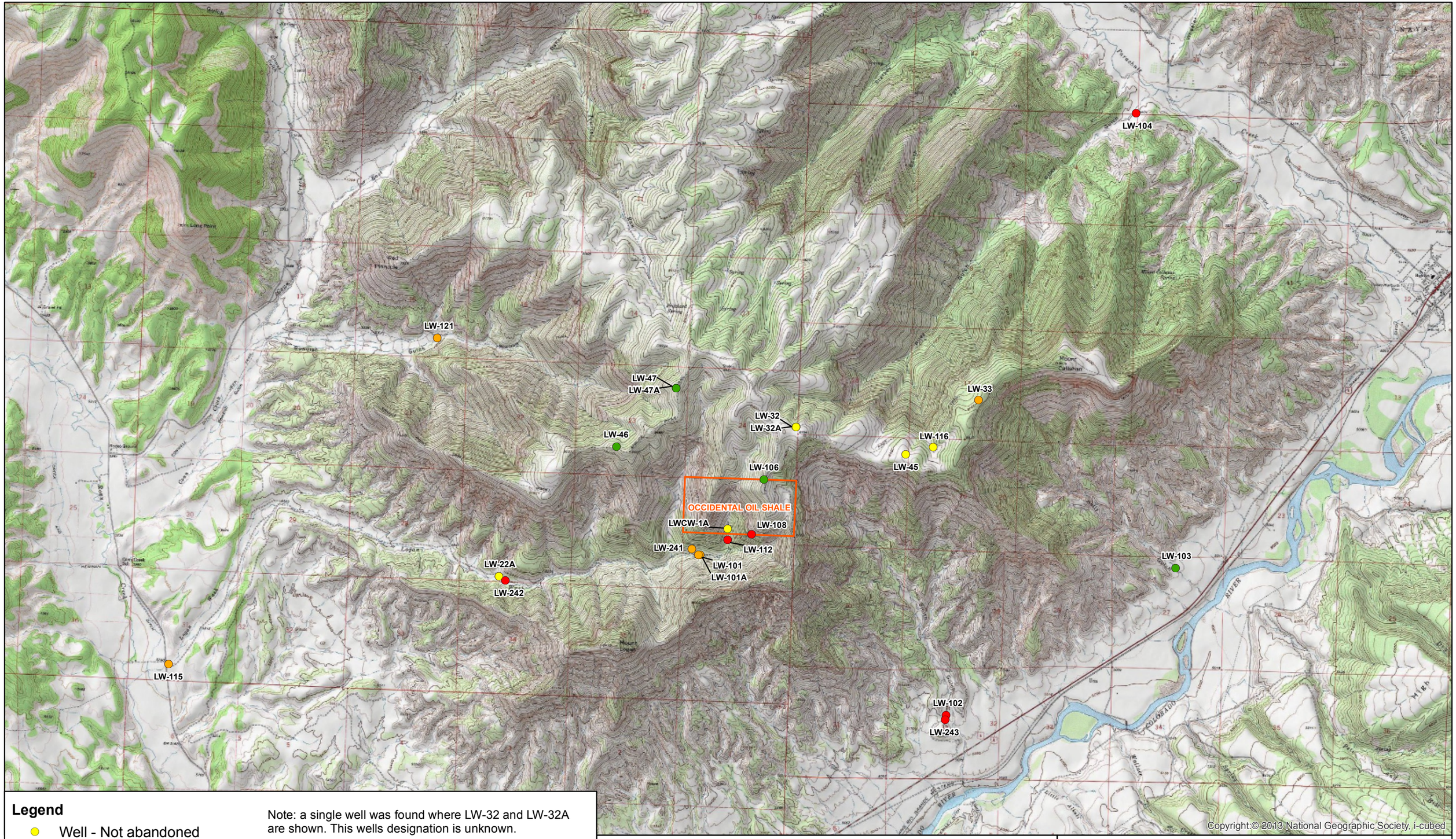

Legend

- Well - Not abandoned
- Well - Abandoned
- Well - Could not be located; Potentially abandoned
- Well - Not investigated; Status unknown

Note: a single well was found where LW-32 and LW-32A are shown. This wells designation is unknown.

0 0.5 1 2 Miles

1:50,000

N

Figure 3. Logan Wash Mine Wells

Garfield County, Colorado

Western Water & Land, Inc.
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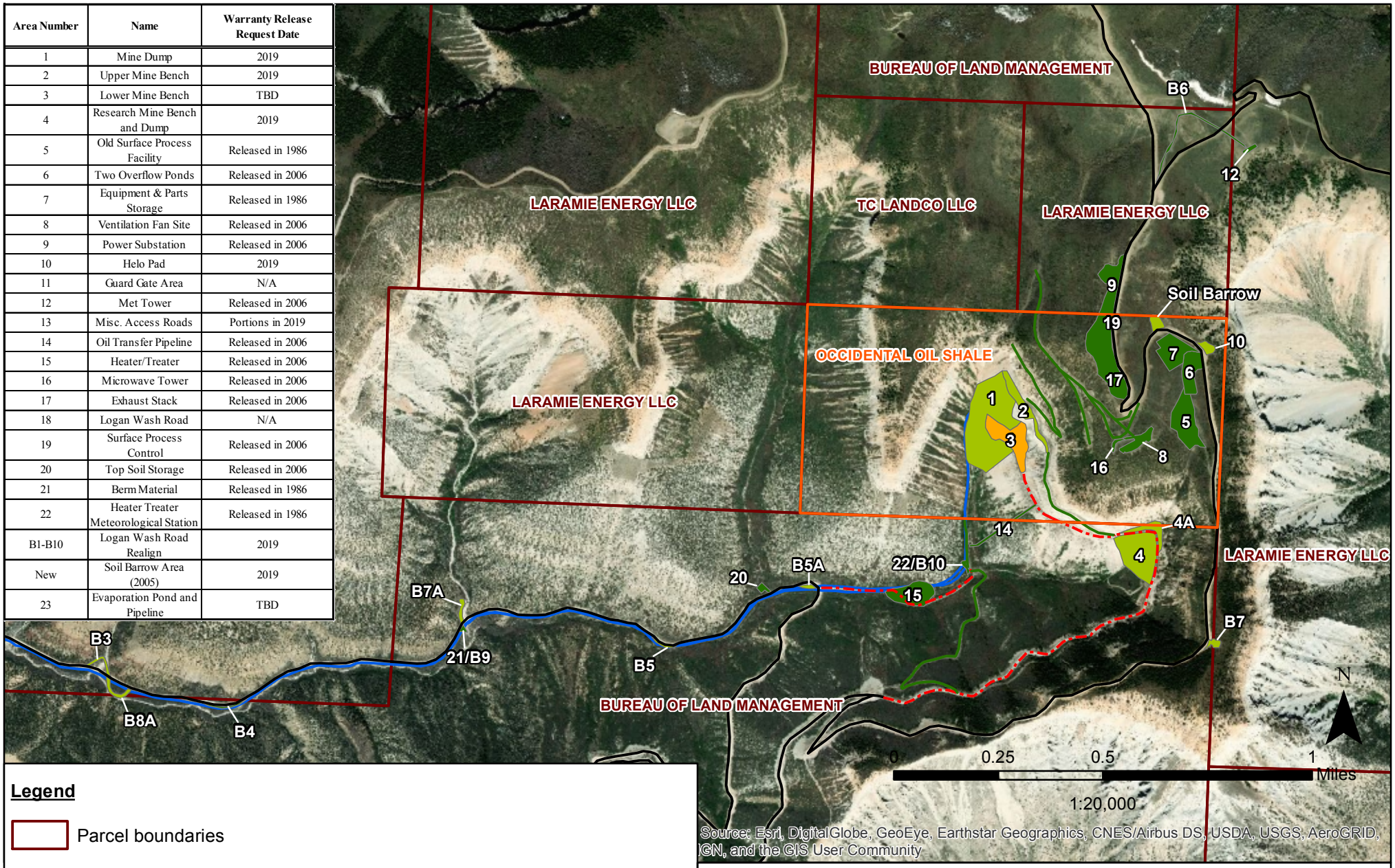
Area Number	Name	Warranty Release Request Date
1	Mine Dump	2019
2	Upper Mine Bench	2019
3	Lower Mine Bench	TBD
4	Research Mine Bench and Dump	2019
5	Old Surface Process Facility	Released in 1986
6	Two Overflow Ponds	Released in 2006
7	Equipment & Parts Storage	Released in 1986
8	Ventilation Fan Site	Released in 2006
9	Power Substation	Released in 2006
10	Helo Pad	2019
11	Guard Gate Area	N/A
12	Met Tower	Released in 2006
13	Misc. Access Roads	Portions in 2019
14	Oil Transfer Pipeline	Released in 2006
15	Heater/Treater	Released in 2006
16	Microwave Tower	Released in 2006
17	Exhaust Stack	Released in 2006
18	Logan Wash Road	N/A
19	Surface Process Control	Released in 2006
20	Top Soil Storage	Released in 2006
21	Berm Material	Released in 1986
22	Heater Treater Meteorological Station	Released in 1986
B1-B10	Logan Wash Road Realign	2019
New	Soil Barrow Area (2005)	2019
23	Evaporation Pond and Pipeline	TBD



Legend

- Parcel boundaries

Permit Reclamation Areas

- Not to be reclaimed
- In use; Not under reclamation
- Reclaimed and released
- Under reclamation

- Evaporation Pond Pipeline

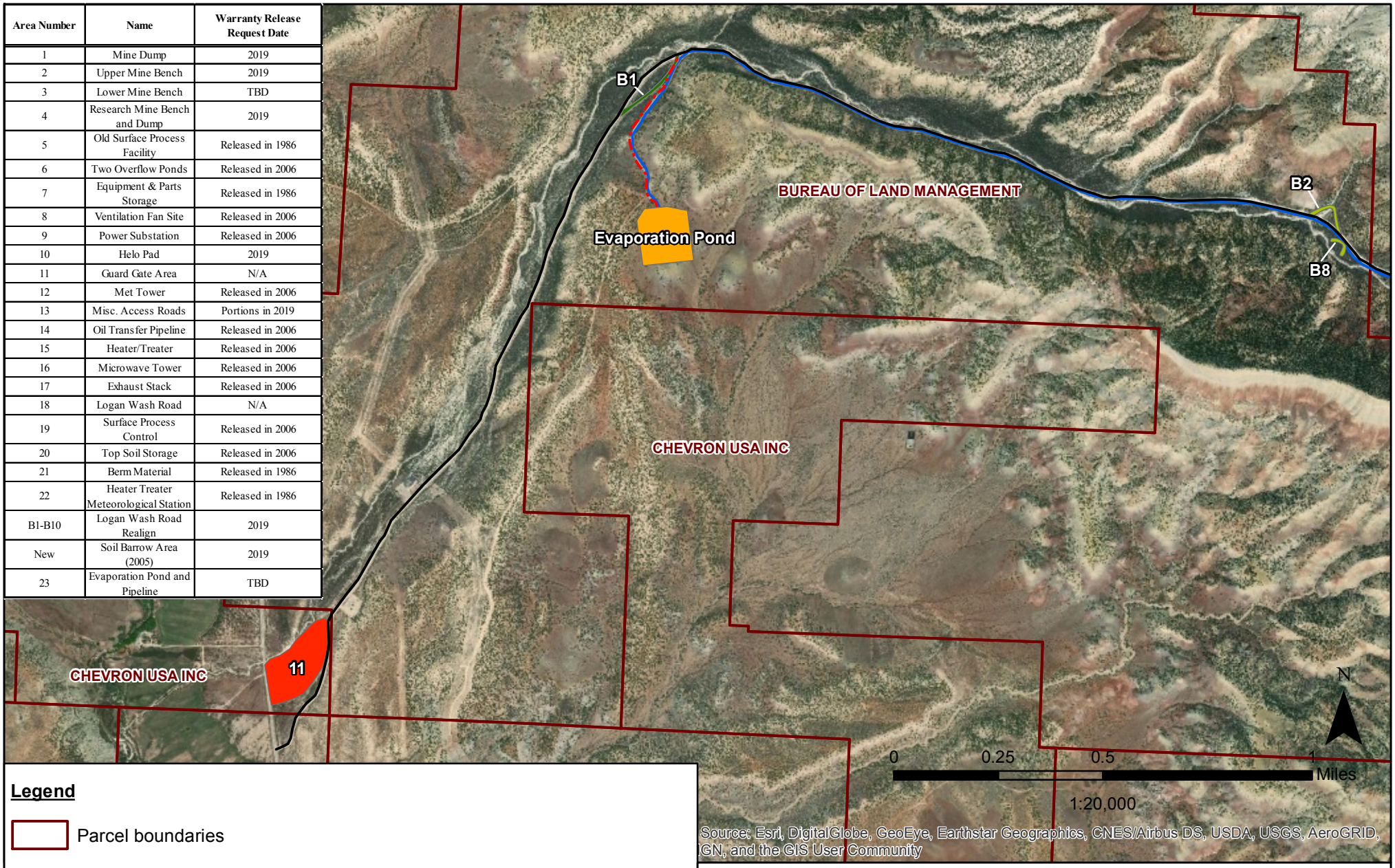
Roads

- Not to be reclaimed
- Reclaimed
- In use; Not under reclamation

Figure 4A. Logan Wash Mine Reclamation Status

Garfield County, Colorado

Area Number	Name	Warranty Release Request Date
1	Mine Dump	2019
2	Upper Mine Bench	2019
3	Lower Mine Bench	TBD
4	Research Mine Bench and Dump	2019
5	Old Surface Process Facility	Released in 1986
6	Two Overflow Ponds	Released in 2006
7	Equipment & Parts Storage	Released in 1986
8	Ventilation Fan Site	Released in 2006
9	Power Substation	Released in 2006
10	Helo Pad	2019
11	Guard Gate Area	N/A
12	Met Tower	Released in 2006
13	Misc. Access Roads	Portions in 2019
14	Oil Transfer Pipeline	Released in 2006
15	Heater/Treater	Released in 2006
16	Microwave Tower	Released in 2006
17	Exhaust Stack	Released in 2006
18	Logan Wash Road	N/A
19	Surface Process Control	Released in 2006
20	Top Soil Storage	Released in 2006
21	Berm Material	Released in 1986
22	Heater Treater Meteorological Station	Released in 1986
B1-B10	Logan Wash Road Realign	2019
New	Soil Barrow Area (2005)	2019
23	Evaporation Pond and Pipeline	TBD



Legend

- Parcel boundaries

Permit Reclamation Areas

- Not to be reclaimed
- In use; Not under reclamation
- Reclaimed and released
- Under reclamation

- Evaporation Pond Pipeline

Roads

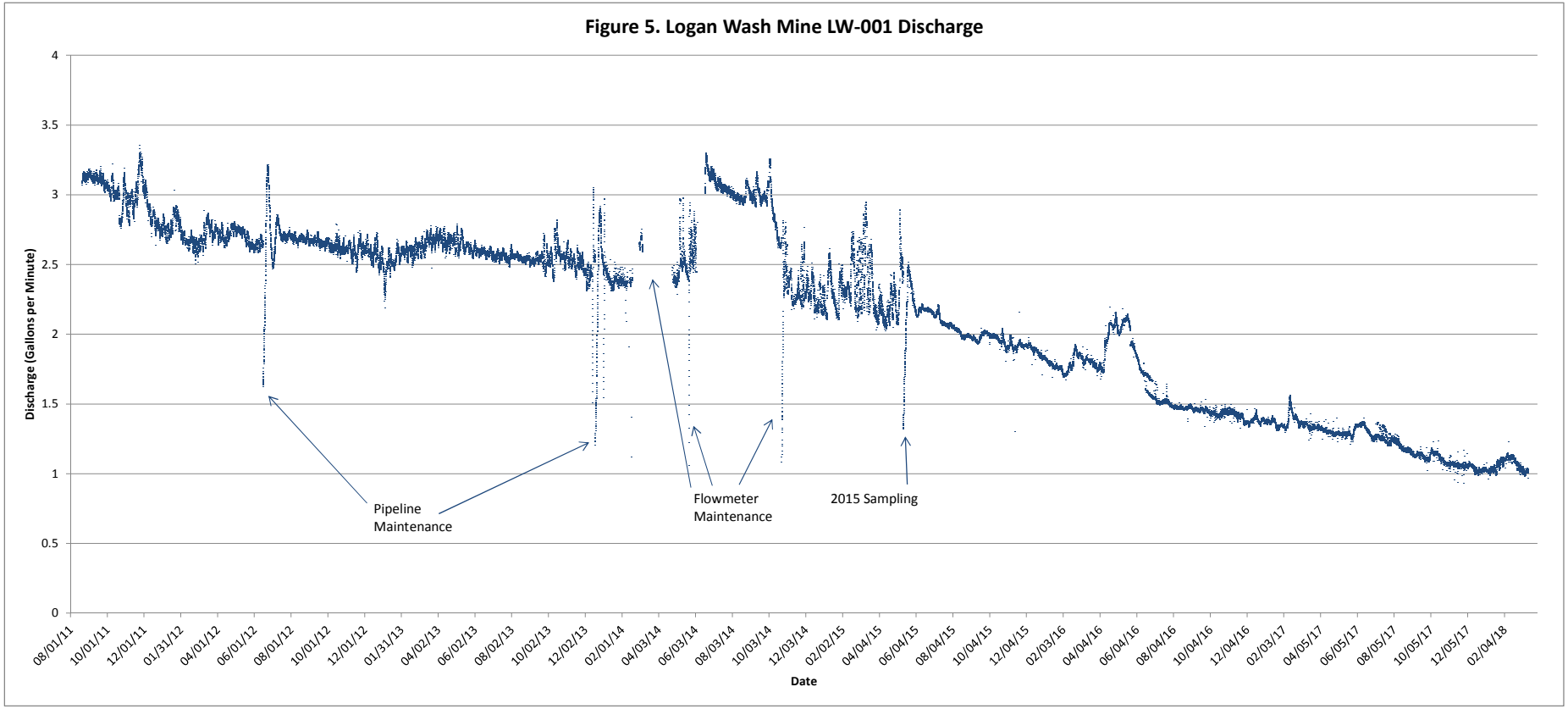
- Not to be reclaimed
- Reclaimed
- In use; Not under reclamation

