Teck

Sä Dena Hes Mine, Yukon Territory
2019 Dam Safety Inspection

Prepared for

Teck Resources Limited

Prepared by

srk consulting

SRK Consulting (Canada) Inc.
May 2020

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2019 Dam Safety Inspection

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Executive Summary

This report presents the results of the 2019 Annual Dam Safety Inspection (DSI) of the structures and features associated with the Tailings Management Area (TMA) that forms part of the closed Sä Dena Hes mine located near Watson Lake, Yukon. The only remaining tailings retaining embankment at the closed site is the North Dam. A small dike referred to as the Sediment Retaining Structure (SRS) was also retained after closure of the site to collect any sediment that would be generated from the till cap that was placed over the exposed tailings. Other structures included in the DSI scope are a series of newly constructed (2014) riprapped lined diversion channels and the reclaimed waste rock dumps at the location of the closed portals adjacent to the Main, Jewelbox and Burnick ore zones.

The inspection was completed by Mr. Peter Healey PEng., an associate of SRK Consulting (Canada) Inc., on September 9 and 10, 2019 while accompanied by Gerry Murdoch (Teck), Morgan Lypka (Teck), Peter Mikes (SRK) and Jeff Basarich (Teck). Mr. Healey is the Engineer of Record (EoR) for the site and has been completing the annual dam inspections since 1992.

The work was completed in accordance with Teck's Tailings and Water Retaining Structures (TWRS) guideline and policy (2019) and the Yukon Territory Sä Dena Hes Water Licence issued April 2017 (QZ16-051).

Summary of Facility Description

The original TMA consisted of three earth structures, which were referred to as the North Dam, the South Dam and the Reclaim Dam. The North and South dams, which impounded the tailings, were constructed between July 1990 and October 1991. The starter dams for both structures were built to a height of about 13 metres.

In addition to the North and South Dams, a Reclaim Dam was built to detain supernatant water decanted from the tailings pond. The mine operation involved recycling of the detained water to the mill, with a controlled discharge when required into the adjacent Camp Creek from April to October each year.

Operations at Sä Dena Hes mine, which commenced in July 1991, were suspended in December 1992 due to low lead and zinc prices. Decommissioning of the site began in 2014 and was completed in 2015.

Structures that currently remain on the site include the North Dam and the Sediment Retaining Structure (SRS). The SRS is a 7 m high dike which impounds a small pond.

Summary of Key Hazards

As a required component of a DSI, the following key hazards at the site were identified and the consequences of different hypothetical failure modes of the North Dam and the SRS were assessed:

- runoff from extreme precipitation events,

- seismic events,
- ice build up and debris in the SRS spillway,
- flow capacity of the SRS spillway, and
- potential for liquefaction of the tailings.

The key hypothetical failure modes assessed included:

- Dam Overtopping,
- Piping, and
- Slope Stability.

The assessment concluded that the North Dam and the SRS Dike are in good condition, meet current expectations and fall within acceptable guidelines for stability. None of the above hypothetical failure modes are of a concern to manifest themselves.

Summary of Consequence Classifications

Consequence classification is not related to the likelihood of a failure, but rather the potential impact resulting from a hypothetical failure if it did occur. The last Dam Safety Review (DSR) was carried out by AMEC Foster Wheeler (AMECFW) (now the WOOD Group) in 2015. Based on this review, the CDA Dam Consequence Classification (DCC) of the North Dam was changed from “Low” to “Significant” and the DCC for the SRS remained as “Low”. The change for the North Dam was based on an issue raised by AMECFW noting that there was a potential for liquefaction of the tailings if the dam were to fail and that during a flood event there was a potential for overtopping of the dam. The Consequence Classification of the Sediment Retaining Structure was assessed during the DSI and remains “Low”.

It is SRK’s opinion that the Dam Consequence Classification (DCC) of “Significant” for the North Dam is overly conservative and should remain as “Low. The next DSR is scheduled for 2025 and the DCC for the North Dam should be reviewed at that time.

