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March 30, 2022

Todd Powell (*via file transfer*)  
Director, Mineral Resources  
Government of Yukon  
PO Box 2703 (K-9)  
Whitehorse, Yukon, Y1A 2C6

Dear Mr. Powell

**Re: Sa Dena Hes Mine – 2021 Annual Quartz Mining License QML-0004 Report**

On behalf of the Sa Dena Hes Operating Corporation, please find enclosed one copy of the 2021 Annual QML Report for Sa Dena Hes Mine as required under QML-0004.

Please contact me if you have any questions or concerns regarding this report.

Yours truly,

Michelle Unger,  
Manager, Environmental Performance  
Teck

Attachment (1)

Cc: Travis Stewart, Liard First Nation Land Manager [travis.stewart@liardfirstnation.ca](mailto:travis.stewart@liardfirstnation.ca)

# Annual Quartz Mining License Report for 2021

Property: Sä Dena Hes Mine

Permit #: QML-0004

Company: Sä Dena Hes Operating Corporation c/o  
Teck Resources Limited

Prepared By: Michelle Unger B.Sc., Manager Environmental Performance

Issued Date: March 30, 2021



## Executive Summary

The Annual Reclamation Report for 2021 for the Sä Dena Hes (SDH) mine site was prepared by Teck Resources Limited on behalf of Sä Dena Hes Mining Corporation, as required in accordance with Yukon Quartz Mining License QML-0004. This annual report describes the progress of closure and reclamation related activities at the Sä Dena Hes Mine in 2021.

The Sä Dena Hes (SDH) property is the site of a former lead-zinc mine that operated from 1991 to 1992. The property is located 45 km north of Watson Lake in the Yukon Territory and is owned by the Sä Dena Hes Mining Corporation which is a joint venture between Teck Resources Limited (Teck) and Pan-Pacific Metal Mining Corp., a wholly-owned subsidiary of Korea Zinc. Teck is the operator under the joint venture agreement for the site.

Permanent closure and decommissioning activities commenced in 2013 and were completed in 2015. Reclamation activities conducted at the site includes applying a simple cover, using natural glacial till materials, to most mine disturbed areas limiting the release of contaminants to the air, water and land. Surface contouring and vegetation have been completed for protection against water erosion. A revegetation program was implemented once the cover system was finished in 2015.

In 2021, samples from all of the required water quality monitoring stations met the standards in water use licence QZ16-051 for all water quality parameters. Water quality monitoring was also conducted under the Adaptive Management Plan (AMP) as part of the Water Licence. Although there were a few specific performance threshold exceedances, review of available water quality data, and information from subsequent sampling events, no additional actions were deemed necessary.

Physical work conducted at the site in 2021 included regular maintenance on the main access road culverts, north creek channel, and north tailings facility drainage swale.

The 2021 inspection indicated that all the geotechnical structures are stable and are functioning in accordance with the closure design parameters.

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Attachment 2 Sä Dena Hes – 2021 Annual Report Yukon Water Licenses QZ16-051 dated March 2022, prepared by Ensero Solutions (*electronically submitted as separate file*)



## 1.0 Introduction

The Sä Dena Hes (SDH) property is the site of a former lead-zinc mine that operated from 1991 to 1992. The property is located 45 km north of Watson Lake in the Yukon Territory and is owned by the Sä Dena Hes Mining Corporation which is a joint venture between Teck Resources Limited (Teck) and Pan-Pacific Metal Mining Corp., a wholly owned subsidiary of Korea Zinc. Teck is the operator under the joint venture agreement for the site.

Teck submitted notice to begin “Permanent Closure” to the Ministry of Energy, Mines and Resources (EMR) on February 17, 2012. The Detailed Decommissioning and Reclamation Plan (DDRP) (Teck, 2012) (Teck, 2013) was revised to plan for permanent closure. Permanent closure and decommissioning activities were carried out in 2014 and in 2015. A final DDRP was submitted in August 2015 (Teck, 2015) to account for amendments issued in 2014 and 2015. In 2015 Teck amended the Quartz Mining License (QML-0004), which expires on December 31, 2040. The current status of the site is Permanent Closure and Reclamation.