Figure 4B. Logan Wash Mine Reclamation Status

Garfield County, Colorado

Western Water & Land, Inc.
Applications in Earth Science

Figure 5. Logan Wash Mine LW-001 Discharge



Sampled Locations

0 0.25 0.5 1 Miles

1:30,000

N

Figure 6. 2018 Semi-Annual Mine Water Sampling Locations

Garfield County, Colorado

Western Water & Land, Inc.
Applications in Earth Science

Figure 7. Logan Wash Mine Evaporation Pond Leak Detection Vault Water Levels

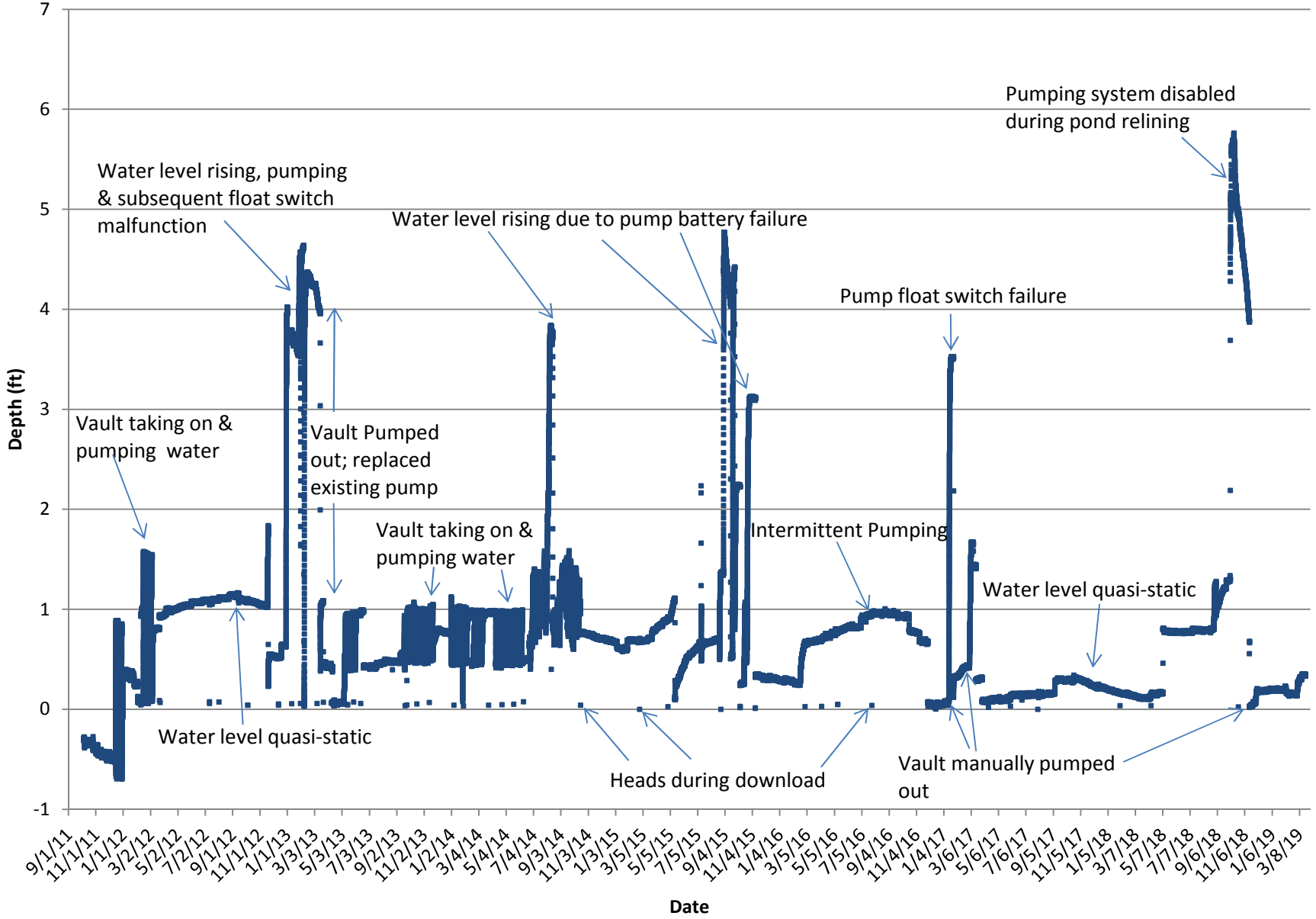


Figure 8. 2018 Logan Wash Mine Precipitation

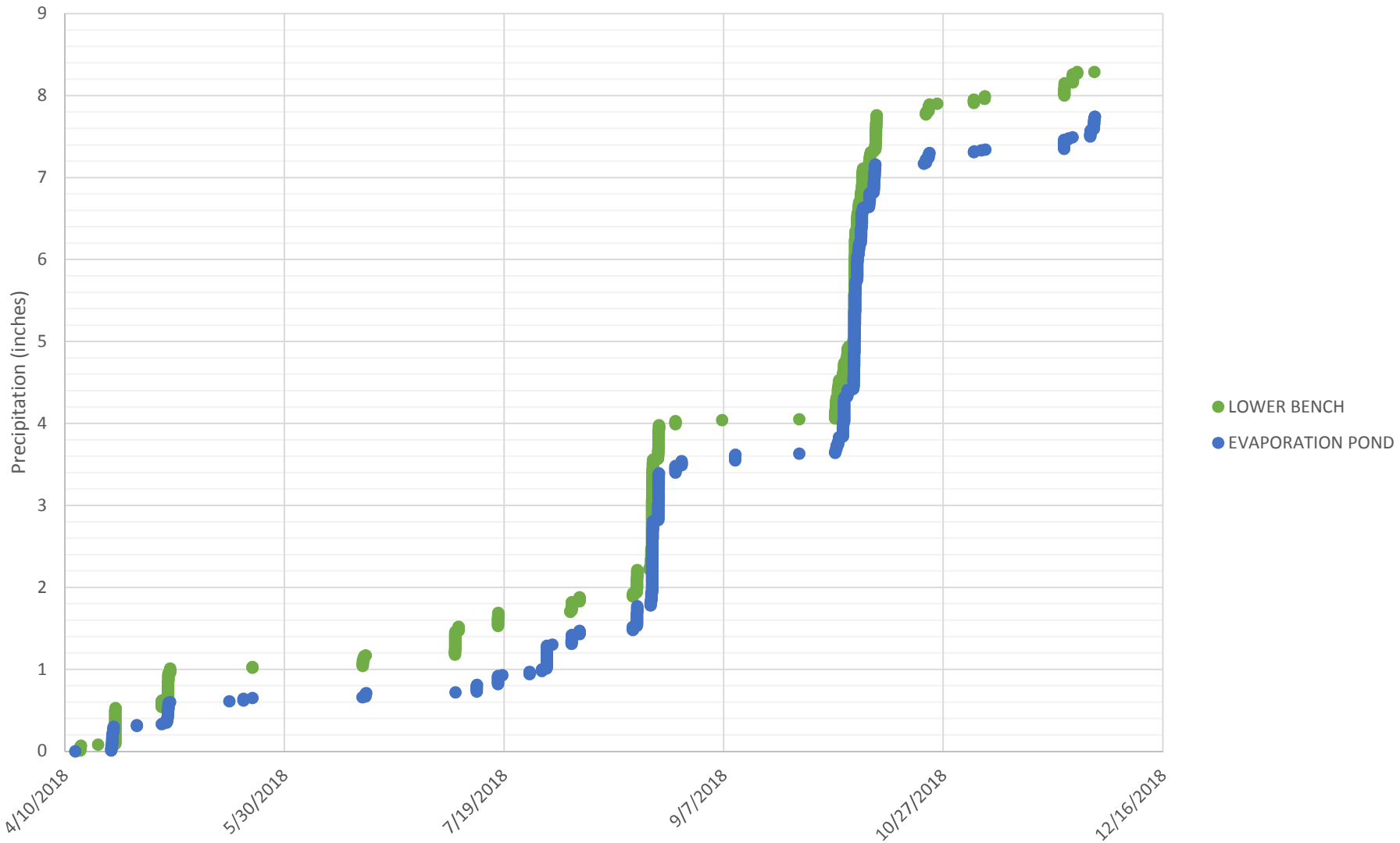
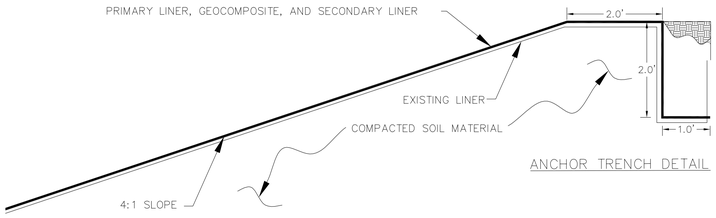


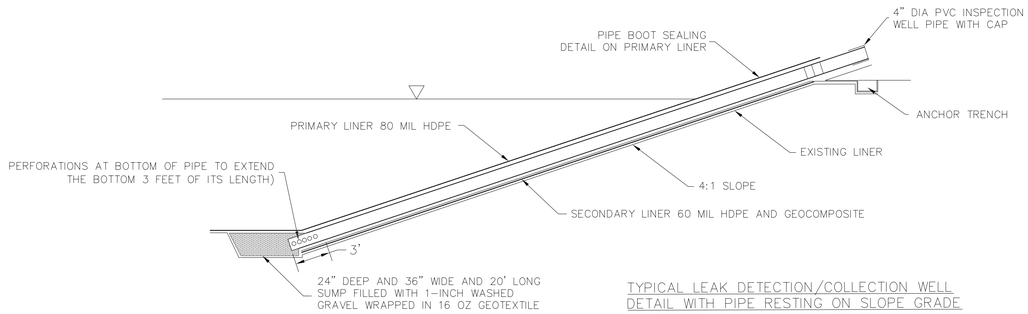
Figure 9. Pond Lining System

UTILITY NOTIFICATION CENTER
OF COLORADO
CALL 811
THREE WORKING DAYS BEFORE YOU DIG, GRADE OR
EXCAVATE FOR THE MARKING OF UNDERGROUND UTILITIES.



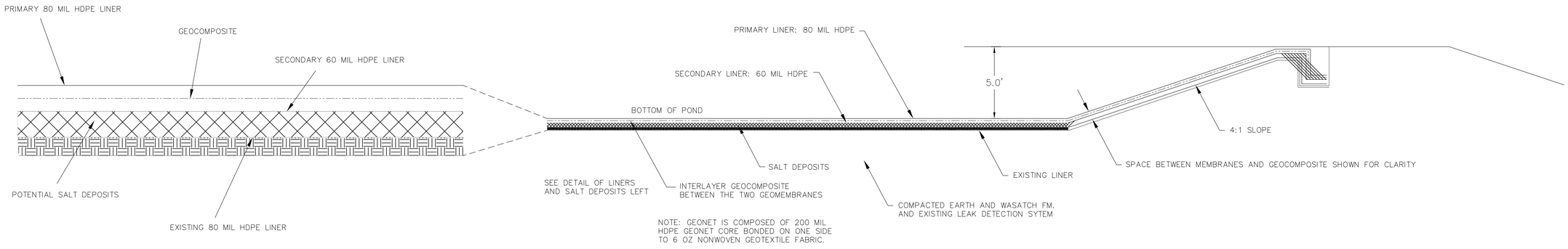
ANCHOR TRENCH DETAIL

NO SCALE



TYPICAL LEAK DETECTION/COLLECTION WELL
DETAIL WITH PIPE RESTING ON SLOPE GRADE

NO SCALE



MEMBRANE LINERS AND GEOCOMPOSITE DETAILS

NO SCALE

PREPARED BY JEK
REVIEWED BY JEK
DATE 06-26-2018
SCALE NO SCALE
JOB NO. 18020.02

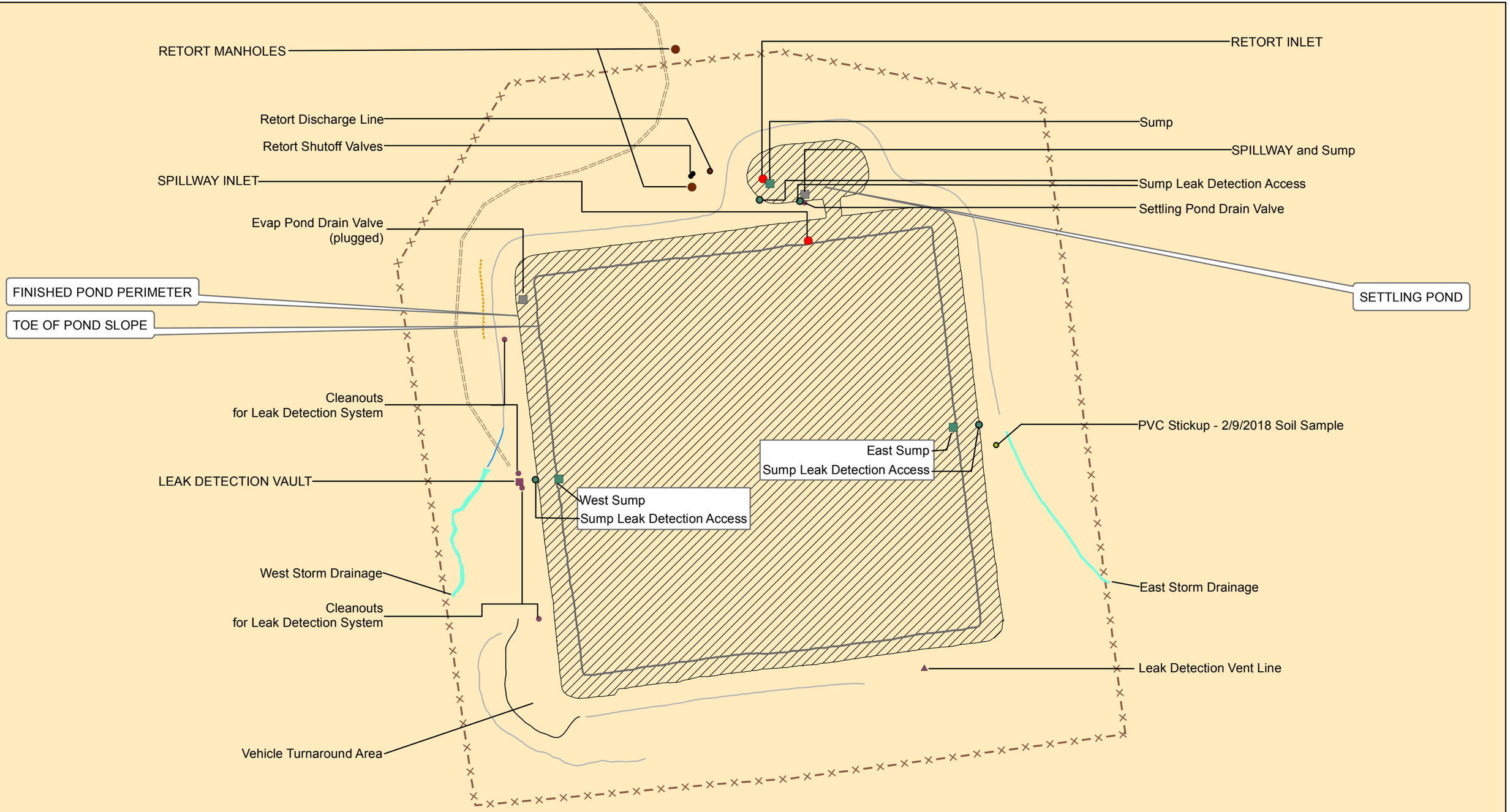
DATE	DESCRIPTION	BY	CK
09-11-18	CHANGED SECONDARY 80 MIL LINER TO 60 MIL LINER	JEK	JEK

LOGAN WASH MINE
EVAPORATION POND RELINING PROJECT
OCCIDENTAL OIL SHALE, INC.

Rhino Engineering
Rhino Engineering, Inc.
PO Box 810
Cedaredge CO 81413
(970) 241-6027
info@rhinoengineers.com
www.rhinoengineers.com

COLORADO LICENSED
33064
06-06-18
PROFESSIONAL ENGINEER
JOHN E. KOSTELIC

SHEET



Legend

- Pond Perimeter Road
- Safety Fence
- Low Crossing Swale
- Toe of Cut Slope
- Access Road

0 65 130 260 Feet

1:1,100

N

Figure 10. Logan Wash Mine
Evaporation Pond Site Map As-Builit 2018 Pond Reline Project

Garfield County, Colorado

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Applications in Earth Science

Legend

- Potentially disturbed area
- Potential transplant area
- CNAP boundary
- Bureau of Land Management (USBLM) parcels
- Penstemon debilis (Location accuracy +/- 10 feet)
- Protective barricade or matting

Figure 11. Locations of P. debilis, Proposed Mitigation measures and Potential Transplant Areas

Garfield County, Colorado

Western Water & Land, Inc.
Applications in Earth Science

Legend

- Original location
- Transplanted location
- CNAP boundary
- Bureau of Land Management (BLM) parcels

0 25 50 100 Feet

1:800

N

Note: The original location of Plant No. 29 was overlooked during the survey.

Figure 12

Logan Wash Mine P. debilis Transplanting

March 25, 2015

N 1/2 S. 25 T. 7S R. 97W 6 P.M.

Garfield County, Colorado

Western Water & Land, Inc.
Applications in Earth Science

Table 1. Reclamation Status at Logan Wash Mine, March 2019

Area Number (Exhibit E & F)	Name	Approved Area	Actual Disturbed Area	Acres Reclaimed (acres/year)	Acres Released (acres/year)
1	Mine Dump[a]	30.00	13.36	13.36/2004	NR
2	Upper Mine Bench	3.00	0.74	0.74/2005	NR
3	Lower Mine Bench	3.80	2.10	2.10/2003[b]	NR
4	Research Mine Bench and	5.00	4.26	4.26/2004	NR
5	Old Surface Process Facility	3.00	1.82	1.82/<1986	1.82/1986
6	Two Overflow Ponds	2.00	2.86	2.86/<1986	2.86/2006
7	Equipment & Parts Storage	2.55	0.67	0.67/<1986	0.67/1986
8	Ventilation Fan Site	1.30	0.41	0.41/1986	0.41/2006
9	Power Substation	0.75	0.75	0.75/1986	0.75/2006
10	Helo Pad	1.00	0.24	0.24/-	NR[c]
11	Guard Gate Area	5.00	8.30	Not to be reclaimed	Transferred/1983[d]
12	Met Tower	1.00	0.80	0.80/<1982	0.80/2006
13	Misc. Access Roads[e]	11.5	15.58	11.78/2005	8.12/1986
14	Oil Transfer Pipeline	0.5	0.5	0.5/<1998	0.5/2006
15	Heater/Treater	3.00	2.96	2.96/1986	2.96/2006
16	Microwave Tower	1.00	0.11	0.11/<1998	0.11/2006
17	Exhaust Stack	3.00	3.00	3.00	3.00/2006
18	Logan Wash Road	55.55	53.43	Not to be reclaimed[f]	---
19	Surface Process Control	1.00	1.0	1.0/<1998	1.0/2006
20	Top Soil Storage	0.5	0.25	0.25/<1998	0.5/2006
21	Berm Material	0.25	0.33	0.25/<1986	0.33/1986
22	Heater Treater Meteorological	0.18-	0.18	0.18/<1986	0.18./1986
B1-B10	Logan Wash Road Realign	6.0	6.0	6.0/<1986	~5.0/1986
New	Soil Barrow Area (2005)	2.0	0.65	0.65/2005	0.65/2006
23	Evaporation Pond and Pipeline	14.87	14.87	5.07/<1986	NR
Total		157.75	135.17	59.84	29.41

Table 1 Notes: [a] The Mine Dump area is to be reclaimed by establishing "vegetated islands"; the entire acreage will not be vegetated. [b] Conducted hydromulch test on Lower Bench; [c] Area 10 was excavated for a pond for the landowner and is under reclamation; [d] Area 11 transferred to Chevron, not to be reclaimed; [e] See Table 2 for description of access roads, release is assumed;. [f] The original reclamation plan named the Logan Wash Road as disturbed acreage, but noted that it would not be reclaimed because the road serves as a main access road to BLM and private lands; NR = Not Released

Table 2. Reclamation Status of Miscellaneous Access Roads, March 2019

Area	Estimated Disturbed Area	Acres Reclaimed (as of March 2015)	Acres Remaining to be Reclaimed
Mine Bench and Portal[a]	7.46	3.66	3.8
Old Surface Process	1.51	1.51	0.0
New Surface Process	2.17	2.17	0.0
Heater/Treater[b]	1.36	1.36	1.36
Beyond Microwave	2.33	2.33	0.0
Vicinity of the Microwave	0.75	0.75	0.0
Total	15.58	11.78	5.16 [a]

[a] Based on Upper Access Road and Lower Bench Road, and Upper Bench Road map measurements

[b] Lower Access Road was under reclamation but unsuccessful due to cattle foraging. Road is still used to access Well LWCW-1A.

Table 3. Well Abandonment Schedule, March 2019

Monitoring Well ID	Abandonment Date	Status
LW-22A	**TBD**	**Monitoring**
LW-32	**TBD**	**To be abandoned**
LW-45	**TBD**	**To be abandoned**
LW-102	**2007**	**Cement plugged**
LW-103	**TBD**	**To be abandoned**
LW-104	**2007**	**Cement plugged**
LW-108	**2005**	**Cement plugged**
LW-112	**2005**	**Cement plugged**
LW-116	**TBD**	**To be abandoned**
LW-242	**2005**	**Cement plugged**
LW-243	**2007**	**Cement plugged**
LWCW-1A	**TBD**	**Monitoring**

Notes: TBD: to be determined

Table 4. Summary of Unreclaimed Acreage at Logan Wash Mine

Area	Acreage	Area to be Requested for Release in 2019
1 – Mine Dump	13.4	Yes
2 – Upper Mine Bench	0.7	Yes
3 – Lower Mine Bench	2.1	No
4 – Research Mine Bench	4.3	Yes
10 – Helo Pad	0.2	Yes
Portions of Area 13*	10.9	Portions
Soil Barrow Area	0.7	Yes
Evaporation Pond	10.2	No
Total	42.5	

*See Section 2.2

Table 5. Summary of Areas Under Reclamation at Logan Wash Mine

Area	Name	Estimated Acres	Revegetation Date
1*	Upper & Lower Mine Dump Faces	13.4	2003-2005
2*	Upper Mine Bench	0.7	2004-2005
3	Lower Mine Bench	2.1	Natural revegetation
4*	Research Mine Bench & Dump	4.3	2003-2004
10*	Helo Pad	0.2	Pre-2000
---*	Soil Barrow Area	0.7	2004
Total		21.4	

* = Area anticipated for request for release in 2019

Table 6. Summary of Areas Not Under Reclamation at Logan Wash Mine

Area	Name	Estimated Acres
3	Lower Bench	2.1
13	Lower Bench Road	1.5
13	Upper Access Road	4.8
13	Evap. Pond Access Road	1.3
23	Evaporation Pond & Pipeline	10.2
13	Lower Access Road	1.8
Total		21.7

Table 7. Summary of Reclamation Status at Logan Wash Mine

Acreage Status Category	Estimated Acreage
Total original disturbed/used acres	135.2
Acres not to be reclaimed (Logan Wash Road, Chevron land)	61.7
Total acres requiring reclamation	73.5
Total acres released to date	31.3
Total new disturbed acres this reporting period	0.0
Total new acreage under reclamation this reporting period	0.0
Total acres under reclamation to date	21.4
Total estimated acres not currently under reclamation	21.7
Total estimated reclaimed acres needing release	43.1

Table 8. Logan Wash Mine Site Monitoring Results, March 2018 to March 2019

Date	LW-002[1] Manometer (inches)	LW-001[2] (L-1 Portal) (gpm)	Upper Manhole[3] (gpm)	Lower Manhole[4] (gpm)	Other
3/14/18	NM	1.03	1.68	2.28	Conduct mine and pond monitoring.
4/4/18	0	1.03	NM	NM	Conduct mine and pond monitoring.
4/10/18	0	1.11	1.84	2.30	Conduct mine and pond monitoring.
4/12/18	NM	1.04	NM	NM	Conduct mine and pond monitoring; Launched rain gauges at the Evaporation Pond and on the Lower Bench
4/18/18	0	NM	1.67	2.27	Conduct mine and pond monitoring.
4/24/18	0	NM	2.07	2.33	Conduct mine and pond monitoring.
5/8/18	0	1.03	1.91	2.34	Conduct mine and pond monitoring.
5/23/18	NM	NM	NM	NM	Semi-annual sampling of LW-22A
5/29/18	NM	NM	NM	NM	Semi-annual sampling of Big Seep, mine water, retort water and Lower Manhole.
6/4/18	NM	NM	NM	NM	Semi-annual sampling of LWCW-1A.
6/26/18	NM	0.98	NM	NM	*P. debilis* status survey with CNAP and BLM.
7/12/18	NM	1.01	2.51	2.56	Semi-annual sampling of LW-22A
8/28/18	0	0.95	2.76	2.62	Conduct mine and pond monitoring.
9/30/18	NM	NM	NM	2.52	
10/22/18	NM	0.99	NM	2.57	Semi-annual sampling of Big Seep, mine water, retort water and Lower Manhole.
10/31/18	NM	NM	NM	NM	Semi-annual sampling of LW-22A
11/13/18	NM	NM	NM	NM	Semi-annual sampling of LWCW-1A.
11/30/18	NM	0.96	2.25	2.58	Conduct mine and pond monitoring.