Summary of Key Observations

North Dam

The North Dam is in good condition and shows no signs of deformation or abnormal settling. The downstream slope of the dam shows no signs of surficial movement or erosion nor is there any sign of bulging at the downstream toe.

The piezometers and settlement gauges on the North Dam are in good condition and continue to function as designed. The seasonal fluctuations recorded in the latter part of 2018 and in the spring and summer of 2019 in the piezometers are consistent with those observed in previous years.

The readings taken of the settlement gauges in the North Dam indicate that there has been no unexpected settlement of the embankment over the 24-year period that readings have been taken, with settlement readings varying to a maximum of 51 mm (or less than 1% of the total height of the dam) from the initial readings taken in 1993. In the last three years, settlement readings have fluctuated no more than 1 mm.

Sediment Retaining Structure

The SRS is in good physical condition and the spillway is functioning in accordance within design parameters.

North Creek

Beaver activity was again evident at the inlet to the channel with the construction of a beaver dam. The dam raises the water level of the pond behind the structure and increases the risk of a rapid release of water that could result in erosion of the riprap protection in the channel. The beaver dam was removed in 2019. Best Practice dictates that beaver dams be removed when identified during the routine inspections. However, there are no downstream structures that are at risk in the event that the beaver dam was to release water.

Summary of Significant Changes

There are no significant changes to the stability of either the North Dam or the SRS since their construction in 1991 and 2014, respectively.

Summary of Review of OMS and EPRP Manuals

The Operation, Maintenance and Surveillance (OMS) Manual was originally prepared by SRK in 2015. The manual was reviewed as part of this 2019 DSI.

Recent changes (2019) to the OMS manual are provided in Section 5.6. The changes focus on (i) updates to site climate data; (ii) updates to the Sä Dena Hes peak ground acceleration (PGA) levels; (iii) subsequent changes to the design criteria for the North Dam and the SRS dike related to the PGA changes; (v) Piezometer maintenance (vi) Addition of trigger levels in the North Dam piezometers and settlement gauges.

The current Emergency Preparedness and Response Plan (EPRP) was prepared by SRK in 2015. Teck is currently updating the requirements for ERPs at all legacy sites. The EPRP for the Sä Dena Hes will be updated once these guidelines have been finalized.

Summary Table of Deficiencies and Non-Conformances

There are no outstanding deficiencies or non-conformances from the 2018 or earlier DSI's. A list of deficiencies or non conformances noted from the 2019 dam safety inspection are summarized below:

Structure	ID No.	Deficiency or Non-Conformance	Applicable Regulatory or OMS Reference	Recommended Action	Priority (Teck 2019)	Recommended Deadline/ Status
North Creek Channel	2019-1	Beaver Dam at inlet to channel		Remove beaver dam in channel	3	Before end of 2019 Completed September 5, 2019 Closed

General Description of Priority Rankings[1]

Priority	Description
1	A high probability or actual dam safety issue considered immediately dangerous to life, health or the environment, or a significant regulatory concern.
2	If not corrected, could likely result in dam safety issues leading to injury, environmental impact or significant regulatory action; or, a repetitive deficiency that demonstrates a systematic breakdown of procedures.
3	Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.
4	Best Management Practice as a suggestion for continuous improvement towards industry best practices that could further reduce potential risks. This typically includes ongoing construction items within the appropriate construction cycle.

[1] Based on the Health, Safety and Reclamation Code (HSRC) for Mines in British Columbia (2016 revision).