The objectives of the decommissioning and reclamation plan are to ensure the:

- Protection of public health and safety;
- Implementation of environmental protection measures that minimize adverse environment impacts;
- Ensuring land use commensurate with surrounding lands;
- Post closure monitoring of the site to assess effectiveness of closure measures for the long term.

Reclamation activities conducted at the site includes applying a simple cover, using natural glacial till materials, to most mine disturbed areas limiting the release of contaminants to the air, water and land. Surface contouring and vegetation have been completed for protection against water erosion. A revegetation program was implemented once the cover system was finished in 2015.

The Yukon Water Board regulates water management of the mine site. Water Use Licence QZ16-051 addressing permanent closure came into effect on April 1, 2017. Teck retains a Surface Lease 105A10-011 on the property and was renewed in 2021 with an expiry 2041.

## 2.0 2021 Decommissioning and Reclamation Activities

The QML and Water Use Licence both require post-reclamation environmental monitoring, physical/geotechnical inspections, and maintenance of constructed/engineered structures to be completed under the *Environmental Monitoring, Surveillance and Reporting Plan* (EMSRP, Alexco, 2017) and Adaptive Management Plan (AMP, Alexco, 2018).

The following summarizes the activities with details further discussed within the subsequent sections:

- Surface Water and Groundwater Quality Monitoring/Sampling
  - Bi-monthly/quarterly surface water and groundwater monitoring and sampling was conducted from January to December as per the Water Use Licence QZ16-051. Access to some of the locations are conducted using helicopter/snowmobiles in the winter months and an all-terrain vehicle in the snow free months.
  - Due to extreme weather conditions, two sampling events in 2021 could not be completed for sample locations that are only accessible by helicopter. In August 2021, MH-30 and MH-13 were not accessible due to low visibility creating unsafe conditions. In December 2021, MH-30, MH-13, and MH-15 were not sampled due to extreme cold weather.
- Terrestrial Monitoring
  - The five-year re-vegetation assessment is considered complete. There were no activities other than to take photographs at the eight permanent photo hubs installed in 2020.
- Aquatic Resources Monitoring
  - Aquatic resource monitoring was not required in 2021. The next scheduled biennial Environmental Effects Monitoring program under QZ16-051 is September 2022.
- Physical/geotechnical inspections
  - Spring and fall routine site inspection of physical/geotechnical features was completed by Teck and the site caretaker.
  - The 2021 Annual Mine Waste Facilities Inspection was completed by the engineer of record on September 22, 2021. As per the QML-0004, the Annual Inspection report was submitted on Dec. 21, 2021.
  - No additional fall inspection as the Annual geotechnical inspection was completed late September
- Maintenance of constructed/engineered structures or access road
  - Inspect and clean debris from access road culverts; installed beaver screens to prevent further blockages;
  - Inspect and clear blockages occurring along North Pond drainage swale, as necessary.

### 3.0 2022 Decommissioning and Reclamation Activities

There are no planned physical activities in 2022 other than monitoring the reclaimed areas and completing maintenance of any areas that may be identified following freshet.

The post closure monitoring as outlined in the EMSRP and AMP will be conducted in 2022 as per the Water Licence issued in April 2017.

#### 4.0 Effectiveness of the Remediation Measures

All the physical remediation and revegetation activities were completed in 2015. Based on the current monitoring programs, the remediation measures appear to be effective. All the engineered structures remain to be in good condition with no signs of surficial movement or erosion with the exception of a few small areas previously identified. The erosion observed along the North Creek channel is due to high flows and beaver activity at the inlet of the channel, however it has been determined to allow the creek to erode until it will eventually sustain itself without maintenance. Beaver dams are removed as required to minimize the water level of the pond.

#### 5.0 Map showing the status of all decommissioning and reclamation activities

All the physical remediation and revegetation activities were completed in 2015. In the 2015 Annual Report, several drawings were included within the AMEC 2015 As-built report. Due to the limited physical work and revegetation completed in 2021 there are no updated maps included within this report.