Table 4 Notes: LW-002 discharge originates at the Research Mine portal, the manometer measures head behind a concrete dam inside the sealed adit.
[2] LW-001discharge originates at the L-1 portal of Logan Wash Mine and during the reporting period discharged into the Infiltration Trench. All measurements recorded by electronic flowmeter display.
[3] Upper Manhole is located on Retort Water Pipeline in Logan Wash approximately 3000 ft down drainage of the Lower Dump.
[4] Lower Manhole is located on Retort Water Pipeline immediately north of Evaporation Pond.
NM = not measured

Table 9. Logan Wash Minewater Analytical Data

SampleID SampleDate Parameters	Units	MINE WATER 3/9/2000	MINE WATER 10/26/2000	MINE WATER 9/26/2001	LWM-001 10/2/2002	LW-001 10/11/2007	LW-001 3/19/2008	LW-001 10/30/2008	LW-001 6/3/2009
General Chemistry									
Alkalinity, Bicarbonate (as CaCO3)	mg/L	390	249	278	287	287	288 J	272	290
Alkalinity, Carbonate (as CaCO3)	mg/L	5 U	30.1	25.1	5 U	5 U	5 U	5 U	5 U
Alkalinity, Total (As CaCO3)	mg/L	390	280	303	291	287	288 J	272	290
Ammonia	mg/L	0.5	0.8 U	0.1 U	0.1 U	0.1 U	0.1 U	5.8 J	0.31
Bromide	mg/L	---	80	---	0.2 U	0.11 J	0.074 B	0.2 U	0.2 U
Chemical Oxygen Demand (COD)	mg/L	---	17	---	64.5	23.4	21.9	104	26.7
Chloride	mg/L	31 J	35.1	40.3	36	53.4	35.8	37.9	37
Specific Conductivity	umhos/cm	---	---	---	2600	2830	3640 J	3540	3500
Cyanide (free)	mg/L	---	---	---	---	---	---	---	---
Fluoride	mg/L	3.1	2.7	3	---	---	---	---	---
Fluoride (dissolved)	mg/L	---	2.1	---	2.3	2.5	2.6	2.3	2.7
Hardness	mg/L	---	564	---	572	590	540	580	570
Nitrate (as N)	mg/L	---	3.4	---	2.5	5.4	3.5	3.1	3.1
Nitrite (as N)	mg/L	---	0.01 U	---	0.05 U	0.05 U	0.05 U	0.05 U	0.05 U
Oil and Grease, Total	mg/L	---	3.7	---	---	---	---	---	---
Oil and grease (HEM), polar	mg/L	---	---	---	---	---	---	---	---
Oil and grease (HEM), total	mg/L	5 U	---	5 U	4.9 U	4.8 U	4.8 U	4.7 U	4.7 U
pH	s.u.	---	---	---	8.2	8.1 J	8	8.2 J	8.2 J
Phenolics (Total)	mg/L	50 U	50 U	10 U	0.01 U	0.007 J	0.0087 B, J	0.01 U	0.0042 J
Phosphorus as P, total	mg/L	---	0.023	---	0.1 U	0.3	0.044 B	0.1 U	0.1 U
Silica	mg/L	---	16.7	---	---	---	---	---	---
Sulfate	mg/L	210 J	1060	1170	1080	1510	1140	1170	1140
Sulfide	mg/L	---	---	---	---	3 U	---	3.2	3 U
Sulfite	mg/L	2 J	2 U	2 U	---	---	---	---	---
Thiocyanate	mg/L	0.4 U	1 U	0.7 U	---	---	---	---	---
Thiosulfate	mg/L	0.4 U	1 U	0.7 U	---	---	---	---	---
Total Dissolved Solids (TDS)	mg/L	1870	1840	2020	1890	2010	1830	1820	2140
Nitrogen, Total Kjeldahl	mg/L	---	---	---	---	3.5	2.8 B	6.2	4.5
Total Organic Carbon (TOC)	mg/L	---	---	---	7.7	9.2	---	7.4	7.9
Total Suspended Solids (TSS)	mg/L	---	5 U	---	---	4 U	4 U	4 U	3.6 J
Dissolved Organic Carbon (DOC)	mg/L	7.8 J	8.5	7.9	7.5	9.2	10.5	7.2	8.2

Table 9. Logan Wash Minewater Analytical Data

SampleID SampleDate Parameters	Units	MINE WATER 3/9/2000	MINE WATER 10/26/2000	MINE WATER 9/26/2001	LWM-001 10/2/2002	LW-001 10/11/2007	LW-001 3/19/2008	LW-001 10/30/2008	LW-001 6/3/2009
Metals									
Arsenic	ug/L	30	31.8	29.5	24.7	19.3	---	19	17.4
Arsenic (Dissolved)	ug/L	---	33.2	---	---	---	20.6	---	16.4
Boron	ug/L	4300	4540	4580	---	---	---	---	---
Boron (Dissolved)	ug/L	---	4330	---	4280 J	5510	6210	4030	5260
Cadmium	ug/L	2 U	0.22	5 U	---	---	---	---	---
Cadmium (Dissolved)	ug/L	---	0.05 U	---	0.17	1 U	1 U	0.42 J	1 U
Calcium (Dissolved)	ug/L	---	78100	---	74900	84300	---	73100	78500
Chromium	ug/L	---	0.6 U	---	---	0.59 J	0.54 B	0.6 J	0.49 J
Chromium (Dissolved)	ug/L	---	0.04 U	---	10.7	0.54 J	0.46 B	0.88 J	0.61 J
Chromium III	ug/L	---	10 U	---	---	---	---	---	---
Chromium VI	ug/L	---	0.05 U	---	10 U	---	---	---	---
Copper	ug/L	---	2.8	---	---	---	---	---	---
Copper (Dissolved)	ug/L	---	2.7	---	8.9	5.8	5.8	5.9	4.4
Iron	ug/L	---	0 U	---	29 U	32.1 J	19.7 B	20.9 J	31.2 J
Iron (Dissolved)	ug/L	---	10 U	---	---	41.4 J	42 B	50.8	17.1 J
Lead	ug/L	---	0.19 U	---	---	---	---	---	---
Lead (Dissolved)	ug/L	---	0.03 U	---	1 U	0.38 J	0.064 B, J	1 U	0.24 J
Lithium	ug/L	250	368 J	---	---	---	---	---	---
Lithium (Dissolved)	ug/L	---	382 J	384	386	395	352	372	379
Magnesium	ug/L	---	98900	---	---	---	---	---	---
Magnesium (Dissolved)	ug/L	---	89700	---	90800 J	87300	82700	77100	96100
Manganese	ug/L	---	1.2	---	---	---	---	---	---
Manganese (Dissolved)	ug/L	---	1.5	---	1.4	2.1	1.2	0.88	0.91
Mercury	ug/L	---	0.12 U	---	0.2 U	---	---	---	---
Mercury (Dissolved)	ug/L	---	0.12 U	---	---	0.2 U	0.2 U	0.2 U	0.2 U
Molybdenum (Dissolved)	ug/L	---	---	---	---	---	---	---	---
Nickel	ug/L	---	8.2	---	---	---	---	---	---
Nickel (Dissolved)	ug/L	---	10.9	---	6.9	---	---	---	---
Potassium	ug/L	---	20700	---	---	---	---	---	---
Potassium (Dissolved)	ug/L	---	15200	---	15600	91400	74600	83700	82200
Selenium	ug/L	---	3.3	---	---	---	---	---	---
Selenium (Dissolved)	ug/L	---	5	---	7.1 J	7	8.7	6.5	7.2 J
Silicon	ug/L								
Silicon (Dissolved)	ug/L	---	---	---	7850 J	7490	7380	6680	8630

Table 9. Logan Wash Minewater Analytical Data

SampleID SampleDate Parameters	Units	MINE WATER 3/9/2000	MINE WATER 10/26/2000	MINE WATER 9/26/2001	LWM-001 10/2/2002	LW-001 10/11/2007	LW-001 3/19/2008	LW-001 10/30/2008	LW-001 6/3/2009
Metals									
Silver	ug/L	5 U	0.05 U	10 U	---	---	---	---	---
Silver (Dissolved)	ug/L	---	0.03 U	---	0.07 J	---	---	---	---
Sodium (Dissolved)	ug/L	---	374000	---	424000	490000	446000	408000	390000
Strontium	ug/L	---	7030 J	---	---	---	---	---	---
Strontium (Dissolved)	ug/L	---	7060 J	---	6330	5820	5280	5810	5430
Uranium (Dissolved)	ug/L	---	---	---	4.1 J	---	---	---	---
Zinc	ug/L	---	5.6	---	---	---	---	---	---
Zinc (Dissolved)	ug/L	---	4.9	---	24.1	18.5	10.7	15.5 U	13.6
Volatile Organic Compounds - BTEX									
Benzene	ug/L	1 U	2 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethylbenzene	ug/L	1 U	2 U	1 U	1 U	1 U	1 U	1 U	1 U
Toluene	ug/L	1 U	2 U	1 U	1 U	1 U	1 U	1 U	1 U
Xylenes, Total	ug/L	1 U	2 U	1 U	3 U	3 U	1 U	3 U	3 U
Petroleum Products									
Diesel fuel	mg/L	---	---	---	---	---	---	---	---
TPH - Extractable (DRO)	mg/L	---	---	---	---	---	---	---	---
TPH (non-polar)	mg/L	---	0.1 U	---	0.1 U	42	0.11	0.12 U	0.21
TPH (C21 - C28)	mg/L	---	---	---	---	---	---	---	---
Radiology									
Gross Alpha Analytes	pci/l	0	14 + or - 16	2 + or - 12	---	---	---	---	---
Gross Beta Analytes	pci/l	26	18 + or - 9	6.8 + or - 2	---	---	---	---	---
Field Parameters									
Conductivity, field	umhos/cm	---	---	---	---	---	---	---	---
Dissolved oxygen (DO), field	mg/L	---	---	---	---	---	---	---	---
Oxidation reduction potential (ORP), field	millivolts	---	---	---	---	---	---	---	---
pH, field	s.u.	---	---	---	---	---	---	---	---
Temperature, ambient	Deg C	---	---	---	---	---	---	---	---
Temperature, field	Deg C	---	---	---	---	---	---	---	---
Turbidity, field	NTU	---	---	---	---	---	---	---	---

Table 9. Logan Wash Minewater Analytical Data

SampleID SampleDate Parameters	Units	LW-001 11/5/2009	LW-001 6/2/2010	LW-001 11/22/2010	LW-001 5/11/2011	LW-001 10/19/2011	LW-001 6/14/2012	LW-001 10/24/2012	LW-001 5/28/2013	LW-001 10/24/2013
General Chemistry										
Alkalinity, Bicarbonate (as CaCO3)	mg/L	272	271	261	281	250	260	290	260	250
Alkalinity, Carbonate (as CaCO3)	mg/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Alkalinity, Total (As CaCO3)	mg/L	272	271	261	281	250	260	290	260	250
Ammonia	mg/L	0.25	0.1 U	0.1 U	0.1 U	0.24 U	0.1 U	0.15	0.12 U	0.16 U
Bromide	mg/L	0.2 U J	1 U	0.15 J	0.5 U	1 U	0.5 U	1.3 U	1.3 U	1.3 U
Chemical Oxygen Demand (COD)	mg/L	19.7	20.3 U	23.8	27.8	17	21	9.1 J	23 U	23
Chloride	mg/L	36.4	25.5	42.4	33.8	32	35	38	32	48
Specific Conductivity	umhos/cm	3500	3420	3560	3390	3900	3600	3600	3300	3100
Cyanide (free)	mg/L	---	---	---	0.0029 J	0.003 J	---	---	---	---
Fluoride	mg/L	---	---	---	---	---	---	---	---	---
Fluoride (dissolved)	mg/L	1.8	2.3	2.1	3	2.1	2.6	2.6	2.2	3
Hardness	mg/L	590	590	600	680	690	680	660	640	680
Nitrate (as N)	mg/L	2.9	2.8	2.9	4.4	3.3	2.9	2.5	2.5	3.6
Nitrite (as N)	mg/L	0.05 U J	0.25 U	0.27	1.2 U	0.25 U	0.13 U	0.13 U	0.13 U	0.13 U
Oil and Grease, Total	mg/L	---	---	---	---	---	---	---	---	---
Oil and grease (HEM), polar	mg/L	---	---	---	---	4.9 U	4.7 U	1.4 J	4.8 U	1.4 J
Oil and grease (HEM), total	mg/L	4.6 U	4.6 U	4.6 U	2.4 J	---	---	---	---	---
pH	s.u.	8.1 J	8.2 J	8 J	8.1 J	7.85 J	8.08 J	8.08 J	7.66 J	8.22 J
Phenolics (Total)	mg/L	0.01 U	0.01 U	0.01 U	0.0088 J	0.01 U	0.042	0.02	0.01 U	0.0073 J
Phosphorus as P, total	mg/L	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U
Silica	mg/L	---	---	---	---	---	---	---	---	---
Sulfate	mg/L	1150	1220	1320	1200	1200	1400	1300	1200	1500
Sulfide	mg/L	3 U	1.7 J	3 U	3 U	3 U	3 U	3 U	0.24 J	0.32 J
Sulfite	mg/L	---	---	---	---	---	---	---	---	---
Thiocyanate	mg/L	---	---	---	---	---	---	---	---	---
Thiosulfate	mg/L	---	---	---	---	---	---	---	---	---
Total Dissolved Solids (TDS)	mg/L	1790	2170	2230	2100	2100	1900	2100	1700	1900
Nitrogen, Total Kjeldahl	mg/L	4.5	3 U	5 U	3.3 J	5 U	5 U	0.41	5 U	5 U
Total Organic Carbon (TOC)	mg/L	7.6	6.7	7.1	8.9	6.9	6.4	5.9	4.8	8.3
Total Suspended Solids (TSS)	mg/L	4 U	4 U	4 U	4 U	4 U	4 U	4 U	2 U	2 U
Dissolved Organic Carbon (DOC)	mg/L	8.1 J	6.5	7.4	8.8	7.7	---	6.3	4.8	8.3

Table 9. Logan Wash Minewater Analytical Data

SampleID SampleDate Parameters	Units	LW-001 11/5/2009	LW-001 6/2/2010	LW-001 11/22/2010	LW-001 5/11/2011	LW-001 10/19/2011	LW-001 6/14/2012	LW-001 10/24/2012	LW-001 5/28/2013	LW-001 10/24/2013
Metals										
Arsenic	ug/L	18 J	15.8	18.9	15.9	17	19	16	18	14
Arsenic (Dissolved)	ug/L	17.1	16.3	20.1	16.5	15	18	17	17	18
Boron	ug/L	---	---	---	4800	5100	---	---	---	---
Boron (Dissolved)	ug/L	4740 J	4050	4690	4640	4500	4600	4400	4700	6000
Cadmium	ug/L	---	---	---	---	---	---	---	---	---
Cadmium (Dissolved)	ug/L	0.12 J	1 U	1 U	1 U	1 U	1 U	1 U	0.13 J	5 U
Calcium (Dissolved)	ug/L	83400 J	78600	100000	85700	92000	94000	90000	91000	100000
Chromium	ug/L	2 U	0.6 J	0.54 J	0.37 J	1.4 J	2 U	0.42 J	0.43 J	2 U
Chromium (Dissolved)	ug/L	2 U J	0.44 J	0.49 J	0.42 J	0.38 J	2 U	0.56 J	0.46 J	10 U
Chromium III	ug/L	---	---	---	---	---	---	---	---	---
Chromium VI	ug/L	---	---	---	---	---	---	---	---	---
Copper	ug/L	---	---	---	---	---	---	---	---	---
Copper (Dissolved)	ug/L	4 J	3.5	4.3	3.3	2.4	4.4	4.2	4.3	9.5 J
Iron	ug/L	47.1 J	50.7	235 J	50 U	160	200	50	95	38 J
Iron (Dissolved)	ug/L	11.4 J	22.5 J	53.2	50 U	30 J	59	18 J	20 J	250 U
Lead	ug/L	---	---	---	---	---	---	---	---	---
Lead (Dissolved)	ug/L	1 U J	0.25 J	0.32 J	1 U	1 U	1 U	0.034 J	1 U	5 U
Lithium	ug/L	---	---	---	---	---	---	---	---	---
Lithium (Dissolved)	ug/L	37.8 J	370	398	336	360	400	400	380	430
Magnesium	ug/L	---	---	---	---	---	---	---	---	---
Magnesium (Dissolved)	ug/L	97700 J	82700	116000	95200	100000	110000	96000	110000	110000
Manganese	ug/L	---	---	---	---	---	---	---	---	---
Manganese (Dissolved)	ug/L	0.89 J	1.1 U	1.9	1.3	3 J	5 U	1.7 J	1.7 J	2.3 J
Mercury	ug/L	---	---	---	0.2 U	0.2 U	---	---	---	---
Mercury (Dissolved)	ug/L	0.2 U J	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.047 J	0.2 U	0.2 U
Molybdenum (Dissolved)	ug/L	---	---	---	330	300	---	---	---	---
Nickel	ug/L	---	---	---	---	---	---	---	---	---
Nickel (Dissolved)	ug/L	---	---	---	---	---	---	---	---	---
Potassium	ug/L	---	---	---	---	---	---	---	---	---
Potassium (Dissolved)	ug/L	94000 J	86200	115000	69600	76000	86000	83000	87000	78000
Selenium	ug/L	---	---	---	11	6.5	---	---	---	---
Selenium (Dissolved)	ug/L	5.6 J	5.1	7.6	11.6	5.6	7	3.7 J	4.6 J	11 J
Silicon	ug/L									
Silicon (Dissolved)	ug/L	7520 J	6430	9440	7030	7200	8200	7800	8400	7400

Table 9. Logan Wash Minewater Analytical Data

SampleID SampleDate Parameters	Units	LW-001 11/5/2009	LW-001 6/2/2010	LW-001 11/22/2010	LW-001 5/11/2011	LW-001 10/19/2011	LW-001 6/14/2012	LW-001 10/24/2012	LW-001 5/28/2013	LW-001 10/24/2013
Metals										
Silver	ug/L	---	---	---	---	---	---	---	---	---
Silver (Dissolved)	ug/L	---	---	---	---	---	---	---	---	---
Sodium (Dissolved)	ug/L	431000 J	403000	468000	405000	410000	420000	420000	430000	510000
Strontium	ug/L	---	---	---	---	---	---	---	---	---
Strontium (Dissolved)	ug/L	6140 J	5560	8100	5320	5400	6800	6300	6500	7100
Uranium (Dissolved)	ug/L	---	---	---	---	---	---	---	---	---
Zinc	ug/L	---	---	---	---	---	---	---	---	---
Zinc (Dissolved)	ug/L	7.1 J	29.2	67.5	9.4	6.3 U	7.5	7.4 U	18	25 U
Volatile Organic Compounds - BTEX										
Benzene	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethylbenzene	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Toluene	ug/L	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Xylenes, Total	ug/L	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U	3 U
Petroleum Products										
Diesel fuel	mg/L	---	---	---	---	---	---	0.35 J	---	0.35 J
TPH - Extractable (DRO)	mg/L	---	---	---	---	---	---	---	---	---
TPH (non-polar)	mg/L	0.21 U	0.16 U	0.23	0.5 U	0.37 J	0.36 J	---	0.48 U	---
TPH (C21 - C28)	mg/L	---	---	---	---	---	---	---	---	---
Radiology										
Gross Alpha Analytes	pci/l	---	---	---	---	---	---	---	---	---
Gross Beta Analytes	pci/l	---	---	---	---	---	---	---	---	---
Field Parameters										
Conductivity, field	umhos/cm	---	---	---	---	---	---	2670	3090	2760
Dissolved oxygen (DO), field	mg/L	---	---	---	---	---	---	5.90	6.82	3.34
Oxidation reduction potential (ORP), field	millivolts	---	---	---	---	---	---	184.1	183.3	61.9
pH, field	s.u.	---	---	---	---	---	---	7.58	8.14	7.93
Temperature, ambient	Deg C	---	---	---	---	---	---	8.2	32	18
Temperature, field	Deg C	---	---	---	---	---	---	9.5	11.1	10.9
Turbidity, field	NTU	---	---	---	---	---	---	0.28	0.76	3.07

Table 9. Logan Wash Minewater Analytical Data

SampleID SampleDate Parameters	Units	LW-001 5/21/2014	LW-001 10/22/2014	LW-001 5/12/2015	LW-001 10/14/2015	LW-001 5/23/2016	LW-001 10/4/2016	LW-001 5/1/2017	LW-001 10/3/2017	LW-001 5/29/2018	LW-001 10/22/2019
General Chemistry											
Alkalinity, Bicarbonate (as CaCO3)	mg/L	250	260 B	360	270 B	271	233	234	240	258	245
Alkalinity, Carbonate (as CaCO3)	mg/L	12	5 U	5 U	5 U	2.7 U	5.93 J	2.71 U	2.71 U	6.17 J	3.69 J
Alkalinity, Total (As CaCO3)	mg/L	260	260 B	360	270	271	239 J	234	240	264	249
Ammonia	mg/L	0.1 U	0.1 U	0.1 U	0.1 U	0.038 U	0.038 U	0.042 U	0.0317 U	0.1 U	0.0317 U
Bromide	mg/L	1.3 U	1.3 U	0.5 U	2.5 U	0.079 U	R	1.58 U	0.079 U	1 U	1.58 U
Chemical Oxygen Demand (COD)	mg/L	19	25	19	10 U	32.3	21.3	13.2	10.8	15	19
Chloride	mg/L	29	42	31	35	37.4	38.9	32.3	41.2	34.3	38
Specific Conductivity	umhos/cm	2600	2900	2500	3000	2910	2890	2840	3030	2870	1920
Cyanide (free)	mg/L	---	---	---	---	---	---	---	---		
Fluoride	mg/L	---	---	---	---	2.55	2.28	2.25	2.56	2.14	2.49
Fluoride (dissolved)	mg/L	2.5	2.4	2.6	2.3	---	---	---	---	---	---
Hardness	mg/L	620	640	520	640	612	623	674	666	628	637
Nitrate (as N)	mg/L	2.5	2.8	2.7	2.3	1.99	1.8	0.972	1.91	0.655	1.78
Nitrite (as N)	mg/L	0.13 U	0.13 U	0.05 U	0.25 U	0.045 J	0.0277 U	0.0277 U	0.0277 U	0.1 U	0.0277 U
Oil and Grease, Total	mg/L	---	1.9 J	---	---	---	---	---	---	---	---
Oil and grease (HEM), polar	mg/L	4.7 U	---	4.4 U	4.3 U	---	---	---	---	---	---
Oil and grease (HEM), total	mg/L	---	---	---	---	1.16 U	1.16 U	1.16 U	1.16 U	5.88 U	2.05 J
pH	s.u.	8.39 J	7.97 HF	8.25 J	8.13 HF	7.76 J	8.36 J	8.17 J	8.71 J	8.26 T8	8.23 J
Phenolics (Total)	mg/L	0.01 U	0.01 U	0.011	0.01 U	0.008 U	0.0249 U	0.0083 U	0.0083 U	0.0292 J	0.0083 U
Phosphorus as P, total	mg/L	0.1 U	0.1 U	0.1 U	0.1 U	0.043 J	0.035 U	0.035 U	0.035 U	0.1 U	0.27
Silica	mg/L	---	---	---	---	15.9	16.3	15	15.8	15.8	14.3
Sulfate	mg/L	1200	1300	1100	1100	1280	1320	1330	1440	1410	1290
Sulfide	mg/L	3 U	3 U	0.76 J	1.6 J	0.0065 U	0.0065 U	0.0065 U	0.007 J	0.05 U	0.0065 U
Sulfite	mg/L	---	---	---	---	---	---	---	---	---	---
Thiocyanate	mg/L	---	---	---	---	---	---	---	---	---	---
Thiosulfate	mg/L	---	---	---	---	---	---	---	---	---	---
Total Dissolved Solids (TDS)	mg/L	2000	2100	1900	2300	2120	2210	2050	2220	2010	1930
Nitrogen, Total Kjeldahl	mg/L	2.8 J	1.7 J	2.7 J	5 U	0.94	0.444	0.326	0.48	0.425	1.29
Total Organic Carbon (TOC)	mg/L	5.9	5.7	9.4	6.6	51.3	5.98	5.67	6.51	5.74	6.73
Total Suspended Solids (TSS)	mg/L	2 U	2.8	---	---	---	---	---	---	0	0
Dissolved Organic Carbon (DOC)	mg/L	6	6.9	13	7.8	32.8	6.13	6.13	6.35	5.82	6.4

Table 9. Logan Wash Minewater Analytical Data

SampleID SampleDate Parameters	Units	LW-001 5/21/2014	LW-001 10/22/2014	LW-001 5/12/2015	LW-001 10/14/2015	LW-001 5/23/2016	LW-001 10/4/2016	LW-001 5/1/2017	LW-001 10/3/2017	LW-001 5/29/2018	LW-001 10/22/2019
Metals											
Arsenic	ug/L	16	15	14	16	17.0	16.2	16.4	14.8	17	16.2
Arsenic (Dissolved)	ug/L	15	15	14	16	14.7	14.7	16.7	14.2	16.6	14.7
Boron	ug/L	---	---	5200	5600	---	---	---	---	---	---
Boron (Dissolved)	ug/L	3900	4200 B	---	---	5760	4450	5940	3410	3440 O1 V	3920
Cadmium	ug/L	---	---	---	---	---	---	---	---	---	---
Cadmium (Dissolved)	ug/L	1 U	1 U	1 U	0.47 J	0.220 U	0.220 U	0.220 U	2.2 U	1.00 U	0.220 U
Calcium (Dissolved)	ug/L	82000	81000 B	70000	86000 B	95100	108000	103000	106000	98400 V	116000
Chromium	ug/L	1 J	0.32 J	2 U	0.8 J	0.320 U	0.499 U	0.320 U	0.32 U	1.00 U	0.970 J
Chromium (Dissolved)	ug/L	0.89 J	2 U	2 U	0.87 J	0.320 U	0.438 U	0.398 J	3.2 U	1.00 U	0.320 U
Chromium III	ug/L	---	---	---	---	---	---	---	---	---	---
Chromium VI	ug/L	---	---	---	---	---	---	---	---	---	---
Copper	ug/L	---	---	---	---	---	---	---	---	---	---
Copper (Dissolved)	ug/L	3.5	3.3 B	4.1	4.2	3.25	4.11	9.29	6.56 J	6.24	3.19
Iron	ug/L	120	24 J	61	20 J	33.6 J	21.8 J	15.0 U	32.1 J	100 U	30.1 J
Iron (Dissolved)	ug/L	50 U	19 J	18 J	12 J	15.0 U	15.0 U	15.0 U	150 U	100 U	17.8 J
Lead	ug/L	---	---	---	---	---	---	---	---	---	---
Lead (Dissolved)	ug/L	1 U	0.17 JB	0.082 J	0.12 J	0.260 U	0.260 U	0.452 J	2.6 U	1.00 U	0.260 U
Lithium	ug/L	---	---	---	---	---	---	---	---	---	---
Lithium (Dissolved)	ug/L	350	430	390	430	415	426	415	388	361	384
Magnesium	ug/L	---	---	---	---	---	---	---	---	---	---
Magnesium (Dissolved)	ug/L	98000	89000 B	78000	88000 B	92200	92500	102000	99000	97700 O1 V	97700
Manganese	ug/L	---	---	---	---	---	---	---	---	---	---
Manganese (Dissolved)	ug/L	1.8 J	1.9 JB	2.8 J	2 JB	4.38 J	3.01 J	4.99 J	5.1 U	1.65 J	1.93 J
Mercury	ug/L	---	---	---	---	---	---	---	---	---	---
Mercury (Dissolved)	ug/L	0.2 U	0.2 U	0.2 U	0.033 JB	0.0490 U	0.0490 U	0.0490 U	0.049 U	0.0591 B J	0.0490 U
Molybdenum (Dissolved)	ug/L	---	---	---	---	---	---	---	---	---	---
Nickel	ug/L	---	---	---	---	---	---	---	---	---	---
Nickel (Dissolved)	ug/L	---	---	---	---	---	---	---	---	---	---
Potassium	ug/L	---	---	---	---	---	---	---	---	---	---
Potassium (Dissolved)	ug/L	69000	68000	49000	73000	61800	64300	77300	88000	74800 V	70400
Selenium	ug/L	---	---	---	---	---	---	---	---	---	---
Selenium (Dissolved)	ug/L	5.8	3.6 J	8.4	5.2	5.60	5.22	4.89	3.2 U	3.82	5.01
Silicon	ug/L					7420	7640	6990	7390	7390	6700
Silicon (Dissolved)	ug/L	8000	6500	6600	8300	---	---	---	---	---	---

Table 9. Logan Wash Minewater Analytical Data

SampleID SampleDate Parameters	Units	LW-001 5/21/2014	LW-001 10/22/2014	LW-001 5/12/2015	LW-001 10/14/2015	LW-001 5/23/2016	LW-001 10/4/2016	LW-001 5/1/2017	LW-001 10/3/2017	LW-001 5/29/2018	LW-001 10/22/2019
Metals											
Silver	ug/L	---	---	---	---	---	---	---	---	---	---
Silver (Dissolved)	ug/L	---	---	---	---	---	---	---	---	---	---
Sodium (Dissolved)	ug/L	360000	380000	370000	360000	386000	368000	388000	393000	379000 O1 V	410000
Strontium	ug/L	---	---	---	---	---	---	---	---	---	---
Strontium (Dissolved)	ug/L	5400	5600	4100	5900	5260	7510	6650	5930	6350	5510
Uranium (Dissolved)	ug/L	---	---	---	---	---	---	---	---	---	---
Zinc	ug/L	---	---	---	---	---	---	---	---	---	---
Zinc (Dissolved)	ug/L	12	9.3 B	30	5.1 B	10.3 U	22.6	34.8	84.3 U	6.17 J	10.1
Volatile Organic Compounds - BTEX											
Benzene	ug/L	1 U	1 U	5 U	5 U	0.331 U	0.331 U	0.331 U	0.331 U	1.00 U	0.331 U
Ethylbenzene	ug/L	1 U	1 U	5 U	5 U	0.384 U	0.384 U	0.384 U	0.384 U	1.00 U	0.384 U
Toluene	ug/L	1 U	1 U	5 U	5 U	0.780 U	0.780 U	0.412 U	0.412 U	1.00 U	0.412 U
Xylenes, Total	ug/L	3 U	3 U	10 U	10 U	1.06 U	1.06 U	1.06 U	1.06 U	3.00 U	1.06 U
Petroleum Products											
Diesel fuel	mg/L	0.25 J	0.35 J	0.92	0.51	0.83	0.198	0.174	0.33	0.213 B	0.247
TPH - Extractable (DRO)	mg/L	---	---	---	---	---	---	---	---	---	---
TPH (non-polar)	mg/L	---	---	---	---	---	---	---	---	---	---
TPH (C21 - C28)	mg/L	---	---	---	---	---	---	---	---	---	---
Radiology											
Gross Alpha Analytes	pci/l	---	---	---	---	---	---	---	---	---	---
Gross Beta Analytes	pci/l	---	---	---	---	---	---	---	---	---	---
Field Parameters				---	---	---	---				
Conductivity, field	umhos/cm	2870	3053	3000	3450	3500	2127	2745	2233	2796	2770
Dissolved oxygen (DO), field	mg/L	10.39	3.36	6.1	7.13	4.17	7.83	5.97	63.4	NM	7.44
Oxidation reduction potential (ORP), field	millivolts	204	86.8	62.4	---	-43.8	-24.3	153.9	83.7	313.2	178.1
pH, field	s.u.	7.92	8.12	8.26	8.2	7.47	8.63	7.71	8.54	7.04	7.17
Temperature, ambient	Deg C	15.5	---	18	29.4	---	---	15.6	7.2	---	---
Temperature, field	Deg C	9.22	11.5	10.4	13	11.21	10.6	9.9	11.2	10.7	11.15
Turbidity, field	NTU	3.69	---	2.35	0.02	2.07	1.39	1.85	1.33	2.17	0.72

Table 9. Logan Wash Mine Retort Water Analytical Data

Notes:

U = result not detected at the reporting limit

J = result value greater than the MDL and less than the RL; result considered estimated

B = analyte found in sample and associated blank

HF = analysis holding time exceeded; result considered estimated

E = result estimated due to the presence of interference

R = rejected data

O1 = failed the method required serial dilution test and or subsequent post spike criteria. Failures indicate matrix interference

V = sample concetration is too high to evaluate accurate spike recoveries

--- = Analysis not performed

Table 10. Logan Wash Mine Retort Water Analytical Data

SampleID		LWRTRT-Pipe	Retort Water	RT-1	Upper Manhole	Retort Water	RW-1	RW-2	Retort Water	Retort Water	Retort Water	LW-RETORT
SampleDate		2/16/2000	10/26/2000	10/26/2000	10/26/2000	10/2/2002	10/2/2002	10/2/2002	10/3/2006	10/11/2007	3/19/2008	10/30/2008
Parameters	Units											
General Chemistry												
Alkalinity, Bicarbonate (as CaCO3)	mg/L	---	426	439	---	471	474	487	---	439	436	497
Alkalinity, Carbonate (as CaCO3)	mg/L	---	12.9	5 U	---	43.1	43	72	---	57.1	69.6	5 U
Alkalinity, Total (As CaCO3)	mg/L	---	439	439	---	515	517	559	521	496	506	497
Ammonia	mg/L	26 D	0.8 U	4 U	1.9	11.1	10.7	5.3	7 J	3.5	4.9 J	0.33 U J
Bromide	mg/L	---	240	---	---	0.2	0.2	0.22	---	240	0.24	0.23
Chemical Oxygen Demand (COD)	mg/L	---	135	---	---	167	94.3	67.2	---	142	171	16.7
Chloride	mg/L	---	75.9	---	---	72.7	72.1	77.6	87.8	94.6	86.1	94.2
Specific Conductivity	umhos/cm	1800	---	---	---	6870	6930	8370	---	7750	11200	10800
Cyanide (free)	mg/L	---	---	---	---	---	---	---	---	---	---	---
Fluoride	mg/L	3.5	13.7	14.8	---	---	---	---	8	---	---	---
Fluoride (dissolved)	mg/L	---	11.6	---	---	9.2	9.9	11	---	11.5	10.1	10
Hardness	mg/L	---	279	---	---	224	228	193	---	300	340	310
Nitrate (as N)	mg/L	---	0.8	0.74	---	0.05 U	0.05 U	0.05 U	U	0.05 U	0.05 U	0.05 U
Nitrite (as N)	mg/L	---	0.01 U	0.01 U	---	0.05 U	0.05 U	0.05 U	---	0.05 U	0.05 U	0.05 U
Oil and Grease, Total	mg/L	---	14.5	---	---	---	---	---	---	---	---	---
Oil and grease (HEM), polar	mg/L	---	---	---	---	---	---	---	---	---	---	---
Oil and grease (HEM), total	mg/L	---	---	---	---	4.9 U	---	4.9 U	15.8	4.8 U	11.4	4.7 U
pH	s.u.	8.3	---	---	---	8.7	8.8	8.8	---	8.6 J	8.6	8.4 J
Phenolics (Total)	mg/L	---	50 U	---	---	0.034	---	---	93 J	0.046	0.058 J	0.065
Phosphorus as P, total	mg/L	---	0.15	---	---	0.1 U	0.1 U	0.1 U	---	0.1 U	0.1 U	0.081 J
Silica	mg/L	---	20700	---	---	---	---	---	---	---	11200	---
Sulfate	mg/L	---	3920	---	1810	3110	2770	3740	3790	4060	3650	3680
Sulfide	mg/L	---	---	---	---	---	---	---	---	---	---	23.4
Sulfite	mg/L	---	2 U	---	---	---	---	---	---	---	---	---
Thiocyanate	mg/L	---	1 U	---	---	---	---	---	---	---	---	---
Thiosulfate	mg/L	---	1 U	---	---	---	---	---	---	---	---	---
Total Dissolved Solids (TDS)	mg/L	---	6660	---	---	5350	5290	6380	6180	1470	5990	5730
Nitrogen, Total Kjeldahl	mg/L	---	---	---	---	---	---	---	---	5.8	4.5	10.1
Total Organic Carbon (TOC)	mg/L	---	---	---	---	22.8	---	---	---	---	35.5	24.3
Total Suspended Solids (TSS)	mg/L	---	179	---	---	---	---	---	---	4 U	4.8	2.4 J
Dissolved Organic Carbon (DOC)	mg/L	---	40 U	---	---	23.8	---	---	---	1.4	35.7	24.4

Table 10. Logan Wash Mine Retort Water Analytical Data

SampleID		LWRTRT-Pipe	Retort Water	RT-1	Upper Manhole	Retort Water	RW-1	RW-2	Retort Water	Retort Water	Retort Water	LW-RETORT
SampleDate		2/16/2000	10/26/2000	10/26/2000	10/26/2000	10/2/2002	10/2/2002	10/2/2002	10/3/2006	10/11/2007	3/19/2008	10/30/2008
Parameters	Units											
Metals												
Arsenic	ug/L	20	75.2	314	---	28.9	24.9	47.7	---	---	---	33.6
Arsenic (Dissolved)	ug/L	---	128	---	---	---	---	---	25.2	24.9	34.7	---
Boron	ug/L	6700	12900 E	13600 E	---	---	---	---	129000	---	---	---
Boron (Dissolved)	ug/L	---	13500 E	---	---	12800 J	12500 J	13600 J	---	10400	12600	9620
Cadmium	ug/L	2 U	2.4	3.9	---	---	---	---	---	---	---	---
Cadmium (Dissolved)	ug/L	---	2.3	---	---	0.75	0.68	0.64	---	1 U	1 U	0.68 J
Calcium	ug/L	---	---	---	---	---	---	---	61500 J	---	---	---
Calcium (Dissolved)	ug/L	---	68400	---	---	37300	37100	37100	---	51100	60100	49900
Chromium	ug/L	---	0.6 U	0.6 U	---	---	---	---	---	2 U	---	0.38 J
Chromium (Dissolved)	ug/L	---	1.1	---	---	18.6	15.4	19.5	---	0.36 J	0.26	0.67 J
Chromium III	ug/L	---	10 U	---	---	---	---	---	---	---	---	---
Chromium VI	ug/L	---	0.05 U	---	---	10 U	10 U	10 U	---	---	---	---
Copper	ug/L	---	3	16.9	---	---	---	---	---	---	---	---
Copper (Dissolved)	ug/L	---	3.1	---	---	13.5	14	16.4	---	12.1	2.1	5.9
Iron	ug/L	---	13900 E	54800 E	---	741 J	922 J	206 U	---	403	604	110
Iron (Dissolved)	ug/L	---	16800 E	---	---	---	---	---	---	280	114	235
Lead	ug/L	---	1.3	3.6	---	---	---	---	---	---	---	---
Lead (Dissolved)	ug/L	---	1.6	---	---	1 U	1 U	0.12	---	0.63 J	0.089 J	1 U
Lithium	ug/L	---	491 J	407 J	---	---	---	---	---	---	---	---
Lithium (Dissolved)	ug/L	---	582 J	---	---	355	349	367	---	435	489	503
Magnesium	ug/L	---	26700 E	28300 E	---	---	---	---	47200 J	---	---	---
Magnesium (Dissolved)	ug/L	---	26300 E	---	---	30700 J	30100 J	22200 J	---	34100	43300	36300
Manganese	ug/L	---	38	62.1	---	---	---	---	---	---	---	---
Manganese (Dissolved)	ug/L	---	42.1	---	---	70.5	83	13.9	---	19.4	15.4	14.8
Mercury	ug/L	---	0.12 U	0.12 U	---	0.2 U	0.2 U	0.2 U	---	---	---	---
Mercury (Dissolved)	ug/L	---	0.12 U	---	---	---	---	---	---	0.2 U	0.2 U	0.2 U
Molybdenum (Dissolved)	ug/L	---	---	---	---	---	---	---	---	---	---	---
Nickel	ug/L	---	3.7	6.4	---	---	---	---	---	---	---	---
Nickel (Dissolved)	ug/L	---	3.9	---	---	0.37	0.29	0.17	---	---	---	---
Potassium	ug/L	---	167000 E	1160000 E	---	---	---	---	559000 J	---	---	---
Potassium (Dissolved)	ug/L	---	858000 E	---	---	754000	743000	917000	---	978000	711000	943000
Selenium	ug/L	---	15.1	57.7	---	---	---	---	3.1 B	---	---	---
Selenium (Dissolved)	ug/L	---	11.8	---	---	14.2 J	14 J	18.6 J	---	3.9 J	5.4	4.6 J

Table 10. Logan Wash Mine Retort Water Analytical Data

SampleID SampleDate Parameters	Units	LWRTRT-Pipe 2/16/2000	Retort Water 10/26/2000	RT-1 10/26/2000	Upper Manhole 10/26/2000	Retort Water 10/2/2002	RW-1 10/2/2002	RW-2 10/2/2002	Retort Water 10/3/2006	Retort Water 10/11/2007	Retort Water 3/19/2008	LW-RETORT 10/30/2008
Metals												
Silicon	ug/L											
Silicon (Dissolved)	ug/L	---	---	---	---	11700 J	11400 J	12800 J	---	---	12200	10100
Silver	ug/L	5 U	0.05 U	0.05 U	---	---	---	---	---	---	---	---
Silver (Dissolved)	ug/L	---	0.03 U	---	---	0.049 J	0.028 J	1 U	---	---	---	---
Sodium	ug/L	---	---	---	---	---	---	---	1450000 J	---	---	---
Sodium (Dissolved)	ug/L	---	1070000	---	---	1160000	1140000	1320000	---	740000	1430000	1320000
Strontium	ug/L	---	1300 J	2150 J	---	---	---	---	---	---	---	---
Strontium (Dissolved)	ug/L	---	998 J	---	---	1450	1440	1480	---	1700	1970	1700
Uranium (Dissolved)	ug/L	---	---	---	---	1.6 J	1.5 J	1.7 J	---	---	---	---
Zinc	ug/L	---	4.9	18 U	---	---	---	---	---	---	---	---
Zinc (Dissolved)	ug/L	---	10.6	---	---	1.9	1.8	2.3	---	5.9	4.5 B	14.8 U
Volatile Organic Compounds - BTEX												
Benzene	ug/L	47 D	0.52 J	0.51 J	0.52 J	5.3	5.5	0.47 J	3.0	2.6	1.5	3.5
Ethylbenzene	ug/L	11 D	0.37 J	0.36 J	0.35 J	1.5	1.6	0.23 J	1.2	1.2	0.59 J	1.8
Toluene	ug/L	2 U	0.33 J	0.33 J	0.37 J	0.36 J	0.38 J	0.24 J	3.0	1.4	0.6 J	2.6
Xylenes, Total	ug/L	46 D	0.94 J	0.91 J	1 J	6.3	6.6	0.64 J	7.9	8.2	3.4	12
Petroleum Products												
Diesel fuel	mg/L	---	---	---	---	---	---	---	---	---	---	---
TPH - Extractable	mg/L	---	---	---	---	4.9	---	5.1	7.3	0.36	---	5
TPH (non-polar)	mg/L	---	---	---	---	4.9	---	5.1	7.3	0.36	26	5
TPH (C21 - C28)	mg/L	---	16	---	---	---	---	---	---	---	---	---
Radiology												
Gross Alpha Analytes	pci/l	---	180 + or - 95	---	---	---	---	---	---	---	---	---
Gross Beta Analytes	pci/l	---	650 + or - 80	---	---	---	---	---	---	---	---	---
Field Parameters												
Conductivity, field	uS/cm	---	---	---	---	---	---	---	---	---	---	---
Dissolved oxygen (DO), field	mg/L	---	---	---	---	---	---	---	---	---	---	---
Oxidation reduction potential (ORP), field	millivolts	---	---	---	---	---	---	---	---	---	---	---
pH, field	s.u.	---	---	---	---	---	---	---	---	---	---	---
Temperature, ambient	Deg C	---	---	---	---	---	---	---	---	---	---	---
Temperature, field	Deg C	---	---	---	---	---	---	---	---	---	---	---
Turbidity, field	NTU	---	---	---	---	---	---	---	---	---	---	---

Table 10. Logan Wash Mine Retort Water Analytical Data

SampleID		LW-RETORT	LW-RETORT	Settling Pond	LW-005	LW-RETORT	LW-RETORT	LW-RETORT	LW-RETORT	LW-RETORT	LW-RETORT	LW-RETORT
SampleDate		6/3/2009	11/5/2009	11/5/2009	6/2/2010	6/2/2010	11/22/2010	5/11/2011	10/19/2011	6/14/2012	10/24/2012	5/28/2013
Parameters	Units											
General Chemistry												
Alkalinity, Bicarbonate (as CaCO3)	mg/L	557	470	435	474	485	457	515	440	470	410 J	420
Alkalinity, Carbonate (as CaCO3)	mg/L	34.4	46.1	30.5	58.7	58.9	67.8	33.3	70	46	61 J	59
Alkalinity, Total (As CaCO3)	mg/L	592	516	465	532	543	525	572	510	520	470 J	480
Ammonia	mg/L	5.7	5.9	2.3	7.9	5.4	3.5	3.8	3.1	3.6	2.8 J	2.8
Bromide	mg/L	0.2 U	0.2 U J	0.2 U J	2 U	2 U	0.2 U	1 U	2 U	1 U	2.5 U	2.5 U
Chemical Oxygen Demand (COD)	mg/L	138	106	73.4	128	112	267	150	120	110	120 J	100
Chloride	mg/L	73.2	87.9	97	59.5	58.9	65.8	87.3	68	85	75	80
Specific Conductivity	umhos/cm	12500	11300	11500	10500	10300	11000	10000	12000	11000	13000 J	9900
Cyanide (free)	mg/L	---	---	---	---	---	---	---	---	---	---	---
Fluoride	mg/L	---	---	---	---	---	---	---	---	---	---	---
Fluoride (dissolved)	mg/L	13.4	12.6	12.3	9.4	9.3	10.1	12	10	9.9	10	9.7
Hardness	mg/L	352	300	340	320	310	300	400	300	330	330	320
Nitrate (as N)	mg/L	0.05 U	0.05 U	0.98	0.5 U	0.5 U	0.05 U	0.25 U	0.5 U	0.25 U	1 U J	0.5 U
Nitrite (as N)	mg/L	0.031 J	2.5 U J	2.5 U J	0.5 U	0.5 U	0.46	2.5 U	0.5 U	0.25 U	0.25 U J	0.25 U
Oil and Grease, Total	mg/L	---	---	---	---	---	---	---	---	---	---	---
Oil and grease (HEM), polar	mg/L	---	---	---	---	---	---	---	22	10	5 J	4.7 U
Oil and grease (HEM), total	mg/L	4.7 U	11.5	4.8 U	48.8 J	6.8 J	38.5	558	---	---	---	---
pH	s.u.	8.5 J	8.6 J	8.5 J	8.7 J	8.6 J	8.6 J	8.5 J	8.26 J	8.53 J	8.76 J	8.16 J
Phenolics (Total)	mg/L	0.1	0.069	0.018	0.071 J	0.07 J	0.072	0.1	0.06	0.066	0.071 J	0.044
Phosphorus as P, total	mg/L	0.1 U	0.045 J	0.07 J	0.1 U	0.1 U	0.1 U	0.031 J	0.1 U	0.045 J	0.038 J	0.058 J
Silica	mg/L	---	---	---	---	---	---	---	---	---	---	---
Sulfate	mg/L	3930	4150	4140	3980	4210	3310	3820	3600	3700	3600 J	3900
Sulfide	mg/L	5.8	5	2.4 J	5.5	6.4	14.3	18.5	46	20	20 J	46
Sulfite	mg/L	---	---	---	---	---	---	---	---	---	---	---
Thiocyanate	mg/L	---	---	---	---	---	---	---	---	---	---	---
Thiosulfate	mg/L	---	---	---	---	---	---	---	---	---	---	---
Total Dissolved Solids (TDS)	mg/L	6930	5360	7200	7010	6690	6580	1520	6900	6500	6000 J	6100
Nitrogen, Total Kjeldahl	mg/L	11.2	10.4	7.1	7.9	7.3	7.2	11.5	4.6 J	5.6	5.0 J	5.1
Total Organic Carbon (TOC)	mg/L	27.5	31.7	23.9	70.6	240	45.7	21.7	20	20	17 J	13
Total Suspended Solids (TSS)	mg/L	8.8	4 U	2.8 J	11.6 J	5.2 J	100	4 U	16	4 U	4 U J	2 U
Dissolved Organic Carbon (DOC)	mg/L	22	23.3 J	24.2 J	20.9	20.9	21.3	20.6	19	17	17 J	17