#### 6.0 Inspection of Engineered structures

The 2021 geotechnical inspection of the structures and features associated with the Tailings Management Area at SDH completed by SRK on September 22, 2021. The inspection report *Sä Dena Hes Mine, Yukon Territory 2021 Annual Mine Waste Facilities Inspection, dated December 2021*, (SRK, 2021) submitted to EMR on December 21, 2021.

The report presents SRK's observations of the following structures and features, identifies any deficiencies and provides recommendations where appropriate:

- The North Dam;
- The decommissioned North Creek Dyke and Second Crossing;
- The relocated Camp Creek Channel;
- The North Channel and South Channel;
- The Sediment Retaining Structure (SRS);
- The Burnick Portals (1200 and 1300) and Waste Rock Dumps;
- The Jewelbox and Main Zone Waste Rock Dump and Portal areas.

The South and Reclaim Dams including the tailings were decommissioned in 2014. The Camp Creek Diversion and Exit Chute were decommissioned in 2015. The North Creek Dyke and spillway including a second crossing culvert system on North Creek downstream below the dyke were decommissioned in 2015.

The North Dam remains as an earthen embankment that retains the stored tailings. A variable depth till cover was placed over the tailings in 2014 as a growth medium and to control the migration of windblown tailings. No resloping of the downstream dam face was needed.

The SRS is an approximately 5 m high berm that was formed during the decommissioning and removal of the South Dam. The berm was designed to retain sediment in runoff from the till tailings cover and incorporates a riprap lined spillway. The spillway has capacity for the 1 in 1000-year flood event.

The Burnick 1200 and 1300 Portals were capped in 2015 with locally available waste rock and graded with a gently sloped face to provide long term stability. The crests of the associated waste rock dumps were recontoured to provide added stability. No resloping of the downstream face of the dumps was required.

The 2021 inspection indicated that all the geotechnical structures are stable and are functioning in accordance with the closure design parameters.

The North Dam settlement gauges were last surveyed on July 24, 2020. The survey was discontinued after that due to no unexpected settlement over the 27-year monitoring period. The gauges remain operational and will be surveyed following any major seismic event.

The 2021 Annual Tailings Mine Waste Facilities Recommendations and timelines:

- 2021-1: North Dam – Displaced cap on NDW-4A – install a proper 2-inch PVC pipe plug and trim the pipe such that it fits in steel protective casing – Spring 2022
- 2021-2: North Dam – With the long-term goal of reducing all potential failure modes to non-credible, undertake a credible failure modes assessment for the TMA – Q4 2022
- 2021-3: North Dam – Due to water levels in Piezometer 2A triggering alerts and event-driven inspections during the last 2 freshets, review the trigger action alert levels and consider additional levels for seasonal freshet conditions; Establish snowpack monitoring stations to investigate possible impact between snowmelt and North Dam foundation pressures – Q4 2022

## 7.0 Results of Studies and Monitoring Programs

### 7.1 Water Licence Monitoring

The water quality standards and monitoring requirements are managed under Water Licence QZ16-051 Effective Date April 1, 2017 with the expiry date of December 31, 2040.

The licence describes the water quality monitoring program for post closure monitoring, which is the applicable program for the current status of the SDH (Permanent Closure and Reclamation). The water quality program outlines the sampling sites, frequency and required water quality parameters.

As required by Licence QZ16-051, water quality data is reported quarterly to the Yukon Territory Water Board. The 2021 monitoring results are discussed in the annual report prepared by Ensero Solutions entitled *Sä Dena Hes – 2021 Annual Report Yukon Water Licence QZ16-051 dated March 2022* (Ensero Solutions, 2022). The report provides a detailed analysis of data and is included as Attachment 2. Surface and groundwater water quality monitoring conducted under the AMP are also included in the water licence monitoring requirements. The AMP describes a means of interpreting data to indicate if water quality is changing from conditions observed over the past 20 years. The plan also describes when and how changes in water quality require a response.

In 2021, samples from all the required water quality monitoring stations met the standards in licence QZ16-051 for all water quality parameters, however, exceedances of the AMP thresholds did occur. Based on the review of available water quality data, and information from subsequent sampling events, no additional actions were deemed necessary.

## 7.2 Environmental Effects Monitoring

The biennial biological effects monitoring at the site was completed and reported in the 2020 Water Licence report. The next monitoring event will occur in 2022.