Table 10. Logan Wash Mine Retort Water Analytical Data

SampleID		LW-RETORT	LW-RETORT	Settling Pond	LW-005	LW-RETORT	LW-RETORT	LW-RETORT	LW-RETORT	LW-RETORT	LW-RETORT	LW-RETORT
SampleDate		6/3/2009	11/5/2009	11/5/2009	6/2/2010	6/2/2010	11/22/2010	5/11/2011	10/19/2011	6/14/2012	10/24/2012	5/28/2013
Parameters	Units											
Metals												
Arsenic	ug/L	34.6	39.6 J	35.9	26.5	30.4	31.3	19.2	25	39	37	28
Arsenic (Dissolved)	ug/L	29.2	29.2	37.1 J	28.6	25.7	12.1	29.5	31	36	32	36 J
Boron	ug/L	---	---	---	---	---	---	---	---	---	---	---
Boron (Dissolved)	ug/L	11800	11500 J	---	10700	11100	11000	10600	11000	11000	9500	13000 J
Cadmium	ug/L	---	---	---	---	---	---	---	---	---	---	---
Cadmium (Dissolved)	ug/L	1 U	0.23 J	11500 J	1 U	0.2 J	1 U	0.28 J	1 U	0.2 J	0.12 J	0.64 J
Calcium	ug/L	---	---	---	---	---	---	---	---	---	---	---
Calcium (Dissolved)	ug/L	52100	50600 J	54600 J	49600	51500	49500	48100	52000	57000	50000	68000 J
Chromium	ug/L	0.41 J	2 U	2 U J	2 U	0.19 J	2 U	0.24 J	0.91 J	0.18 J	2 U	10 U
Chromium (Dissolved)	ug/L	0.46 J	2 U J	2 U J	0.26 J	0.25 J	0.27 J	0.2 J	2 U	2 U	2 U	10 U J
Chromium III	ug/L	---	---	---	---	---	---	---	---	---	---	---
Chromium VI	ug/L	---	---	---	---	---	---	---	---	---	---	---
Copper	ug/L	---	---	---	---	---	---	---	---	---	---	---
Copper (Dissolved)	ug/L	0.89 J	1.2 J	---	0.42 J	0.46 J	0.1 J	0.54 J	0.41 J	1.5 J	0.89 J	3.6 J
Iron	ug/L	154	112	174	273	70.9	206 J	132	150	130	80	110 J
Iron (Dissolved)	ug/L	75.3	5.1 J	33.1 J	50 U	50 U	3.9 J	50 U	46 J	37 J	15 J	250 U J
Lead	ug/L	---	---	---	---	---	---	---	---	---	---	---
Lead (Dissolved)	ug/L	0.065 J	1 U J	1 U J	0.025 J	0.02 J	1 U	1 U	1 U	1 U	1 U	5 U J
Lithium	ug/L	---	---	---	---	---	---	---	---	---	---	---
Lithium (Dissolved)	ug/L	498	492 J	483 J	519	533	536	472	470	520	450	480 J
Magnesium	ug/L	---	---	---	---	---	---	---	---	---	---	---
Magnesium (Dissolved)	ug/L	43600	42400 J	48700 J	36700	37700	46800	43400	41000	45000	37000	48000 J
Manganese	ug/L	---	---	---	---	---	---	---	---	---	---	---
Manganese (Dissolved)	ug/L	16.2	13.3 J	17 J	11.5	11.7	11.2	11.4	13	11	7.8	9.1 J
Mercury	ug/L	---	---	---	---	---	---	---	---	---	---	---
Mercury (Dissolved)	ug/L	0.2 U	0.2 U J	0.2 U J	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U J
Molybdenum (Dissolved)	ug/L	---	---	---	---	---	---	---	---	---	---	---
Nickel	ug/L	---	---	---	---	---	---	---	---	---	---	---
Nickel (Dissolved)	ug/L	---	---	---	---	---	---	---	---	---	---	---
Potassium	ug/L	---	---	---	---	---	---	---	---	---	---	---
Potassium (Dissolved)	ug/L	939000	960000 J	950000 J	906000	904000	1050000	865000	950000	930000	890000	1100000 J
Selenium	ug/L	---	---	---	---	---	---	---	---	---	---	---
Selenium (Dissolved)	ug/L	2.6 J	4.3 J	4.4 J	2.2 J	2.1 J	4.4 J	3.7 J	2.2 J	1.8 J	5 U	25 U J

Table 10. Logan Wash Mine Retort Water Analytical Data

SampleID		LW-RETORT	LW-RETORT	Settling Pond	LW-005	LW-RETORT	LW-RETORT	LW-RETORT	LW-RETORT	LW-RETORT	LW-RETORT	LW-RETORT
SampleDate		6/3/2009	11/5/2009	11/5/2009	6/2/2010	6/2/2010	11/22/2010	5/11/2011	10/19/2011	6/14/2012	10/24/2012	5/28/2013
Parameters	Units											
Metals												
Silicon	ug/L	---	---	---	---	---	---	---	---	---	---	---
Silicon (Dissolved)	ug/L	11800	10600 J	11200 J	9130	9270	12600	9590	9600	11000	9100	12000 J
Silver	ug/L	---	---	---	---	---	---	---	---	---	---	---
Silver (Dissolved)	ug/L	---	---	---	---	---	---	---	---	---	---	---
Sodium	ug/L	---	---	---	---	---	---	---	---	---	---	---
Sodium (Dissolved)	ug/L	1350000	1320000 J	1780 J	1310000	1310000	1460000	1250000	1300000	1400000	1300000	1700000 J
Strontium	ug/L	---	---	---	---	---	---	---	---	---	---	---
Strontium (Dissolved)	ug/L	1790	1730 J	3.5 J	1690	1730	2170	1780	1800	2300	1900	2400 J
Uranium (Dissolved)	ug/L	---	---	---	---	---	---	---	---	---	---	---
Zinc	ug/L	---	---	---	---	---	---	---	---	---	---	---
Zinc (Dissolved)	ug/L	4 J	2.3 J	3.5 J	1.6 J	1 J	2.6 J	2 J	5 U	5.4 U	5 U	25 U J
Volatile Organic Compounds - BTEX												
Benzene	ug/L	5.1	4.3	1 U	3.7	3.8	3.2	4.1	2.5	2.5	2.4 J	2.1
Ethylbenzene	ug/L	1.5	1.6	1 U	1.3	1.7	1.4	1.9	1.6	1.6	1.1 J	1.1
Toluene	ug/L	3.2	2.3	1 U	1.8	1.9	2.3	3.1	1.4	1.8	1 J	1.1
Xylenes, Total	ug/L	9.5	11	3 U	8.4	12	11	12	9.6	11	5.7 J	8.6
Petroleum Products												
Diesel fuel	mg/L	---	---	---	---	---	---	---	---	---	7.3 J	6.3
TPH - Extractable	mg/L	28	7.6	2.9	16 J	7.1 J	47	110	4.5	6.9	---	---
TPH (non-polar)	mg/L	28	7.6	2.9	16 J	7.1 J	47	110	4.5	6.9	---	---
TPH (C21 - C28)	mg/L	---	---	---	---	---	---	---	---	---	---	---
Radiology												
Gross Alpha Analytes	pci/l	---	---	---	---	---	---	---	---	---	---	---
Gross Beta Analytes	pci/l	---	---	---	---	---	---	---	---	---	---	---
Field Parameters												
Conductivity, field	uS/cm	---	---	---	---	---	---	---	5590	5480	6008	8850
Dissolved oxygen (DO), field	mg/L	---	---	---	---	---	---	---	0.58	1.41	0.83	0.37
Oxidation reduction potential (ORP), field	millivolts	---	---	---	---	---	---	---	-182.9	-298	-256	-192.8
pH, field	s.u.	---	---	---	---	---	---	---	8.8	8.92	8.79	8.78
Temperature, ambient	Deg C	---	---	---	---	---	---	---	22	34	8.2	32
Temperature, field	Deg C	---	---	---	---	---	---	---	14.7	15	14.2	14.1
Turbidity, field	NTU	---	---	---	---	---	---	---	1.43	3.34	1.48	1.48

Table 10. Logan Wash Mine Retort Water Analytical Data

SampleID SampleDate Parameters	Units	LW-003 (DUP) 5/28/2013	LW-RETORT 10/24/2013	LW-RETORT 5/21/2014	LW-003 (DUP) 5/21/2014	LW-RETORT 10/22/2014	LW-RETORT 5/12/2015	LW-003 (DUP) 5/12/2015	LW-RETORT 10/14/2015	LW-003 (DUP) 10/14/2015	LW-RETORT 5/23/2016	LW-003 (DUP) 5/23/2016
General Chemistry												
Alkalinity, Bicarbonate (as CaCO3)	mg/L	460 J	540	690	680	580 B	410	500	370 B	277 B	354	372
Alkalinity, Carbonate (as CaCO3)	mg/L	410 J	45	120	610	5 U	100	390	76	390 B	21.5	26.9
Alkalinity, Total (As CaCO3)	mg/L	49 J	590	810	69	580 B	520	110	440 B	---	375	399
Ammonia	mg/L	3.9 J	4.8	5.7	6	3.2	2.8	3.2	2.6	2.8	1.7	1.69
Bromide	mg/L	2.5 U J	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	5 U	5 U	0.08 U	0.08 U
Chemical Oxygen Demand (COD)	mg/L	97 J	190	380	100	750	50	83	81	81	114	87.5
Chloride	mg/L	80 J	94	98	91	96	84	83	67	68	76.8	77.3
Specific Conductivity	umhos/cm	---	8800	8300	8400	8700	8500	8600	8700	---	85700	85100
Cyanide (free)	mg/L	---	---	---	---	---	---	---	---	---	---	---
Fluoride	mg/L	---	---	---	---	---	---	---	---	---	9.5	9.72
Fluoride (dissolved)	mg/L	9.6 J	10	14	8.7	10	10	10	8.7	8.9	---	---
Hardness	mg/L	330 J	370	410	390	400	330	310	340	340	332	336
Nitrate (as N)	mg/L	0.5 U J	0.5 U	0.5 U	0.5 U	0.035 J	0.64	0.5 U	1 U	1 U	0.023 U	0.023 U
Nitrite (as N)	mg/L	0.25 U J	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.25 U	0.5 U	0.5 U	0.028 U	0.028 U
Oil and Grease, Total	mg/L	---	---	---	---	560	---	---	---	---	---	---
Oil and grease (HEM), polar	mg/L	4.7 U J	20	14	4.7 U	---	3.4 J	2.9 J	1.6 J	4.1 U	---	---
Oil and grease (HEM), total	mg/L	---	---	---	---	---	---	---	---	---	1.38 J	1.74 J
pH	s.u.	0.00834 J	8.48 J	8.46 J	8.5 J	8.62 HF	8.44 J	8.58 J	8.74 HF	8.76 H F	8.25 J	7.36
Phenolics (Total)	mg/L	0.047 J	0.18	0.25	0.091	0.11	0.033	0.02065 U	0.058	0.031 U	0.014 U	0.046 U
Phosphorus as P, total	mg/L	0.062 J	0.075 J	0.11	0.067 J	1.2	0.056 J	0.087 J	0.077 J	0.059 J	0.064 J	0.054 J
Silica	mg/L	---	---	---	---	---	---	---	---	---	19.7	19.6
Sulfate	mg/L	4000 J	4000	3300	3800	4100	4200	4200	3500	3700	4120	4160
Sulfide	mg/L	38 J	58	110	55	3 U	46	45	46	50	0.34 J	1.32 J
Sulfite	mg/L	---	---	---	---	---	---	---	---	---	---	---
Thiocyanate	mg/L	---	---	---	---	---	---	---	---	---	---	---
Thiosulfate	mg/L	---	---	---	---	---	---	---	---	---	---	---
Total Dissolved Solids (TDS)	mg/L	6300 J	5800	5800	5700	6500	7100	7200	7100	7000	6740	6810
Nitrogen, Total Kjeldahl	mg/L	---	6.8	12	---	15	4.9 J	4.4 J	3.9 J	4.5 J	2.75	2.68
Total Organic Carbon (TOC)	mg/L	13 J	24	27	17	2.6	19	---	19	19	686	166
Total Suspended Solids (TSS)	mg/L	2 U J	7.2	22	2 U	1500	---	---	---	---	---	---
Dissolved Organic Carbon (DOC)	mg/L	13 J	24	25	23	19	20	20	19	18	118	74.8

Table 10. Logan Wash Mine Retort Water Analytical Data

SampleID		LW-003 (DUP)	LW-RETORT	LW-RETORT	LW-003 (DUP)	LW-RETORT	LW-RETORT	LW-003 (DUP)	LW-RETORT	LW-003 (DUP)	LW-RETORT	LW-003 (DUP)
SampleDate		5/28/2013	10/24/2013	5/21/2014	5/21/2014	10/22/2014	5/12/2015	5/12/2015	10/14/2015	10/14/2015	5/23/2016	5/23/2016
Parameters	Units											
Metals												
Arsenic	ug/L	28	21	40	34	630	9.5 J	12 J	14	17	32.9	34.3
Arsenic (Dissolved)	ug/L	33 J	19	38	32	39	21 J	23 J	26	30	28.7	26.2
Boron	ug/L	---	---	---	---	---	---	---	---	---	---	---
Boron (Dissolved)	ug/L	12000 J	12000	13000	12000	10000 B	10000	11000	11000	11000	10800	11200
Cadmium	ug/L	---	---	---	---	---	---	---	---	---	---	---
Cadmium (Dissolved)	ug/L	0.61 J	5 U	1 U	1 U	10 U	1 U	1 U	1.9 J	2.2 J	0.52 J	0.568 J
Calcium	ug/L	---	---	---	---	---	---	---	---	---	---	---
Calcium (Dissolved)	ug/L	63000 J	65000	60000	60000	53000 B	53000	53000	58000 B	59000 B	65400	64700
Chromium	ug/L	10 U	2 U	0.77 J	0.79 J	4 J	2 U	2 U	20 U	20 U	0.32 U	0.320 U
Chromium (Dissolved)	ug/L	10 U J	10 U	0.79 J	0.57 J	20 U	2 U	2 U	20 U	20 U	0.32 U	0.320 U
Chromium III	ug/L	---	---	---	---	---	---	---	---	---	---	---
Chromium VI	ug/L	---	---	---	---	---	---	---	---	---	---	---
Copper	ug/L	---	---	---	---	---	---	---	---	---	---	---
Copper (Dissolved)	ug/L	3.6 J	6 J	0.55 J	0.63 J	20 U	1.4 J	1.4 J	7.3 J	7.3 J	16.2	0.412 J
Iron	ug/L	340	820	2900	180	200000	180	120	340 J	210 J	462	123
Iron (Dissolved)	ug/L	250 U J	250 U	50 U	50 U	500 U	9.1 J	12 J	500 U	500 U	227	15 U
Lead	ug/L	---	---	---	---	---	---	---	---	---	---	---
Lead (Dissolved)	ug/L	5 U J	5 U	1 U	1 U	10 U	1 U	1 U	10 U	10 U	1.63	0.26 U
Lithium	ug/L	---	---	---	---	---	---	---	---	---	---	---
Lithium (Dissolved)	ug/L	490 J	520	520	530	530	500	500	550	540	518	513
Magnesium	ug/L	---	---	---	---	---	---	---	---	---	---	---
Magnesium (Dissolved)	ug/L	44000 J	47000	70000	67000	39000 B	36000	37000	41000 B	41000 B	39300	39200
Manganese	ug/L	---	---	---	---	---	---	---	---	---	---	---
Manganese (Dissolved)	ug/L	8.7 J	13 J	1.2	12	12 JB	13	13	15 J	16 J	10.4	9.77
Mercury	ug/L	---	---	---	---	---	---	---	---	---	---	---
Mercury (Dissolved)	ug/L	0.2 U J	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.037 JB	0.04 J B	0.049 U	0.0490 U
Molybdenum (Dissolved)	ug/L	---	---	---	---	---	---	---	---	---	---	---
Nickel	ug/L	---	---	---	---	---	---	---	---	---	---	---
Nickel (Dissolved)	ug/L	---	---	---	---	---	---	---	---	---	---	---
Potassium	ug/L	---	---	---	---	---	---	---	---	---	---	---
Potassium (Dissolved)	ug/L	1100000 J	920000	760000	780000	870000	930000	920000	910000	940000	968000	994000
Selenium	ug/L	---	---	---	---	---	---	---	---	---	---	---
Selenium (Dissolved)	ug/L	25 U J	6.6 J	2.9 J	3.2 J	50 U	4.5 J	4.1 J	3.6 J	4.8 J	3.18	2.75

Table 10. Logan Wash Mine Retort Water Analytical Data

SampleID SampleDate Parameters	Units	LW-003 (DUP) 5/28/2013	LW-RETORT 10/24/2013	LW-RETORT 5/21/2014	LW-003 (DUP) 5/21/2014	LW-RETORT 10/22/2014	LW-RETORT 5/12/2015	LW-003 (DUP) 5/12/2015	LW-RETORT 10/14/2015	LW-003 (DUP) 10/14/2015	LW-RETORT 5/23/2016	LW-003 (DUP) 5/23/2016
Metals												
Silicon	ug/L	---	---	---	---	---	---	---	---	---	9220	9160
Silicon (Dissolved)	ug/L	11000 J	8900	11000	11000	8100	7900	8400	8500	8800	---	---
Silver	ug/L	---	---	---	---	---	---	---	---	---	---	---
Silver (Dissolved)	ug/L	---	---	---	---	---	---	---	---	---	---	---
Sodium	ug/L	---	---	---	---	---	---	---	---	---	---	---
Sodium (Dissolved)	ug/L	1500000 J	1500000	1400000	1400000	1200000	1500000	1600000	1300000	1300000	1370000	1400000
Strontium	ug/L	---	---	---	---	---	---	---	---	---	---	---
Strontium (Dissolved)	ug/L	2200 J	2600	2400	2300	1900	1600	1600	1900	2000	2100	2140
Uranium (Dissolved)	ug/L	---	---	---	---	---	---	---	---	---	---	---
Zinc	ug/L	---	---	---	---	---	---	---	---	---	---	---
Zinc (Dissolved)	ug/L	25 U J	25 U	5 U	5 U	25 JB	1.1 J	1.5 J	15 JB	14 J B	163	2.39 U
Volatile Organic Compounds - BTEX												
Benzene	ug/L	2.1 J	6.7	10	3.5	0.75 J	4.9 J	3.6 J	5 U	5 U	1.22	1.21
Ethylbenzene	ug/L	1.4 J	1.9	3	2	1 U	3.6 J	3.1 J	5 U	5 U	0.85 J	0.825 J
Toluene	ug/L	1.2 J	7.6	12	3.7	1 U	5 U	5 U	5 U	5 U	0.78 U	0.780 U
Xylenes, Total	ug/L	9 J	16	21	14	1.2 J	24	19	10	9.7 J	4.38	4.14
Petroleum Products												
Diesel fuel	mg/L	5.2 J	15	39	5	1400	5.2	5.4	7.3	7	6.8	7.34
TPH - Extractable	mg/L	---	---	---	---	---	---	---	---	---	---	---
TPH (non-polar)	mg/L	---	---	---	---	---	---	---	---	---	---	---
TPH (C21 - C28)	mg/L	---	---	---	---	---	---	---	---	---	---	---
Radiology												
Gross Alpha Analytes	pci/l	---	---	---	---	---	---	---	---	---	---	---
Gross Beta Analytes	pci/l	---	---	---	---	---	---	---	---	---	---	---
Field Parameters												
Conductivity, field	uS/cm	---	5690	9230	9500	9600	9730	9660	9670	9670	9550	9520
Dissolved oxygen (DO), field	mg/L	---	0.17	---	---	1.09	0.85	1.44	5.24	5.24	11.7	5.9
Oxidation reduction potential (ORP), field	millivolts	---	-281	-267	-190.1	-266	-226	-259	---	---	-256	-275
pH, field	s.u.	---	8.64	8.16	8.77	8.61	8.92	8.92	8.88	8.77	8.75	8.79
Temperature, ambient	Deg C	---	32	---	---	---	18	65	24	---	---	---
Temperature, field	Deg C	---	14	13.4	14.8	13.7	11.8	12.2	25	14.1	13.2	13.7
Turbidity, field	NTU	---	12.98	10.92	---	---	2.27	1.7	1.93	1.93	3.36	2.73

Table 10. Logan Wash Mine Retort Water Analytical Data

SampleID		LW-RETORT	LW-003 (DUP)	LW-RETORT	LW-003 (DUP)	LW-RETORT	LW-003 (DUP)	LW-RETORT	LW-003 (DUP)	LW-RETORT	LW-003 (DUP)	LW-LM
SampleDate		10/4/2016	10/4/2016	5/1/2017	5/1/2017	10/3/2017	10/3/2017	5/29/2018	5/29/2018	10/22/2018	10/22/2018	5/13/2015
Parameters	Units											
General Chemistry												
Alkalinity, Bicarbonate (as CaCO3)	mg/L	352	334	307	309	324	348	337	353	346	347	490
Alkalinity, Carbonate (as CaCO3)	mg/L	61.6	64.7	54.8	55.2	79.3	34.2	36.3	14.3 J	10.9 J	11.6 J	5 U
Alkalinity, Total (As CaCO3)	mg/L	413 J	399 J	362	364	403	382	373	367	357	359	490
Ammonia	mg/L	2.65	1.85	1 U	1.49	1.52	1.5	0.798	0.802	1.24	1.22	0.1
Bromide	mg/L	R	R	7.9 U	7.9 U	0.079 U	0.079 U	1 U	1 U	3.95 U	3.95 U	2.5 U
Chemical Oxygen Demand (COD)	mg/L	102	12.9	173	78.2	75.3	89.4	162	125	53.8	3 U	30
Chloride	mg/L	80.4	80.5	79.1	83.5	84.5	84.4	83.2	83.3	79.7	80.1	80
Specific Conductivity	umhos/cm	8310	8260	8780	8800	9080	9040	9290	9280	9050	8990	8500
Cyanide (free)	mg/L	---	---	---	---	---	---	---	---	---	---	---
Fluoride	mg/L	8.87	8.9	8.53	8.73	8.37	8.49	9.57	9.62	9.95	9.99	---
Fluoride (dissolved)	mg/L	---	---	---	---	---	---	---	---	---	---	10
Hardness	mg/L	327	320	520	527	525 0	374	374	378	332	357	350
Nitrate (as N)	mg/L	0.023 U	0.023 U	2.27 UJ	2.27 UJ	0.0227 U	0.0227 U	0.1 U	0.1 U	0.0227 U	0.0227 U	3
Nitrite (as N)	mg/L	0.028 U	0.028 U	0.0277 U	0.0277 U	0.0277 U	0.0277 U	0.1 U	0.1 U	0.0277 U	0.0277 U	0.25 U
Oil and Grease, Total	mg/L	---	---	---	---	---	---	---	---	---	---	---
Oil and grease (HEM), polar	mg/L	---	---	---	---	---	---	---	---	---	---	4.7 U
Oil and grease (HEM), total	mg/L	3.58 J	1.160 U	157	12.5	25.3	3.51 J	54.5	434	589	327	---
pH	s.u.	8.43 J	8.73 J	8.60 J	8.61 J	8.48 J	8.69 J	8.77 T8	8.74 T8	8.68 J	8.65 J	8.04 J
Phenolics (Total)	mg/L	0.039 UJ	0.188 J	0.0309 J	0.0291 J	0.0137 U	0.0148 U	0.0387 J	0.033 J	0.0356 U	0.0352 U	0.027
Phosphorus as P, total	mg/L	0.059 J	0.058 J	0.109	0.0744 J	0.0526 U	0.0686 U	0.0447 J	0.0414 J	0.344	0.314	0.055 J
Silica	mg/L	19.6	19.6	15.6	15.8	15.7	16.3	15.9	15.5	15.2	14.4	---
Sulfate	mg/L	4010	3930	4090	4980	4400	4460	4570	4760	4660	4640	4000
Sulfide	mg/L	1.77	1.84	0.274	1.12	0.091	0.079	0.043 J	0.027 J	0.019 J	0.007 J	1.8 J
Sulfite	mg/L	---	---	---	---	---	---	---	---	---	---	---
Thiocyanate	mg/L	---	---	---	---	---	---	---	---	---	---	---
Thiosulfate	mg/L	---	---	---	---	---	---	---	---	---	---	---
Total Dissolved Solids (TDS)	mg/L	6250	6330	6280	6870	6890	5970	7080	6860	6950	7010	6900
Nitrogen, Total Kjeldahl	mg/L	2.98	2.99	3.81	2.85	2.46	2.38	2.18	2.51	3.64	5.28	3.3 J
Total Organic Carbon (TOC)	mg/L	25.4	16.9	17.7	16.2	19.7	18.1	25	25.1	20.7	20.1	15
Total Suspended Solids (TSS)	mg/L	---	---	---	---	---	---	---	---	---	---	---
Dissolved Organic Carbon (DOC)	mg/L	21.1	21.7	17.2	20.3	33.9	18.8	16.7	16.3	17.7	17.8	15