## 7.3 Vegetation Monitoring

In 2015, a total 27,000 plugs were planted of *Salix alaxensis*, *S. bebbiana*, *S. barclayi*, *S. planifolia* and *Populus balsamifera* were installed in several discrete areas throughout the reclaim, south pond, north pond and mill areas. The remaining open areas of these sites were planted with approximately 70,000 alder (*Alnus viridis crispa*) plugs. The alder were planted at a much lower density than the other tree species.

The fifth year of revegetation monitoring was conducted in 2020 by Laberge Environmental Services. The detailed results of the monitoring are included in the attached report entitled "*Revegetation Monitoring at the Reclaimed Sä Dena Hes Mining Site, 2020*" dated January 2021 (Laberge, 2021). Monitoring of the plots is not required until 2025, however eight permanent photo hubs were established in 2020 throughout the revegetated areas to document growing conditions each summer. The locations of the photo plots are displayed in Figure 1 in Appendix A. Although the photo plots weren't established until 2020, photographs have been taken of each site previously and have been included for comparison purposes in Appendix A.

Table 1 – Locations of Permanent Photo Hubs, July 2020

Hub #	Latitude	Longitude	Site Description	Bearing (°)
PH-1	60.53885°	128.85624°	At Revegetation sign at the north dam	70 to 80
PH-2	60.53144°	128.85213°	North end of South tailings facility near VMP-2; near old access road	360 view
PH-3	60.52005°	128.87726°	Jewel box, at MW13-02 and GP3	346
PH-4	60.54871°	128.85471°	Landfill at MW14-02	360 view
PH-5	60.53388°	128.85292°	South end of north tailings facility near VMP-4	5 and 65
PH-6	60.52305°	128.86575°	Mill area near access road	360 view
PH-7	60.52457°	128.84914°	Reclaim and Borrow pit G – near osprey nest	360 view
PH-8	60.55294°	128.87687°	Burnick, GP-6 & MW13-06	220

VMP – Vegetation monitoring plot; GP – Grass monitoring plot

## 8.0 Invasive Plants

There were no formal assessments completed in 2021. However the areas are being monitored and the larger plants are removed as necessary. It is expected the areas that were previously identified will decrease in size and will continue to be monitored.

## 9.0 Spills and Accidents

There were no reportable spills or accidents in 2021.

## 10.0 Wildlife Incidents and Other Accidents

There were no direct wildlife incidents or other accidents reported in 2021 other than notable activity of beavers plugging road culverts along the main access road and North Creek Channel.

## 11.0 Site Improvements to address Sediment and Erosion

There were no signs of major erosion in any of the capped areas in 2020. Erosion has been observed in the North Creek channel, but it is recommended to let it sustain itself without

maintenance. In 2020, seepage was observed above the North Drainage Channel which triggered subsidence of the channel. To prevent flow from possibly creating a collapse of the channel and disturbing the covered tailings, the geotechnical engineer recommended buttressing the downstream portion of the channel which was completed in 2020. This area was monitored and photographed in 2021 with no significant changes although water appears to continue to trickle under repaired section of the North Diversion channel.

## 12.0 Closing

I trust this report meets the requirements under Part 5, Section 11.4 of QML-0004. Please contact Michelle Unger at 250-427-8422 [michelle.unger@teck.com](mailto:michelle.unger@teck.com) if you have any questions regarding this report.



Michelle Unger, B.Sc.  
Manager, Environmental Performance  
Teck Legacy Properties