Table 10. Logan Wash Mine Retort Water Analytical Data

SampleID		LW-RETORT	LW-003 (DUP)	LW-RETORT	LW-003 (DUP)	LW-RETORT	LW-003 (DUP)	LW-RETORT	LW-003 (DUP)	LW-RETORT	LW-003 (DUP)	LW-LM
SampleDate		10/4/2016	10/4/2016	5/1/2017	5/1/2017	10/3/2017	10/3/2017	5/29/2018	5/29/2018	10/22/2018	10/22/2018	5/13/2015
Parameters	Units											
Metals												
Arsenic	ug/L	45.6	50.8	34.1	23.7	36.3	38.2	32.1	30.5	73.5	49.4	33
Arsenic (Dissolved)	ug/L	32.2	43.0	35.0	37.8	34.9	28.1	29.1	29.4	63.3	60	33
Boron	ug/L	---	---	---	---	---	---	---	---	---	---	9600
Boron (Dissolved)	ug/L	10800	11500	13600	11900	10100	9470	10500	10900	10600	10400	---
Cadmium	ug/L	---	---	---	---	---	---	---	---	---	---	---
Cadmium (Dissolved)	ug/L	0.26 J	0.335 J	0.230 J	0.220 U	4.4 U	4.4 U	0.318 J	0.393 J	0.220 U	0.220 U	1 U
Calcium	ug/L	---	---			---	---	---	---	---	---	---
Calcium (Dissolved)	ug/L	48600	70300	109000	112000	77200	78800	81200	80800	68300	68200	55000
Chromium	ug/L	0.32 U	0.320 U	0.320 U	0.320 U	0.32 U	0.32 U	1.00 U	1.00 U	1.72	0.744 J	2 U
Chromium (Dissolved)	ug/L	0.38 U	0.650 U	0.320 U	0.455 J	6.4 U	6.4 U	0.390 J	1.00 U	0.320 U	0.320 U	2 U
Chromium III	ug/L	---	---	---	---	---	---	---	---	---	---	---
Chromium VI	ug/L	---	---	---	---	---	---	---	---	---	---	---
Copper	ug/L	---	---	---	---	---	---	---	---	---	---	---
Copper (Dissolved)	ug/L	0.29 J	0.66 J	13.0	15.1	18.1 J	16.7 J	15.9	16.1	0.749 J	1.52	1.6 J
Iron	ug/L	250	228	1380	1030	19.1 J	2480	19.9 J	19.8 J	42700	1020	61
Iron (Dissolved)	ug/L	15 U	22.1 J	20.6 J	36.4 J	300 U	300 U	21.0 B J	16.8 B J	157	89.2 J	40 J
Lead	ug/L	---	---	---	---	---	---	---	---	---	---	---
Lead (Dissolved)	ug/L	0.26 U	0.260 U	0.260 U	0.260 U	5.2 U	5.2 U	1.00 U	1.00 U	0.260 U	0.260 U	1 U
Lithium	ug/L	---	---	---	---	---	---	---	---	---	---	---
Lithium (Dissolved)	ug/L	528	524	584	569	475	460	438	463	448	463	480
Magnesium	ug/L	---	---	---	---	---	---	---	---	---	---	---
Magnesium (Dissolved)	ug/L	28200	39300	44400	45100	40900	40200	47100	46000	39300	38800	38000
Manganese	ug/L	---	---	---	---	---	---	---	---	---	---	---
Manganese (Dissolved)	ug/L	14.1	20.5	46.5	47.6	27.4 J	24.9 J	39.9	38.7	24	23.5	14
Mercury	ug/L	---	---	---	---	---	---	---	---	---	---	---
Mercury (Dissolved)	ug/L	0.049 U	0.0490 U	0.0490 U	0.0490 U	0.049 U	0.049 U	0.0673 B J	0.0636 B J	0.0490 U	0.0490 U	0.2 U
Molybdenum (Dissolved)	ug/L	---	---	---	---	---	---	---	---	---	---	---
Nickel	ug/L	---	---	---	---	---	---	---	---	---	---	---
Nickel (Dissolved)	ug/L	---	---	---	---	---	---	---	---	---	---	---
Potassium	ug/L	---	---	---	---	---	---	---	---	---	---	---
Potassium (Dissolved)	ug/L	670000	963000	1270000	1130000	997000	984000	1100000	1070000	952000	933000	890000
Selenium	ug/L	---	---	---	---	---	---	---	---	---	---	---
Selenium (Dissolved)	ug/L	2.38	3.07	4.94	5.20	6.4 U	6.4 U	4.24	3.96	4.99	4.88	4.4 J

Table 10. Logan Wash Mine Retort Water Analytical Data

SampleID		LW-RETORT	LW-003 (DUP)	LW-RETORT	LW-003 (DUP)	LW-RETORT	LW-003 (DUP)	LW-RETORT	LW-003 (DUP)	LW-RETORT	LW-003 (DUP)	LW-LM
SampleDate		10/4/2016	10/4/2016	5/1/2017	5/1/2017	10/3/2017	10/3/2017	5/29/2018	5/29/2018	10/22/2018	10/22/2018	5/13/2015
Parameters	Units											
Metals												
Silicon	ug/L	9170	9170	7310	7360	7310	7630	7420	7220	7100	6720	---
Silicon (Dissolved)	ug/L	---	---	---	---	---	---	---	---	---	---	7800
Silver	ug/L	---	---	---	---	---	---	---	---	---	---	---
Silver (Dissolved)	ug/L	---	---	---	---	---	---	---	---	---	---	---
Sodium	ug/L	---	---	---	---	---	---	---	---	---	---	---
Sodium (Dissolved)	ug/L	1560000	1370000	1770000	1570000	1330000	1310000	1520000	1480000	1440000	1390000	1500000
Strontium	ug/L	---	---	---	---	---	---	---	---	---	---	---
Strontium (Dissolved)	ug/L	1530	2400	2790	2900	2070	2080	2430	2560	2200	2250	1900
Uranium (Dissolved)	ug/L	---	---	---	---	---	---	---	---	---	---	---
Zinc	ug/L	---	---	---	---	---	---	---	---	---	---	---
Zinc (Dissolved)	ug/L	4.24 J	15.6 J	2.39 J	3.67 J	38.2 U	38.2 U	10.0 U	10.0 U	2.89 J	3.46 J	2 J
Volatile Organic Compounds - BTEX												
Benzene	ug/L	1.9	1.85	1.44	1.47	1.59	1.67	1.15	1.17	1.23	1.16	5 U
Ethylbenzene	ug/L	0.92 J	0.845 J	0.857 J	0.807 J	0.732 J	0.743 J	0.484 J	0.501 J	0.427 J	0.436 J	5 U
Toluene	ug/L	0.78 U	0.780 U	0.419 J	0.432 J	0.425 J	0.417 J	1.00 U	1.00 U	0.412 U	0.412 U	5 U
Xylenes, Total	ug/L	4.86	4.56	4.56	4.38	3.21	3.24	1.57 J	1.55 J	1.37 J	1.38 J	10 U
Petroleum Products												
Diesel fuel	mg/L	5.2	4.34	5.9	9.55	5.11	5.7	24.3	3.41	9.55	6.9	2.2
TPH - Extractable	mg/L	---	---	---	---	---	---	---	---	---	---	---
TPH (non-polar)	mg/L	---	---	---	---	---	---	---	---	---	---	---
TPH (C21 - C28)	mg/L	---	---	---	---	---	---	---	---	---	---	---
Radiology												
Gross Alpha Analytes	pci/l	---	---	---	---	---	---	---	---	---	---	---
Gross Beta Analytes	pci/l	---	---	---	---	---	---	---	---	---	---	---
Field Parameters												
Conductivity, field	uS/cm	8740	8870	8840	8730	9200	9130	8847	8791	8556	8577	8866
Dissolved oxygen (DO), field	mg/L	1.26	1.14	--	6	27.0	28.6	NM	NM	1.46	2.58	7.04
Oxidation reduction potential (ORP), field	millivolts	-220	-249	-166.4	-199.6	-240	-242	-208.9	-241.9	-228.1	-232.5	-7.6
pH, field	s.u.	8.75	8.87	8.67	8.8	8.55	8.65	7.6	7.58	8.53	8.3	7.91
Temperature, ambient	Deg C	---	---	60	60	12.8	12.8	---	---	---	---	21
Temperature, field	Deg C	13.8	13.4	13.4	12.8	12.9	12.9	14.1	14.1	14.1	14.4	11.25
Turbidity, field	NTU	3.17	3.29	11.75	7.31	7.97	7.01	0.79	15.65	6.4	60.5	1.07

Table 10. Logan Wash Mine Retort Water Analytical Data

SampleID		LW-LM	LW-LM	LW-LM	LW-LM	LW-LM	LW-LM	LW-LM
SampleDate		10/14/2015	5/23/2016	10/4/2016	5/1/2017	10/3/2017	5/29/2018	10/22/2018
Parameters	Units							
General Chemistry								
Alkalinity, Bicarbonate (as CaCO3)	mg/L	410 B	391	391	342	374	348	350
Alkalinity, Carbonate (as CaCO3)	mg/L	5 U	2.71 U	2.71 U	2.71 U	7.7 J	20 U	2.71 U
Alkalinity, Total (As CaCO3)	mg/L	410 B	391	391 J	342	382	348	350
Ammonia	mg/L	0.1 U	0.038 U	0.038 U	0.05 U	0.0317 U	0.1 U	0.0317 U
Bromide	mg/L	5 U	0.079 U	R	7.9 U	0.079 U	1 U	3.95 U
Chemical Oxygen Demand (COD)	mg/L	39	49.9	83.9	41.2	44.3	38.4	3 U
Chloride	mg/L	66	78.8	82.4	81.8	86.4	82.9	80.4
Specific Conductivity	umhos/cm	8700	86000	8300	8760	8920	9310	9000
Cyanide (free)	mg/L	---	---	---	---	---	---	---
Fluoride	mg/L	---	9.6	8.95	8.81	8.57	9.55	9.99
Fluoride (dissolved)	mg/L	8.7	---	---	---	---	---	---
Hardness	mg/L	330	351	325	526	376	396	330
Nitrate (as N)	mg/L	330	0.0227 U	0.0227 U	2.27 U	1.01	0.1 U	0.807
Nitrite (as N)	mg/L	330	0.0277 U	0.0227 U	0.0277 U	0.0277 U	0.1 U	0.0277 U
Oil and Grease, Total	mg/L	330	---	---	---	---	---	---
Oil and grease (HEM), polar	mg/L	330	---	---	---	---	---	---
Oil and grease (HEM), total	mg/L	330	1.86 J	1.16 U	1.16 U	1.16 U	5.56 U	1.16 U
pH	s.u.	330	7.36 J	8.22 J	8.36 J	8.15 T8	7.75 T8	7.93 J
Phenolics (Total)	mg/L	330	0.0188 U	0.0215 U	0.0142 J	0.0083 U	0.00934 J	0.012 U
Phosphorus as P, total	mg/L	330	0.0814 J	0.0541 J	0.0738 J	0.0737 B J	0.1 U	0.14 U
Silica	mg/L	330	19.6	19.6	17.4	17.2	14.6	15
Sulfate	mg/L	330	4020	4100	4830	4580	4580	4330
Sulfide	mg/L	330	0.0065 U	0.0065 U	0.0065 U	0.0065 U	0.05 U	0.0065 U
Sulfite	mg/L	330	---	---	---	---	---	---
Thiocyanate	mg/L	330	---	---	---	---	---	---
Thiosulfate	mg/L	330	---	---	---	---	---	---
Total Dissolved Solids (TDS)	mg/L	330	6770	6470	7460	5860	7040	6980
Nitrogen, Total Kjeldahl	mg/L	330	1.21	1.1	1.16	1.26	0.979	1.22
Total Organic Carbon (TOC)	mg/L	330	68.3	14	16.2	15.6	---	---
Total Suspended Solids (TSS)	mg/L	330	---	---	---	---	14.8	15.9
Dissolved Organic Carbon (DOC)	mg/L	330	20 J	17.2	15	15.6	13.9	15.1

Table 10. Logan Wash Mine Retort Water Analytical Data

SampleID		LW-LM	LW-LM	LW-LM	LW-LM	LW-LM	LW-LM	LW-LM
SampleDate		10/14/2015	5/23/2016	10/4/2016	5/1/2017	10/3/2017	5/29/2018	10/22/2018
Parameters	Units							
Metals								
Arsenic	ug/L	41	33.1	32.7	20.1	31.7	25.1	44.1
Arsenic (Dissolved)	ug/L	39	34.7	29.5	20.5	28.1	25.8	41.3
Boron	ug/L	11000	---	---	---	---	---	---
Boron (Dissolved)	ug/L	---	11200	11200	11300	9690 V	11300	10900
Cadmium	ug/L	---	---	---	---	---	---	---
Cadmium (Dissolved)	ug/L	2.7 J	0.663 J	0.263 J	0.240 J	4.40 U	0.352 J	0.220 U
Calcium	ug/L	---	---	---	---	---	---	---
Calcium (Dissolved)	ug/L	59000 B	74600	62600	107000	79800 V	82100	68000
Chromium	ug/L	20 U	0.320 U	0.320 U	0.320 U	0.649 J	1.00 U	0.407 J
Chromium (Dissolved)	ug/L	20 U	0.536 J	0.386 U	0.320 U	6.40 U	1.00 U	0.320 U
Chromium III	ug/L	---	---	---	---	---	---	---
Chromium VI	ug/L	---	---	---	---	---	---	---
Copper	ug/L	---	---	---	---	---	---	---
Copper (Dissolved)	ug/L	6.8 J	1.02	0.270 U	14.4	19.5 J	16.2	0.631 J
Iron	ug/L	81 J	67.5 J	105	46.3 J	67.9 J	19.1 J	89.2 J
Iron (Dissolved)	ug/L	500 U	15.0 U	22.5 J	25.9 J	300 U	18.8 B J	55.2 J
Lead	ug/L	---	---	---	---	---	---	---
Lead (Dissolved)	ug/L	10 U	0.260 U	0.260 U	1.01	5.20 U	1.00 U	0.260 U
Lithium	ug/L	---	---	---	---	---	---	---
Lithium (Dissolved)	ug/L	530	510	525	607	469 O1	453 O1	455
Magnesium	ug/L	---	---	---	---	---	---	---
Magnesium (Dissolved)	ug/L	43000 B	46500	36500	46100	43300 V	46400	38100
Manganese	ug/L	---	---	---	---	---	---	---
Manganese (Dissolved)	ug/L	3.4 J	4.72 J	7.65	17.4	29.7 B J	18.7	37
Mercury	ug/L	---	---	---	---	---	---	---
Mercury (Dissolved)	ug/L	0.034 JB	0.0490 U	0.0490 U	0.0490 U	0.0677 J	0.0605 B J	0.0490 U
Molybdenum (Dissolved)	ug/L	---	---	---	---	---	---	---
Nickel	ug/L	---	---	---	---	---	---	---
Nickel (Dissolved)	ug/L	---	---	---	---	---	---	---
Potassium	ug/L	---	---	---	---	---	---	---
Potassium (Dissolved)	ug/L	950000	1030000	837000	1050000	994000 V	1110000	957000
Selenium	ug/L	---	---	---	---	---	---	---
Selenium (Dissolved)	ug/L	6.3 J	4.48	4	7.81	6.40 U	10	6.34

Table 10. Logan Wash Mine Retort Water Analytical Data

SampleID		LW-LM	LW-LM	LW-LM	LW-LM	LW-LM	LW-LM	LW-LM
SampleDate		10/14/2015	5/23/2016	10/4/2016	5/1/2017	10/3/2017	5/29/2018	10/22/2018
Parameters	Units							
Metals								
Silicon	ug/L	---	9150	9170	8150	8030	6840	7030
Silicon (Dissolved)	ug/L	9000	---	---	---	---	---	---
Silver	ug/L	---	---	---	---	---	---	---
Silver (Dissolved)	ug/L	---	---	---	---	---	---	---
Sodium	ug/L	---	---	---	---	---	---	---
Sodium (Dissolved)	ug/L	1400000	1520000	1400000	1510000	1360000 V	1520000	1420000
Strontium	ug/L	---			---	---	---	---
Strontium (Dissolved)	ug/L	2000	2510	2510	2790	2140 V	2580	2250
Uranium (Dissolved)	ug/L	---	---	---	---	---	---	---
Zinc	ug/L	---	---	---	---	---	---	---
Zinc (Dissolved)	ug/L	14 JB	6.41 U	4.21 J	12	38.2 U	2.69 J	1.91 J
Volatile Organic Compounds - BTEX								
Benzene	ug/L	5 U	0.331 U	0.331 U	0.331 U	0.331 U	1.00 U	0.331 U
Ethylbenzene	ug/L	5 U	0.384 U	0.384 U	0.384 U	0.384 U	1.00 U	0.384 U
Toluene	ug/L	5 U	0.780 U	0.780 U	0.412 U	0.412 U	1.00 U	0.412 U
Xylenes, Total	ug/L	10 U	1.06 U	1.06 U	1.06 U	1.06 U	3.00 U	1.06 U
Petroleum Products								
Diesel fuel	mg/L	3.2	3.41	2.24	3.24	2.67	1890	3340
TPH - Extractable	mg/L	---	---	---	---	---	---	---
TPH (non-polar)	mg/L	---	---	---	---	---	---	---
TPH (C21 - C28)	mg/L	---	---	---	---	---	---	---
Radiology								
Gross Alpha Analytes	pci/l	---	---	---	---	---	---	---
Gross Beta Analytes	pci/l	---	---	---	---	---	---	---
Field Parameters								
Conductivity, field	uS/cm	8851	9730	8510	8980	8980	8783	8663
Dissolved oxygen (DO), field	mg/L	5.37	---	5.22	--	12.12	NM	5.39
Oxidation reduction potential (ORP), field	millivolts	26.5	236	208	172.5	69.1	194.7	176.5
pH, field	s.u.	7.98	7.52	8.04	7.74	7.26	7.9	7.74
Temperature, ambient	Deg C	24	---	---	60	---	---	---
Temperature, field	Deg C	16.8	12.8	15.6	12.2	17.9	12.8	16.6
Turbidity, field	NTU	1.43	1.32	4.29	3.21	0.73	4.46	1.98

Table 10. Logan Wash Mine Retort Water Analytical Data

Notes:

U = result not detected at the reporting limit

J = result value greater than the MDL and less than the RL; result considered estimated

B = analyte found in sample and associated blank

HF = analysis holding time exceeded; result considered estimated

E = result estimated due to the presence of interference

R = rejected data

O1 = failed the method required serial dilution test and or subsequent post spike criteria. Failures indicate matrix interference

V = sample concetration is too high to evaluate accurate spike recoveries

--- = Analysis not performed

Table 11. Logan Wash Monitoring Well Analytical Data

SampleID		LWCW-1A	LWCW-1A	LWCW-1A	LWCW-1A	LWCW-1A	LWCW-1A	LWCW-1A	LWCW-1A	LWCW-1A	LWCW-1A	LWCW-1A
SampleDate		2/2/2000	3/9/2000	4/7/2000	8/3/2000	10/26/2000	2/7/2001	5/23/2001	9/26/2001	5/10/2011	10/27/2011	6/13/2012
Parameters	Units											
General Chemistry												
Alkalinity, Bicarbonate (as CaCO3)	mg/L	360	390	---	---	471	---	---	376	425	360	370
Alkalinity, Carbonate (as CaCO3)	mg/L	5 U	5 U	---	---	5 U	---	---	5 U	5 U	5 U	5 U
Alkalinity, Total (As CaCO3)	mg/L	360	390	---	---	471	---	---	376	432	360	370
Ammonia	mg/L	1.2	0.8 U	---	---	0.8 U	---	---	0.15	0.1 U	0.12 U	0.14 U
Bromide	mg/L	---	---	---	---	180	---	---	---	0.5 U	1 U	0.5 U
Chemical Oxygen Demand (COD)	mg/L	---	---	---	---	26.3	---	---	---	38.8	28	38
Chloride	mg/L	31 D	35 J	---	---	46.7	---	---	41.6	35.4	16	24
Conductivity	umhos/cm	---	---	---	---	---	---	---	---	5550	4300	4000
Cyanide (free)	mg/L	---	---	---	---	---	---	---	---	---	---	---
Fluoride	mg/L	4.2	3.1	0.4 U	1.8	3.9	2.5	2.3	3.1	---	---	---
Fluoride (dissolved)	mg/L	---	---	---	---	3.1	---	---	---	1.2	1.1 U	1.1
Hardness	mg/L	---	---	---	---	244	---	---	---	1130	770	820
Nitrate (as N)	mg/L	---	---	---	---	19.4	---	---	---	23.1	14	14
Nitrite (as N)	mg/L	---	---	---	---	0.01 U	---	---	---	1.2 U	0.25 U	0.13 U
Oil and Grease, Total	mg/L	---	---	---	---	---	---	---	5 U	---	---	---
Oil and grease (HEM), polar	mg/L	---	---	---	---	---	---	---	---	---	4.7 U	2.4 J
Oil and grease (HEM), total	mg/L	5	2 U	---	---	---	---	---	---	2 J	---	---
pH	s.u.	---	---	---	---	---	---	---	---	7.5 J	7.66 J	7.39 J
Phenolics (Total)	mg/L	0.092	0.05 U	---	---	0.05 U	---	---	0.01 U	0.025	0.01 U	0.01 U
Phosphorus as P, total	mg/L	---	---	---	---	---	---	---	---	0.1 U	0.1 U	0.1 U
Silica	mg/L	---	---	---	---	---	---	---	---	---	---	---
Sulfate	mg/L	1200 D	220 J	---	---	1510	---	---	1340	1950	1400	1700
Sulfide	mg/L	---	---	---	---	---	---	---	---	1.8 J	3 U	3 U
Sulfite	mg/L	2 U	2 U J	---	---	2 U	---	---	2 U	---	---	---
Thiocyanate	mg/L	0.4 U	0.4 U	---	---	1 U	---	---	0.7 U	---	---	---
Thiosulfate	mg/L	0.4 U	0.4 U	---	---	1 U	---	---	0.7 U	---	---	---
Total Dissolved Solids (TDS)	mg/L	2170	2770	---	---	2710	---	---	2400	3620	2700	2500
Nitrogen, Total Kjeldahl	mg/L	1.2	1.7	---	---	1.8	---	---	1.7	5 U	5 U	5 U
Total Organic Carbon (TOC)	mg/L	---	---	---	---	---	---	---	---	14.1	11	11
Total Pet_ Hydrocarbons	mg/L	---	---	---	---	---	---	---	---	0.67	0.48 U	0.5 U
Total Suspended Solids (TSS)	mg/L	---	---	---	---	34	---	---	---	9.2	17	40
Dissolved Organic Carbon (DOC)	mg/L	8.3	11 J	---	---	14.2	---	---	10.9	14.4	12	10