## 13.0 References

- Alexco. (2017). *Sa Dena Hes Mine – Environmental Monitoring, Surveillance and Reporting Plan, June 28, 2017.*
- Alexco. (2018). *Sa Dena Hes Mine - Post-Reclamation Adaptive Management Plan, dated February 12, 2018.*
- Ensero Solutions. (2022). *Sä Dena Hes – 2021 Annual Report Yukon Water Licence QZ16-051 dated March 2022.*
- Laberge. (2021). *Revegetation Monitoring at the Reclaimed Sä Dena Hes Mining Site, 2020, prepared by Laberge Environmental Services, dated January 2021.*
- SRK. (2021). *Sä Dena Hes Mine, Yukon Territory, 2021 Annual Mine Waste Facilities Inspection, prepared by SRK Consulting (Canada) Inc., dated December 21, 2021.*
- Teck. (2012). *Sa Dena Hes Mine, Detailed Decommissioning and Closure Plan, Jan. 2012 update, prepared by Teck Resources Limited, Jan. 28, 2012.*
- Teck. (2013). *Sa Dena Hes Mine, Detailed Decommissioning and Closure Plan, March 2013 Update-Final, prepared by Teck Resources Limited .*
- Teck. (2015). *Sa Dena Hes Mine, Detailed Decommissioning and Reclamation Plan August 2015 Update. Prepared by Teck Resources Limited, August 31, 2015.*
- Teck. (2018). *Water Licence #QZ16-051 – Sa Dena Hes Mine – Submission of Revised Adaptive Management Plan, dated March 7, 2018.*



# Attachment 1

## Revegetation Monitoring Plots and Photos



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Veg Monitoring Locations		
Plot #	Easting	Northing
VMP-1	508182	6710456
VMP 2	508117	6710587
VMP 3	507999	6710278
VMP 4	508062	6710865
VMP 5	508171	6710130
VMP 6	507992	6711385
VMP 7	508283	6709879
VMP 8	507406	6709627
VMP-9	508027	6712609
VMP 10	508195	6709820
VMP 11	508288	6710068
VMP-12	508103	6710511
VMP 13	508088	6711391
VMP-14	507423	6709674

Reference Sites		
Site	Easting	Northing
FF-Ref1	507433	6707799
FF-Ref2	507197	6708648
NC-Ref	506556	6710420

Photo Plots		
Hub #	Latitude	Longitude
PH-1	60.53885	-128.8562
PH-2	60.53144	-128.8521
PH-3	60.52005	-128.8773
PH-4	60.54871	-128.8547
PH-5	60.53388	-128.8529
PH-6	60.52305	-128.8658
PH-7	60.52457	-128.8491
PH-8	60.55294	-128.8769



**Teck**

The maps and map data are provided 'as is' without any guarantee, representation, condition or warranty of any kind, either express, implied, or statutory. Teck Resources Limited assumes no liability with respect to any reliance the user places in the maps and map data, and the user assumes the entire risk as to the truth, accuracy, currency, or completeness of the information contained in the maps and map data.



**Sa Dena Hes Vegetation Monitoring Plots**

- Vegetation Monitoring Locations
- Reference Sites
- Photo Plots
- Reclaimed Areas

\*\*\* Aerial photography was obtained from McElhanney from August 15, 2012 LiDAR survey and represents the site prior to reclamation.

0 100 200 300 400 Meters

**1:15,000**

DATE: 1/8/2021	MINE OPERATION: Sa Dena Hes
DRAWN BY: goulton	COORDINATE SYSTEM: NAD 1983 UTM Zone 9N



# Photo Hub 1 – At Revegetation Sign at the North Dam



August 2015 planting



August 2018



July 2020



August 2021



## Photo Hub 2 – North End of South Tailings Facility Near VMP-2



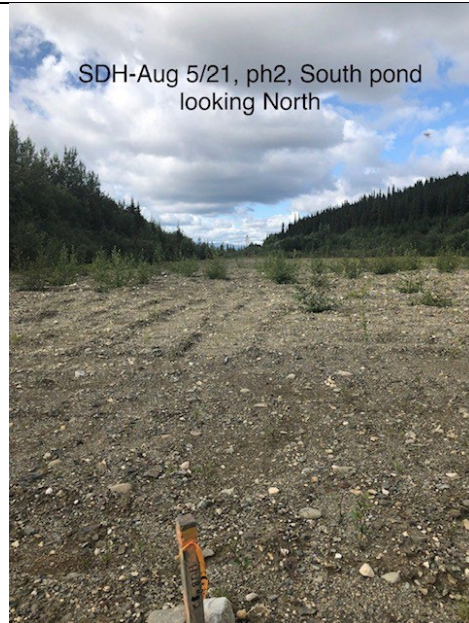
Aug 2015, planting alder



July 2018



July 2020



August 2021



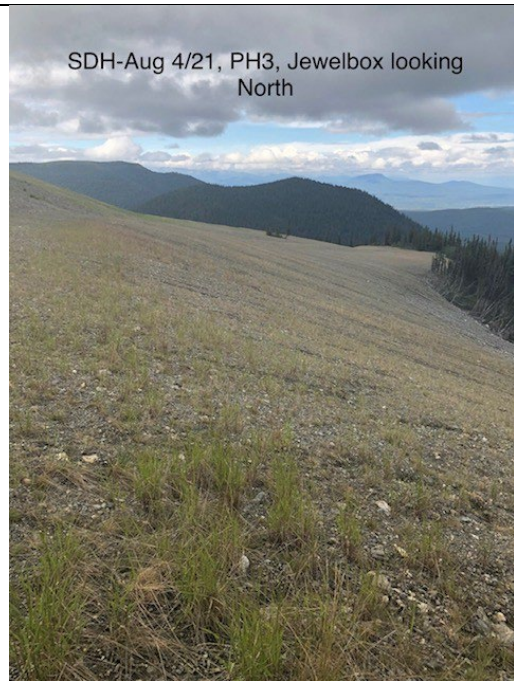
## Photo Hub 3 – Jewelbox Near GP3 and MW13-02



August 2018



July 2020



August 2021

## Photo Hub 4 – Landfill at MW14-02 and VMP-9



August 2015 Planting



August 2018



July 2020



August 2021



## Photo Hub 5 – South End of North Tailings Facility (VMP-4)



August 2015 planting



August 2018

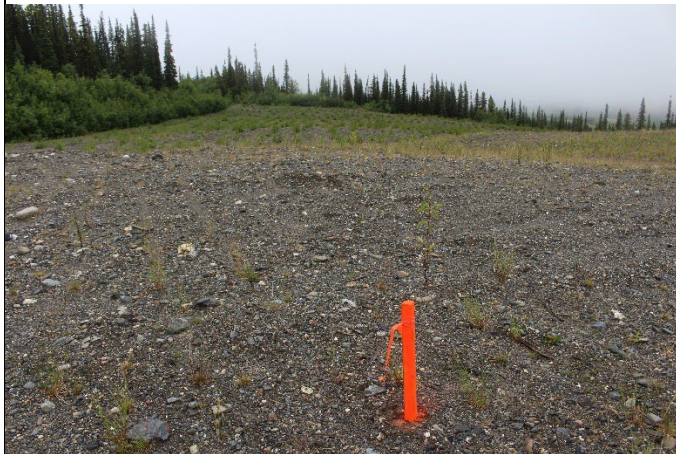


July 2020

## Photo Hub 6 – Mill Site



August 2015 planting



July 2020



August 2021



Photo Hub 7 – Reclaim Pond



August 2015 planting



July 2020



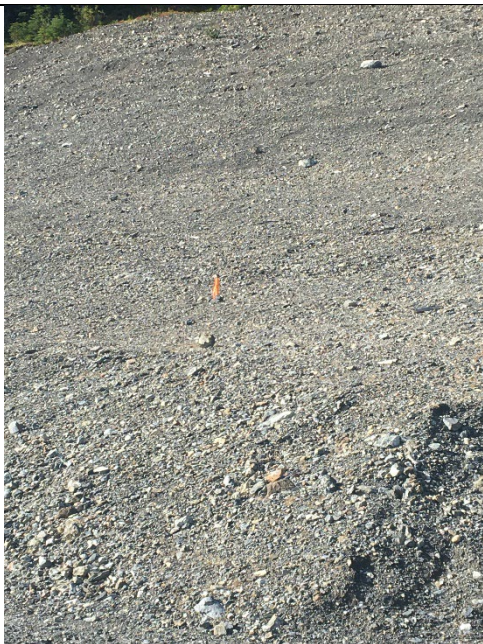
August 2021



Photo Hub 8 – Burnick, GP-6, and MW13-06



July 2016



July 2020



August 2021

## Attachment 2

Sä Dena Hes – 2021 Annual Report Yukon Water Licenses  
QZ16-051 dated March 2022, prepared by Ensero Solutions  
*(electronically submitted as separate file)*