Table 11. Logan Wash Monitoring Well Analytical Data

SampleID		LWCW-1A	LWCW-1A	LWCW-1A	LWCW-1A	LWCW-1A	LWCW-1A	LWCW-1A	LWCW-1A	LWCW-1A	LWCW-1A	LWCW-1A
SampleDate		2/2/2000	3/9/2000	4/7/2000	8/3/2000	10/26/2000	2/7/2001	5/23/2001	9/26/2001	5/10/2011	10/27/2011	6/13/2012
Parameters	Units											
Metals												
Arsenic	ug/L	20	20	20	13	23.2	41	47 U	19.6	14.7	13	15
Arsenic (Dissolved)	ug/L	---	---	---	---	24.9	---	---	---	14.7	14	13
Boron	ug/L	4900	8300	8800	7700	6300 E	2330	6400	5780	---	---	---
Boron (Dissolved)	ug/L	---	---	---	---	6550 E	---	---	---	9590	8200	9700
Cadmium	ug/L	2 U	2 U	0.9 J	2.1 U	0.84	0.73	---	0.51	---	---	---
Cadmium (Dissolved)	ug/L	---	---	---	---	0.49	---	---	---	0.098 J	1 U	1 U
Calcium	ug/L	---	---	---	---	---	---	---	---	---	---	---
Calcium (Dissolved)	ug/L	---	---	---	---	98000	---	---	---	126000	98000	110000
Chromium	ug/L	---	---	---	---	1.4	---	---	---	4.9	3.7	3.2
Chromium (Dissolved)	ug/L	---	---	---	---	1.5	---	---	---	4.6	3.6	2.5
Chromium III	ug/L	---	---	---	---	10 U	---	---	---	---	---	---
Chromium VI	ug/L	---	---	---	---	0.05 U	---	---	---	---	---	---
Copper	ug/L	---	---	---	---	18.9	---	26	---	---	---	---
Copper (Dissolved)	ug/L	---	---	---	---	14.9	---	---	---	6.2	6.5	8.1
Iron	ug/L	---	---	---	---	628 E	---	---	---	198	420	780
Iron (Dissolved)	ug/L	---	---	---	---	369 E	---	---	---	50 U	8.1 J	24 J
Lead	ug/L	---	---	---	59 U	6.9	39.6	59 U	---	---	---	---
Lead (Dissolved)	ug/L	---	---	---	---	7.7	---	---	---	1 U	1 U	1 U
Lithium	ug/L	200 J	620	---	---	337 J	---	---	---	---	---	---
Lithium (Dissolved)	ug/L	---	---	---	---	339 J	---	---	308	264	200	240
Magnesium	ug/L	---	---	---	---	93100 E	---	---	---	---	---	---
Magnesium (Dissolved)	ug/L	---	---	---	---	28.6 U	---	---	---	167000	130000	140000
Manganese	ug/L	---	---	---	---	16.1	---	---	---	---	---	---
Manganese (Dissolved)	ug/L	---	---	---	---	15.1	---	---	---	0.22 J	1.5 J	1 J
Mercury	ug/L	---	---	---	---	0.12 U	---	---	---	---	---	---
Mercury (Dissolved)	ug/L	---	---	---	---	0.12 U	---	---	---	0.2 U	0.2 U	0.2 U
Molybdenum (Dissolved)	ug/L	---	---	---	---	---	---	---	---	---	---	---
Nickel	ug/L	---	---	---	---	5.2	---	---	---	---	---	---
Nickel (Dissolved)	ug/L	---	---	---	---	7.1	---	---	---	---	---	---
Potassium	ug/L	---	---	---	---	1100000 E	---	---	---	---	---	---
Potassium (Dissolved)	ug/L	---	---	---	---	151000 E	---	---	---	18400	18000	17000

Table 11. Logan Wash Monitoring Well Analytical Data

SampleID SampleDate Parameters	Units	LWCW-1A 2/2/2000	LWCW-1A 3/9/2000	LWCW-1A 4/7/2000	LWCW-1A 8/3/2000	LWCW-1A 10/26/2000	LWCW-1A 2/7/2001	LWCW-1A 5/23/2001	LWCW-1A 9/26/2001	LWCW-1A 5/10/2011	LWCW-1A 10/27/2011	LWCW-1A 6/13/2012
Metals												
Selenium	ug/L	---	---	---	---	3.8	---	---	---	---	---	---
Selenium (Dissolved)	ug/L	---	---	---	---	7.1	---	---	---	46.1	37	37
Silicon	ug/L											
Silicon (Dissolved)	ug/L	---	---	---	---	---	---	---	---	6730	6800	7400
Silver	ug/L	5 U	5 U	10 U	---	0.05 U	---	---	10 U	---	---	---
Silver (Dissolved)	ug/L	---	---	---	---	0.03 U	---	---	---	---	---	---
Sodium	ug/L	---	---	---	---	---	---	---	---	---	---	---
Sodium (Dissolved)	ug/L	---	---	---	---	489000	---	---	---	596000	480000	660000
Strontium	ug/L	---	---	---	---	5000 J	---	---	---	---	---	---
Strontium (Dissolved)	ug/L	---	---	---	---	4280 J	---	---	---	4100	3100	4000
Uranium (Dissolved)	ug/L	---	---	---	---	---	---	---	---	---	---	---
Zinc	ug/L	---	---	---	---	66	---	---	---	---	---	---
Zinc (Dissolved)	ug/L	---	---	---	---	58.4	---	---	---	3.5 J	9.9 U	10
Volatile Organic Compounds - BTEX												
Benzene	ug/L	1 U	1 U	1 U	0.2 U	2 U	2 U	2 U	1 U	1 U	1 U	1 U
Ethylbenzene	ug/L	1 U	1 U	1 U	0.2 U	2 U	2 U	2 U	1 U	1 U	1 U	1 U
Toluene	ug/L	1 U	1 U	1 U	0.2 U	2 U	2 U	2 U	1 U	1 U	1 U	1 U
Xylenes, Total	ug/L	1 U	1 U	1 U	0.2 U	2 U	2 U	2 U	1 U	3 U	3 U	3 U
Petroleum Products												
Diesel fuel	mg/L	---	---	---	---	0.1 U	---	---	---	---	---	---
TPH - Extractable (DRO)	mg/L	---	---	---	---	---	---	---	---	---	---	---
TPH (non-polar)	mg/L	---	---	---	---	---	---	---	---	0.67	0.48 U	0.5 U
TPH (C21 - C28)	mg/L	---	---	---	---	---	---	---	---	---	---	---
Radiology												
Gross Alpha Analytes	pci/l	53	5	---	---	10 + or - 16	---	---	5 + or - 2	---	---	---
Gross Beta Analytes	pci/l	150	100	---	---	150 + or - 30	---	---	15 + or - 2	---	---	---
Field Parameters												
Specific conductivity, field	umhos/cm	---	---	---	---	---	---	---	---	---	---	---
Dissolved oxygen (DO), field	mg/L	---	---	---	---	---	---	---	---	---	---	---
Oxidation reduction potential (ORP), fiel	millivolts	---	---	---	---	---	---	---	---	---	---	---
pH, field	s.u.	---	---	---	---	---	---	---	---	---	---	---
Temperature, ambient	Deg C	---	---	---	---	---	---	---	---	---	---	---
Temperature, field	Deg C	---	---	---	---	---	---	---	---	---	---	---
Turbidity, field	NTU	---	---	---	---	---	---	---	---	---	---	---

Table 11. Logan Wash Monitoring Well Analytical Data

SampleID		LWCW-1A	LWCW-1A	LWCW-1A	LWCW-1A	LWCW-1A	LWCW-1A	LWCW-1A	LWCW-1A	LWCW-1A	LWCW-1A	LWCW-1A
SampleDate		10/25/2012	6/12/2013	10/23/2013	5/21/2014	10/27/2014	5/13/2015	10/19/2015	5/25/2016	10/11/2016	5/2/2017	10/11/2017
Parameters	Units											
General Chemistry												
Alkalinity, Bicarbonate (as CaCO3)	mg/L	380	390	400	420	440 B	470	430	367	351	374	391
Alkalinity, Carbonate (as CaCO3)	mg/L	5 U	5 U	5 U	5 U	5 U	5 U	5 U	2.71 U	2.71 U	2.71 U	2.71 U
Alkalinity, Total (As CaCO3)	mg/L	380	390	400	420	440 B	470	430	367	351	374	391
Ammonia	mg/L	0.32	0.15	0.13 U	0.05 J	0.1 U	0.24	0.1 U	0.038 U	0.038 U	0.0317 U	0.0317 U
Bromide	mg/L	1.3 U	2.5 U	1.3 U	1.3 U	1.3 U	1.3 U	1.3 U	0.079 U	0.079 U	0.079 U	0.079 U
Chemical Oxygen Demand (COD)	mg/L	18	34	30	33	51	32	28 B	53.1	64.4	34	31.6
Chloride	mg/L	32	27	28	17	22	23	26	20.2	20.7	23.5	23
Conductivity	umhos/cm	4000	4100	4200	---	4100	4000	4400	4160	38300	3850	4030
Cyanide (free)	mg/L	---	---	---	---	---	---	---	---	---	---	---
Fluoride	mg/L	---	---	---	---	---	---	---	1.31	1.37	1.17	1.19
Fluoride (dissolved)	mg/L	1.1	0.41	0.76	0.38	0.87	1.1	1.2	---	---	---	---
Hardness	mg/L	760	1000	1200	990	1100	1100	1100	896	814	907	995
Nitrate (as N)	mg/L	14 J	16	18	18	22 H	21	21 B	16.4	16.4	18	22.7 U
Nitrite (as N)	mg/L	0.13 U J	0.13 U	0.13 U	0.13 U	0.13 UH	0.13 U	U*	0.0277 U	0.0277 U	0.0277 U	0.0277 U
Oil and Grease, Total	mg/L	---	---	---	---	3.4 J	---	---	---	---	---	---
Oil and grease (HEM), polar	mg/L	5.2 U	1.4 J	1.8 J	4.7 U	---	4.5 U	4.5 U	---	---	---	---
Oil and grease (HEM), total	mg/L	---	---	---	---	---	---	---	1.16 U	1.16 U	1.16 U	1.16 U
pH	s.u.	7.74 J	7.79 J	7.52 J	7.93 J	7.5 HF	7.74 J	7.69 HF	7.56 J	7.70 J	7.69 J	7.6 J
Phenolics (Total)	mg/L	0.01 U	0.0077 J	0.01 U	0.01 U	0.01 U	0.015	0.01 U	0.0205 U	0.0179 J	0.0083 U	0.0083 U
Phosphorus as P, total	mg/L	0.058 J	0.1 U	0.1 U	0.017 J	0.1 U	0.1 U	0.1 U	0.035 U	0.035 U	0.0843 U	0.0958 J
Silica	mg/L	---	---	17	---	---	---	---	16.7	15.8	16.7	16.9
Sulfate	mg/L	1600	1900	2100	1800	2100	2000	2200	1800	1700	1820	1790
Sulfide	mg/L	3 U	3 U	3 U	3 U	0.53 J	0.49 J	30 U	0.0065 U	0.0065 U	0.0065 U	0.0065 U
Sulfite	mg/L	---	---	---	---	---	---	---	---	---	---	---
Thiocyanate	mg/L	---	---	---	---	---	---	---	---	---	---	---
Thiosulfate	mg/L	---	---	---	---	---	---	---	---	---	---	---
Total Dissolved Solids (TDS)	mg/L	2500	2600	2700	2800	3000	3500	3600	3360	2240	3020	2900
Nitrogen, Total Kjeldahl	mg/L	1.1 J	3.4 J	3.9 J	7.9	5 U	5 U	3.4 J	1.32	0.847	0.951	0.120 U
Total Organic Carbon (TOC)	mg/L	11	8.5	10	10	12	13	13	89.3	10.3	11.3	11.6
Total Pet_ Hydrocarbons	mg/L	---	---	---	---	---	---	---	---	---	---	---
Total Suspended Solids (TSS)	mg/L	150	24	7.2	6.4	13	---	---	---	---	---	---
Dissolved Organic Carbon (DOC)	mg/L	11	10	11	10	11	13	13	88.4	9.73	11.4	11.9

Table 11. Logan Wash Monitoring Well Analytical Data

SampleID		LWCW-1A	LWCW-1A	LWCW-1A	LWCW-1A	LWCW-1A	LWCW-1A	LWCW-1A	LWCW-1A	LWCW-1A	LWCW-1A	LWCW-1A
SampleDate		10/25/2012	6/12/2013	10/23/2013	5/21/2014	10/27/2014	5/13/2015	10/19/2015	5/25/2016	10/11/2016	5/2/2017	10/11/2017
Parameters	Units											
Metals												
Arsenic	ug/L	15	12	14	14	14	13	16	21.5	14.5	384	13
Arsenic (Dissolved)	ug/L	11	12	19	15	13	13	15	15.2	13.8	15.3	14.3
Boron	ug/L	---	---	---	---	---	11000	12000	---	---	---	---
Boron (Dissolved)	ug/L	7900	11000	11000	12000	10000	---	---	8450	9720	12800	10600
Cadmium	ug/L	---	---	---	---	---	---	---	---	---	---	---
Cadmium (Dissolved)	ug/L	0.099 J	0.14 J	0.85 J	1 U	0.081 J	1 U	1.5	0.220 U	0.220 U	0.220 U	0.22 U
Calcium	ug/L	---	---	---	---	---	---	---	---	---		---
Calcium (Dissolved)	ug/L	78000	130000	170000	130000	130000	120000	150000 B	115000	121000	141000	139000
Chromium	ug/L	2.5	2.5	2.6	4.9	3.6	3.2	4.7	6.26	2.94	118	3.47
Chromium (Dissolved)	ug/L	1.1 J	2.6	4 J	4.9	3.2	2.9	4.3	4.44	2.98	4.52	3.39
Chromium III	ug/L	---	---	---	---	---	---	---	---	---	---	---
Chromium VI	ug/L	---	---	---	---	---	---	---	---	---	---	---
Copper	ug/L	---	---	---	---	---	---	---	---	---	---	---
Copper (Dissolved)	ug/L	6	7	12	5.5	6	5.6	9.8	5.83	6.92	18.3	11.2
Iron	ug/L	1900	340	160	64	240	350	120	98.8 J	133	2630	22.7 J
Iron (Dissolved)	ug/L	22 J	5.3 J	250 U	50 U	11 J	30 J	50 U	65.9 J	15.0 U	15.0 U	15 U
Lead	ug/L	---	---	---	---	---	---	---	---	---	---	---
Lead (Dissolved)	ug/L	0.14 J	0.57 J	5 U	1 U	0.074 J	1 U	0.9 J	0.260 U	0.260 U	0.260 U	0.26 U
Lithium	ug/L	---	---	---	---	---	---	---	---	---	---	---
Lithium (Dissolved)	ug/L	250	240	240	230	250	250	270	286	255	323	243
Magnesium	ug/L	---	---	---	---	---	---	---	---	---	---	---
Magnesium (Dissolved)	ug/L	97000	150000	210000	160000	160000	150000	170000	125000	128000	152000	155000
Manganese	ug/L	---	---	---	---	---	---	---	---	---	---	---
Manganese (Dissolved)	ug/L	13	5 U	0.46 J	0.32 J	0.87 JB	0.2 J	0.42 J	2.07 J	0.510 U	0.510 U	0.51 U
Mercury	ug/L	---	---	---	---	---	---	---	---	---	---	---
Mercury (Dissolved)	ug/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.0490 U	0.0490 U	0.0490 U	0.049 U
Molybdenum (Dissolved)	ug/L	---	---	570	---	---	---	---	---	---	---	---
Nickel	ug/L	---	---	---	---	---	---	---	---	---	---	---
Nickel (Dissolved)	ug/L	---	---	4.5 J	---	---	---	---	---	---	---	---
Potassium	ug/L	---	---	---	---	---	---	---	---	---	---	---
Potassium (Dissolved)	ug/L	13000	19000	28000	22000	21000	20000	21000	18300	17200	21500	20600

Table 11. Logan Wash Monitoring Well Analytical Data

SampleID		LWCW-1A	LWCW-1A	LWCW-1A	LWCW-1A	LWCW-1A	LWCW-1A	LWCW-1A	LWCW-1A	LWCW-1A	LWCW-1A	LWCW-1A
SampleDate		10/25/2012	6/12/2013	10/23/2013	5/21/2014	10/27/2014	5/13/2015	10/19/2015	5/25/2016	10/11/2016	5/2/2017	10/11/2017
Parameters	Units											
Metals												
Selenium	ug/L	---	---	---	---	---	---	---	---	---	---	---
Selenium (Dissolved)	ug/L	17	40	52	49	46	49	60	42.7	41.1	52.1	45.6
Silicon	ug/L								7810	7410	7810	7880
Silicon (Dissolved)	ug/L	6000	6500	8100	8000	6600	6700	7600	---	---	---	---
Silver	ug/L	---	---	---	---	---	---	---	---	---	---	---
Silver (Dissolved)	ug/L	---	---	5 U	---	---	---	---	---	---	---	---
Sodium	ug/L	---	---	---	---	---	---	---	---	---	---	---
Sodium (Dissolved)	ug/L	630000	540000	720000	610000	600000	550000	720000	556000	576000	649000	631000
Strontium	ug/L	---	---	---	---	---	---	---	---	---	---	---
Strontium (Dissolved)	ug/L	2800	4400	6200	4100	4500	3700	4600	3380	3590	4650	4710
Uranium (Dissolved)	ug/L	---	---	---	---	---	---	---	---	---	---	---
Zinc	ug/L	---	---	---	---	---	---	---	---	---	---	---
Zinc (Dissolved)	ug/L	9.9	15	25 U	5 U	7.7 B	1.9 J	17 B	3.21 U	1.91 U	9.69 J	7.22 U
Volatile Organic Compounds - BTEX												
Benzene	ug/L	1 U	1 U	1 U	1 U	1 U	5 U	5 U	0.331 U	0.331 U	0.331 U	0.331 U
Ethylbenzene	ug/L	1 U	1 U	1 U	1 U	1 U	5 U	5 U	0.384 U	0.384 U	0.384 U	0.384 U
Toluene	ug/L	1 U	1 U	1 U	1 U	1 U	5 U	5 U	0.780 U	0.780 U	0.412 U	0.412 U
Xylenes, Total	ug/L	3 U	3 U	3 U	3 U	3 U	10 U	10 U	1.06 U	1.06 U	1.06 U	1.06 U
Petroleum Products												
Diesel fuel	mg/L	0.51 U	0.48 U	0.49 U	0.52 U	0.54:U	0.5 U	0.33 J	0.148	0.0247 U	0.067 U	0.113
TPH - Extractable (DRO)	mg/L	---	---	---	---	---	---	---	---	---	---	---
TPH (non-polar)	mg/L	---	---	---	---	---	---	---	---	---	---	---
TPH (C21 - C28)	mg/L	---	---	---	---	---	---	---	---	---	---	---
Radiology												
Gross Alpha Analytes	pci/l	---	---	---	---	---	---	---	---	---	---	---
Gross Beta Analytes	pci/l	---	---	---	---	---	---	---	---	---	---	---
Field Parameters												
Specific conductivity, field	umhos/cm	---	---	4265	4007	4177	4227	4515	4164	3669	3884	4052
Dissolved oxygen (DO), field	mg/L	---	---	6.80	9.52	6.34	7.39	9.14	8.02	8.84	9.53	73.4
Oxidation reduction potential (ORP), fiel	millivolts	---	---	203.7	213.6	162.3	252	198.8	173.5	313.6	209.2	75.7
pH, field	s.u.	---	---	7.45	7.41	6.34	7.37	6.91	7.73	6.49	7.67	6.07
Temperature, ambient	Deg C	---	---	12.7	18.3	10.0	18	---	---	---	15.6	15.6
Temperature, field	Deg C	---	---	8.72	8.48	9.69	8.7	9.07	8.09	9.26	9	9.3
Turbidity, field	NTU	---	---	9.67	5.43	10.30	23.51	3.46	16.78	4.56	9.46	1.65

Table 11. Logan Wash Monitoring Well Analytical Data

SampleID		LWCW-1A	LWCW-1A	LW-22A	LW-22A	LW-22A	LW-22A	LW-22A	LW-22A	LW-22A	LW-22A
SampleDate		6/4/2018	11/13/2018	5/13/2015	10/15/2015	5/24/2016	10/5/2016	5/3/2017	10/10/2017	5/23/2018	10/31/2018
Parameters	Units										
General Chemistry											
Alkalinity, Bicarbonate (as CaCO3)	mg/L	432	411	520	480 B	412	435	448	451	338 J3	436
Alkalinity, Carbonate (as CaCO3)	mg/L	20 U	2.71 U	5 U	5 U	2.71 U	2.71 U	2.71 U	2.71 U	20 U	2.71 U
Alkalinity, Total (As CaCO3)	mg/L	432	411	520	480 B	412	435	448	451	338 J3	436
Ammonia	mg/L	0.1 U	0.0317 U	0.1 U	0.1 U	0.038 U	0.038 U	0.0317 U	0.0317 U	0.1 U	0.0317 U
Bromide	mg/L	1 U	1.58 U	0.5 U	1.3 U	0.079 U	0.079 U	0.079 U	0.079 U	1 U	0.395 U
Chemical Oxygen Demand (COD)	mg/L	56.8	33	9.4 J	11	10.9	26.8	20.7	14.4	12.7	9.08 J
Chloride	mg/L	25.2	28.1	15	14	16.7	16.9	15.9	15.5	14.9	14.8
Conductivity	umhos/cm	3510	4240	2400	2500	37600	2750	1430	2500	2390	2500
Cyanide (free)	mg/L	---	---	---	---	---	---	---	---	---	---
Fluoride	mg/L	1.11	1.28	---	---	0.679	0.683	0.603	0.611	0.568	0.66
Fluoride (dissolved)	mg/L	---	---	0.66	0.56	---	---	---	---	---	---
Hardness	mg/L	1070	935	870	900	924	930	970	861	825000 B	832
Nitrate (as N)	mg/L	16.6	19	8.3	9.3	6.76	7.81	8.91	6.65	7.36	8.62
Nitrite (as N)	mg/L	0.1 U	0.0277 U	0.05 U	0.13 U	0.0277 U	0.0277 U	0.0277 U	0.0277 U	0.1 U	0.0277 U
Oil and Grease, Total	mg/L	---	---	---	---	---	---	---	---	---	---
Oil and grease (HEM), polar	mg/L	---	---	4.3 U	4.5 U	---	---	---	---	---	---
Oil and grease (HEM), total	mg/L	5.56 U	1.29 U	---	---	1.16 U	1.16 U	1.16 U	1.16 U	5.56 U	1.16 U
pH	s.u.	7.70 T8	7.65 J	7.62 J	7.39 HF	7.44 J	7.70 J	8.42 J	7.53 J	7.41 T8	7.52 J
Phenolics (Total)	mg/L	0.0126 J	0.0083 U	0.01 U	0.014	0.015 J	0.0207 U	0.0083 U	0.0083 U	0.0443	0.0083 U
Phosphorus as P, total	mg/L	0.1 U	0.0621 U	0.1 U	0.1 U	0.0414 U	0.035 U	0.0693 J	0.0748 U	0.0558 JB	0.165 U
Silica	mg/L	23.6	14.7	---	---	17.9	20.8	25	18.6	25.9	21
Sulfate	mg/L	2030	2000	950	910	986	1100	1030	880	1020	993
Sulfide	mg/L	0.05 U	0.0065 U	3 U	7.5	0.0065 U	0.0065 U	0.0065 U	0.0065 U	0.05 U	0.0065 U
Sulfite	mg/L	---	---	---	---	---	---	---	---	---	---
Thiocyanate	mg/L	---	---	---	---	---	---	---	---	---	---
Thiosulfate	mg/L	---	---	---	---	---	---	---	---	---	---
Total Dissolved Solids (TDS)	mg/L	2790	3320	1900	2000	1730	1840 J	1970	1900	1650	1850
Nitrogen, Total Kjeldahl	mg/L	1.1 J6	1.2	5 U	5 U	0.633	0.608	0.208 J	0.035 U	0.25 U	0.55
Total Organic Carbon (TOC)	mg/L	11.7	13.6	5.3	5.6	92.8	5.5	5.91	5.73	---	---
Total Pet_ Hydrocarbons	mg/L	---	---								
Total Suspended Solids (TSS)	mg/L	---	---	---	---	---	---	---	---	5.23	5.59
Dissolved Organic Carbon (DOC)	mg/L	10.9	12.5	12	5.5	96.1	5.13	5.65	6.45	5.22	5.25

Table 11. Logan Wash Monitoring Well Analytical Data

SampleID		LWCW-1A	LWCW-1A	LW-22A	LW-22A	LW-22A	LW-22A	LW-22A	LW-22A	LW-22A	LW-22A
SampleDate		6/4/2018	11/13/2018	5/13/2015	10/15/2015	5/24/2016	10/5/2016	5/3/2017	10/10/2017	5/23/2018	10/31/2018
Parameters	Units										
Metals											
Arsenic	ug/L	13.4	12.6	2.4	2.5	2.14	1.92	2.5	2.47	3.46	2.49
Arsenic (Dissolved)	ug/L	13.6	13	0.92 J	1.9	1.97	1.78	1.15	1.24	1.96	1.09
Boron	ug/L	---	---	2200	2600	---	---	---	---	---	---
Boron (Dissolved)	ug/L	10700	9890	---	---	1720	2380	2590	2850	2960	2690
Cadmium	ug/L	---	---	---	---	---	---	---	---	---	---
Cadmium (Dissolved)	ug/L	1.00 U	0.220 U	1 U	0.28 J	0.220 U	0.220 U	0.220 U	0.22 U	1.00 U	0.220 U
Calcium	ug/L	---	---	---	---	---	---	---	---	---	---
Calcium (Dissolved)	ug/L	159000	148000	110000	140000 B	145000	162000	149000	140000	148000	136000
Chromium	ug/L	3.61	2.52	0.78 J	1.5 J	1.34	0.460 U	1.7 U	0.958 J	1.13 B	0.830 J
Chromium (Dissolved)	ug/L	3.15	3.22	2 U	0.97 J	1.18	1.29 U	0.320 U	0.342 J	0.602 B J	0.320 U
Chromium III	ug/L	---	---	---	---	---	---	---	---	---	---
Chromium VI	ug/L	---	---	---	---	---	---	---	---	---	---
Copper	ug/L	---	---	---	---	---	---	---	---	---	---
Copper (Dissolved)	ug/L	13	10.7	1.8 J	3	2.63	2.44 U	4.03	3.47	4.4	3.34
Iron	ug/L	83.8 J	27.1 J	1900	5200	3620	1430	2960	3820	4210	3340
Iron (Dissolved)	ug/L	100 U	15.0 U	55	180	3340	812	116	136	157 B	182
Lead	ug/L	---	---	---	---	---	---	---	---	---	---
Lead (Dissolved)	ug/L	0.357 J	0.260 U	1 U	0.064 J	0.351 J	0.260 U	0.260 U	0.26 U	1.00 U	0.260 U
Lithium	ug/L	---	---	---	---	---	---	---	---	---	---
Lithium (Dissolved)	ug/L	248	256	110	110	123	114	131	107	112	118
Magnesium	ug/L	---	---	---	---	---	---	---	---	---	---
Magnesium (Dissolved)	ug/L	158000	173000	97000	110000	119000	130000	127000	122000	133000	126000
Manganese	ug/L	---	---	---	---			---	---	---	---
Manganese (Dissolved)	ug/L	5.00 U	0.510 U	16	9.5	28.3	10.2	9.72	11.7	23.8	28.4
Mercury	ug/L	---	---	---	---			---	---	---	---
Mercury (Dissolved)	ug/L	0.200 U	0.0490 U	0.2 U	0.031 JB	0.0490 U	0.0490 U	0.0490 U	0.049 U	0.200 U	0.0490 U
Molybdenum (Dissolved)	ug/L	---	---	---	---	---	---	---	---	---	---
Nickel	ug/L	---	---	---	---	---	---	---	---	---	---
Nickel (Dissolved)	ug/L	---	---	---	---	---	---	---	---	---	---
Potassium	ug/L	---	---	---	---	---	---	---	---	---	---
Potassium (Dissolved)	ug/L	21500	21000	3400	4100	4190	4440	4180	4340	4470	3940

Table 11. Logan Wash Monitoring Well Analytical Data

SampleID		LWCW-1A	LWCW-1A	LW-22A	LW-22A	LW-22A	LW-22A	LW-22A	LW-22A	LW-22A	LW-22A
SampleDate		6/4/2018	11/13/2018	5/13/2015	10/15/2015	5/24/2016	10/5/2016	5/3/2017	10/10/2017	5/23/2018	10/31/2018
Parameters	Units										
Metals											
Selenium	ug/L	---	---	---	---	---	---	---	---	---	---
Selenium (Dissolved)	ug/L	47.1	48.4	15	19	18.4	20.5	20.5	19.2	22.1	18.5
Silicon	ug/L	11000	6890	---	---	8360	9740	11700	8700	12100	9800
Silicon (Dissolved)	ug/L	---	---	6500	8100	---	---	---	---	---	---
Silver	ug/L	---	---	---	---	---	---	---	---	---	---
Silver (Dissolved)	ug/L	---	---	---	---	---	---	---	---	---	---
Sodium	ug/L	---	---	---	---	---	---	---	---	---	---
Sodium (Dissolved)	ug/L	582000	647000	210000	250000	257000	276000	272000	257000	296000	281000
Strontium	ug/L	---	---	---	---	---	---	---	---	---	---
Strontium (Dissolved)	ug/L	4660	4360	2200	2700	3060	3170	3370	3630	3390	2960
Uranium (Dissolved)	ug/L	---	---	---	---	---	---	---	---	---	---
Zinc	ug/L	9.96 J	9.49 J	---	---	---	---	---	---	---	---
Zinc (Dissolved)	ug/L	---	---	15	23 B	36.2	25.4	12.2	2.23 U	17	6.64 J
Volatile Organic Compounds - BTEX											
Benzene	ug/L	1.00 U	0.331 U	5 U	5 U	0.331 U	0.331 U	0.331 U	0.331 U	1.00 U	0.331 U
Ethylbenzene	ug/L	1.00 U	0.384 U	5 U	5 U	0.384 U	0.384 U	0.384 U	0.384 U	1.00 U	0.384 U
Toluene	ug/L	1.00 U	0.412 U	5 U	5 U	0.780 U	0.780 U	0.412 U	0.412 U	1.00 U	0.412 U
Xylenes, Total	ug/L	3.00 U	1.06 U	10 U	10 U	1.06 U	1.06 U	1.06 U	1.06 U	3.00 U	1.06 U
Petroleum Products											
Diesel fuel	mg/L	0.198	0.159	0.46 U	0.25 J	0.289	24.7 U	0.0517 U	0.0247 U	0.0293 J	0.0362 J
TPH - Extractable (DRO)	mg/L	---	---	---	---	---	---	---	---	---	---
TPH (non-polar)	mg/L	---	---	---	---	---	---	---	---	---	---
TPH (C21 - C28)	mg/L	---	---	---	---	---	---	---	---	---	---
Radiology											
Gross Alpha Analytes	pci/l	---	---	---	---	---	---	---	---	---	---
Gross Beta Analytes	pci/l	---	---	---	---	---	---	---	---	---	---
Field Parameters											
Specific conductivity, field	umhos/cm	4281	4185	1700	1844	1935	1814	2559	2436	2548	2455
Dissolved oxygen (DO), field	mg/L	9.82	7.00	6.16	7.5	---	6.92	7.88	6.54	7.42	6.46
Oxidation reduction potential (ORP), fiel	millivolts	93.1	126.1	22.9	59.0	10.7	75.3	38.8	19.7	-14.0	87.5
pH, field	s.u.	6.89	8.77	7.28	7.32	7.44	7.19	7.39	7.31	6.89	6.95
Temperature, ambient	Deg C	---	---	21	24	---	---	15.6	10	---	---
Temperature, field	Deg C	10.06	8.7	11	11.05	11.1	10.38	11.2	11.0	11.1	11.3
Turbidity, field	NTU	70.4	3.73	57.37	21.52	34.8	23.4	52.6	47.00	70.4	43.18

Table 11. Logan Wash Monitoring Well Analytical Data

SampleID SampleDate Parameters	Units	LW-Big Seep 5/12/2015	LW-Big Seep 10/14/2015	LW-Big Seep 5/23/2016	LW-Big Seep 10/4/2016	LW-Big Seep 5/1/2017	LW-Big Seep 10/11/2017	LW-Big Seep 5/29/2018	LW-Big Seep 10/22/2018	LW-Research Trib 5/12/2015
General Chemistry										
Alkalinity, Bicarbonate (as CaCO3)	mg/L	240	260 B	288	228	243	252	257	246	280
Alkalinity, Carbonate (as CaCO3)	mg/L	36	16	2.71 U	17.4 J	7.72 J	7.98 J	15.8 J	8.18 J	32
Alkalinity, Total (As CaCO3)	mg/L	280	280 B	290	246 J	251	260	273	254	320
Ammonia	mg/L	0.1 U	0.1 U	0.038 U	0.038 U	0.059 U	0.0317 U	0.1 U	0.0317 U	0.1 U
Bromide	mg/L	0.5 U	0.5 U	0.079 U	R	1.58 U	0.079 U	1 U	0.79 U	0.5 U
Chemical Oxygen Demand (COD)	mg/L	15	2.7 J	12.2	54.6	4.94 J	10.6	6.66 J	3 U	10 U
Chloride	mg/L	7.2	7.8	7.85	8.98	10	11.3	11.9	10.6	50
Conductivity	umhos/cm	1400	1700	1400	1620	1560	1920	1980	9030	1600
Cyanide (free)	mg/L	---	---	---	---	---	---	---	---	---
Fluoride	mg/L	---	---	0.0895 J	0.0538 J	0.0733 J	0.0689 J	0.111	0.122	---
Fluoride (dissolved)	mg/L	0.14	0.086 J	---	---	---	---	---	---	0.2
Hardness	mg/L	600	720	561	605	673	832	757	698	660
Nitrate (as N)	mg/L	0.53	0.07 J	0.511	0.276	0.454 UJ	0.291	0.1 U	0.214	2.2
Nitrite (as N)	mg/L	0.05 U	0.05 U	0.0277 U	0.0277 U	0.0277 U	0.0277 U	0.1 U	0.0277 U	0.05 U
Oil and Grease, Total	mg/L	---	---	---	---	---	---	---	---	---
Oil and grease (HEM), polar	mg/L	4.3 U	4 U	---	---	---	---	---	---	4.5 U
Oil and grease (HEM), total	mg/L	---	---	1.16 U	1.16 U	1.16 U	1.16 U	5.05 U	1.16 U	---
pH	s.u.	8.57 J	8.52 HF	7.72 J	8.55 J	8.35 J	8.4 J	8.45 T8	8.38 J	8.55 J
Phenolics (Total)	mg/L	0.01 U	0.01 U	0.0083 U	0.013 U	0.0083 U	0.0083 U	0.04	0.0083 U	0.01 U
Phosphorus as P, total	mg/L	0.1 U	0.1 U	0.048 J	0.035 U	0.0362 J	2.96	0.1 U	0.0473 U	0.1 U
Silica	mg/L	---	---	18.5	17.9	18.9	20.3	20.3	17.5	---
Sulfate	mg/L	580	630	472	704	607	755	1080	849	580
Sulfide	mg/L	3 U	1.2 J	0.0065 U	0.030 J	0.0065 U	0.0065 U	0.05 U	0.0065 U	0.7 J
Sulfite	mg/L	---	---	---	---	---	---	---	---	---
Thiocyanate	mg/L	---	---	---	---	---	---	---	---	---
Thiosulfate	mg/L	---	---	---	---	---	---	---	---	---
Total Dissolved Solids (TDS)	mg/L	1100	1400	1100	1110	1170	1530 0	1480	1450	1300
Nitrogen, Total Kjeldahl	mg/L	2.7 J	5 U	0.444	0.255	0.101 J	0.259 U	0.190 J6	0.254 J	3.3 J
Total Organic Carbon (TOC)	mg/L	3.6	3	43.4	3.23	2.87	3.47 0	---	---	11
Total Pet_ Hydrocarbons	mg/L									
Total Suspended Solids (TSS)	mg/L	---	---	---	---	---	---	3.78	3.5	---
Dissolved Organic Carbon (DOC)	mg/L	9.5	3.7	22.5	3.38	3.13	3.62	3.53	3.74	16

Table 11. Logan Wash Monitoring Well Analytical Data

SampleID SampleDate Parameters	Units	LW-Big Seep 5/12/2015	LW-Big Seep 10/14/2015	LW-Big Seep 5/23/2016	LW-Big Seep 10/4/2016	LW-Big Seep 5/1/2017	LW-Big Seep 10/11/2017	LW-Big Seep 5/29/2018	LW-Big Seep 10/22/2018	LW-Research Trib 5/12/2015
Metals										
Arsenic	ug/L	4.5	4.3	3.9	3.9	4.44	4.68	5.55	5.28	4.2
Arsenic (Dissolved)	ug/L	5	4.1	3.55	3.75	6.15	6.1	5.59	4.87	4.4
Boron	ug/L	48	70	---	---	---	---	---	---	100
Boron (Dissolved)	ug/L	---	---	89.6	74.9	624	93 J	111	153 J	---
Cadmium	ug/L	---	---	---	---	---	---	---	---	---
Cadmium (Dissolved)	ug/L	1 U	1 U	0.220 U	0.220 U	0.220 U	0.22 U	1.00 U	0.220 U	1 U
Calcium	ug/L	---	---	---	---	---	---	---	---	---
Calcium (Dissolved)	ug/L	87000	95000 B	95000	112000	98900	106000	112000	116000	110000
Chromium	ug/L	0.46 J	0.76 J	1.18	1.02 U	0.320 U	0.701 J	0.441 J	0.840 J	0.74 J
Chromium (Dissolved)	ug/L	0.52 J	0.89 J	1.01	1.20 U	0.704 J	0.686 J	0.572 J	0.471 U	0.58 J
Chromium III	ug/L	---	---	---	---	---	---	---	---	---
Chromium VI	ug/L	---	---	---	---	---	---	---	---	---
Copper	ug/L	---	---	---	---	---	---	---	---	---
Copper (Dissolved)	ug/L	1.7 J	2.2	1.4	1.26	8.95	2.5	3.33	1.82	3.4
Iron	ug/L	15 J	50 U	15.0 U	74.6 J	15.0 U	15 U	100 U	121	120
Iron (Dissolved)	ug/L	10 J	50 U	15.0 U	15.0 U	15.0 U	15 U	100 U	15.0 U	12 J
Lead	ug/L	---	---	---	---	---	---	---	---	---
Lead (Dissolved)	ug/L	1 U	0.066 J	0.260 U	0.260 U	0.260 U	0.26 U	1.00 U	0.260 U	1 U
Lithium	ug/L	---	---	---	---	---	---	---	---	---
Lithium (Dissolved)	ug/L	44 J	51	53	53.3	58.4	56.1	66.3	59.7	35 J
Magnesium	ug/L	---	---	---	---	---	---	---	---	---
Magnesium (Dissolved)	ug/L	69000	89000 B	75600	104000	103000	117000	133000	121000	78000
Manganese	ug/L	---	---	---	---	---	---	---	---	---
Manganese (Dissolved)	ug/L	0.9 J	0.11 JB	0.611 J	1.11 J	0.510 U	0.561 J	5.00 U	44.8	1.3 J
Mercury	ug/L	---	---	---	---	---	---	---	---	---
Mercury (Dissolved)	ug/L	0.2 U	0.2 U	0.0490 U	0.0490 U	0.0490 U	0.049 U	0.0614 B J	0.0490 U	0.2 U
Molybdenum (Dissolved)	ug/L	---	---	---	---	---	---	---	---	---
Nickel	ug/L	---	---	---	---	---	---	---	---	---
Nickel (Dissolved)	ug/L	---	---	---	---	---	---	---	---	---
Potassium	ug/L	---	---	---	---	---	---	---	---	---
Potassium (Dissolved)	ug/L	950	1200	1070	1040	1550	1470	1350	2040	1600

Table 11. Logan Wash Monitoring Well Analytical Data

SampleID SampleDate Parameters	Units	LW-Big Seep 5/12/2015	LW-Big Seep 10/14/2015	LW-Big Seep 5/23/2016	LW-Big Seep 10/4/2016	LW-Big Seep 5/1/2017	LW-Big Seep 10/11/2017	LW-Big Seep 5/29/2018	LW-Big Seep 10/22/2018	LW-Research Trib 5/12/2015
Metals										
Selenium	ug/L	---	---	---	---	---	---	---	---	---
Selenium (Dissolved)	ug/L	3.5 J	1.9 J	2.56	1.80 J	1.73 J	1.74 J	1.88 J	1.56 J	7.7
Silicon	ug/L	---	---	8620	8350	8850	9470	9480	8170	---
Silicon (Dissolved)	ug/L	7200	7800	---	---	---	---	---	---	8200
Silver	ug/L	---	---	---	---	---	---	---	---	---
Silver (Dissolved)	ug/L	---	---	---	---	---	---	---	---	---
Sodium	ug/L	---	---	---	---	---	---	---	---	---
Sodium (Dissolved)	ug/L	100000	120000	114000	138000	144000	148000	182000	166000	110000
Strontium	ug/L	---	---	---	---	---	---	---	---	---
Strontium (Dissolved)	ug/L	3800	4500	3970	5450	5680	5830	6320	5050	3000
Uranium (Dissolved)	ug/L	---	---	---	---	---		---	---	---
Zinc	ug/L	---	---	---	---	---		---	---	---
Zinc (Dissolved)	ug/L	0.94 J	1.5 JB	2.51 U	4.00 J	2.83 J	2.52 U	10.0 U	12.2	0.43 J
Volatile Organic Compounds - BTEX										
Benzene	ug/L	5 U	5 U	0.331 U	0.331 U	0.331 U	0.331 U	1.00 U	0.331 U	5 U
Ethylbenzene	ug/L	5 U	5 U	0.384 U	0.384 U	0.384 U	0.384 U	1.00 U	0.384 U	5 U
Toluene	ug/L	5 U	5 U	0.780 U	0.780 U	0.412 U	0.412 U	1.00 U	0.412 U	5 U
Xylenes, Total	ug/L	10 U	10 U	1.06 U	1.06 U	1.06 U	1.06 U	3.00 U	1.06 U	10 U
Petroleum Products										
Diesel fuel	mg/L	0.48 U	0.22 J	0.0526 J	0.0458 J	0.0781 J	0.0247 U	0.0717 B J	0.0610 J	0.5 U
TPH - Extractable (DRO)	mg/L	---	---	---	---	---	---	---	---	---
TPH (non-polar)	mg/L	---	---	---	---	---	---	---	---	---
TPH (C21 - C28)	mg/L	---	---	---	---	---	---	---	---	---
Radiology										
Gross Alpha Analytes	pci/l	---	---	---	---	---	---	---	---	---
Gross Beta Analytes	pci/l	---	---	---	---	---	---	---	---	---
Field Parameters										
Specific conductivity, field	umhos/cm	1445	1098	896	923	1542	1826	1946	1941	1627
Dissolved oxygen (DO), field	mg/L	8.52	8.44	11.1	13.75	8.57	7.25	9.21	9.24	7.24
Oxidation reduction potential (ORP), fiel	millivolts	341.3	306.8	343.6	234.7	257	185	129.3	150.5	222.6
pH, field	s.u.	8.25	6.51	6.25	6.57	6.16	8.31	7.22	6.43	8.35
Temperature, ambient	Deg C	16	24	---	---	15.6	15.6	---	---	16
Temperature, field	Deg C	10.39	8.9	4.62	1.7	6.4	7.9	8.56	10.1	10.71
Turbidity, field	NTU	2.89	1.48	---	4.51	1.42	0.87	0.98	0.19	2.67

Table 11. Logan Wash Mine Retort Water Analytical Data

Notes:

U = result not detected at the reporting limit

J = result value greater than the MDL and less than the RL; result considered estimated

B = analyte found in sample and associated blank

HF = analysis holding time exceeded; result considered estimated

E = result estimated due to the presence of interference

R = rejected data

O1 = failed the method required serial dilution test and or subsequent post spike criteria. Failures indicate matrix interference

V = sample concetration is too high to evaluate accurate spike recoveries

--- = Analysis not performed