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List of Abbreviations

AEP	Annual Exceedance Probability
AMECFW	AMEC Foster Wheeler
CDA	Canadian Dam Association
CSP	Corrugated Steel Pipe
DCC	Dam Consequence Classification
DDRP	Detailed Decommissioning Reclamation Plan
DSI	Dam Safety inspection
DSR	Dam Safety review
ECCC	Environment Climate Change Canada
EoR	Engineer of Record
EPRP	Emergency Preparedness and Response Plan
FoS	Factor of Safety
HSRC	Health, Safety and Reclamation Code
IDF	Inflow Flood Design
KCB	Klohn Crippen Berger
OMS	Operation, Maintenance, Surveillance
PGA	Peak Ground Acceleration
PMF	Probable Maximum Flood
PMP	Probable Maximum Precipitation
SRS	Sediment Retaining Structure
TMA	Tailings Management Area
TWRS	Tailings and Water Retaining Structures

1 Introduction

1.1 Purpose, Scope of Work, and Methodology

This report presents the results of the 2019 Annual Dam Safety Inspection (DSI) of the structures and features associated with the Tailings Management Area (TMA) that forms part of the closed Sä Dena Hes mine located near Watson Lake, Yukon. The current Yukon Water Licence (QZ16-051) and Teck's Guideline for Tailings and Water Retaining Structures (Teck 2019). The work was authorized by Mr. Gerry Murdoch, Teck Resources Limited (Teck) on behalf of the Sä Dena Hes Operating Corp.

Mr. Peter Healey PEng, an associate of SRK Consulting (Canada) Inc., completed the site inspection on September 10 and 11, 2019 while accompanied by Gerry Murdoch (Teck), Morgan Lypka (Teck), Peter Mikes (SRK) and Jeff Basarich (Teck). Mr. Healey is the Engineer of Record (EoR) for the site and has been completing the annual dam inspections since 1992.

The scope of the work consisted of:

- A visual inspection of the physical condition of the following structures and features to identify any deficiencies and non-conformances:
  - The North Tailings Dam
  - The North Creek channel that was reclaimed following decommissioning of the North Creek Dike and Second Crossing of North Creek
  - The relocated Camp Creek drainage channel
  - The North and South drainage Channels
  - The Sediment Retaining Structure (SRS)
  - The Burnick, Main and Jewelbox Waste Rock Dump areas
- A review of the Operation, Maintenance and Surveillance Manual (OMS) and Emergency Preparedness and Response Plan (EPRP) for the TMA
- A review of the Dam Consequence Classifications
- A review of the routine site inspection forms provided by Teck
- A review of the piezometer and settlement records of the North Dam provided by Teck
- A review of the 2015 Dam Safety Review (DSR) carried out by AMEC Foster Wheeler (AMECFW), now the WOOD Group

It should be noted that all elevations referenced in this report are based on a datum that was established during a LiDAR survey carried out in 2012. The original site datum used to design and build the structures in the early 90's was about 2 m lower than the 2012 datum. All previous inspection reports, prior to 2014, used the 1990 datum.

1.2 Regulatory Requirements and Guidelines

This DSI addresses the performance of the TMA, the associated water management infrastructure including the Jewelbox and Main Zone open pits, and the Jewelbox, Main Zone and Burnick waste rock dumps. The work was completed in accordance with the following regulatory requirements and guidelines, which in combination, fall within Teck's internal requirements included in Teck's Tailings and Water Retaining Structures (TWRS) guideline and policy (2019):

- Canadian Dam Association (CDA) Dam Safety Guidelines 2007 (2013 Edition)
- Canadian Dam Association (CDA) Application of Dam Safety Guidelines to Mining Dams. Technical Bulletin, 2014
- The Yukon Territory Sä Dena Hes Water Licence (QZ99-045). New Licence issued April 2017 (QZ16-051)
- The Yukon Territory Sä Dena Hes Quartz Mining Licence (QML-0004)

While the DSI is focused on the TMA, the waste rock dumps are included in the DSI in accordance with Clause 45 of the current Water Licence (QZ16-051).

1.3 Facility Description

1.3.1 Overview

This section provides a description of the components remaining at the mine site after the TMA was decommissioned in 2014 and 2015. A map showing the overall mine site is provided on Figure 1. A general arrangement map of the TMA is provided in Figure 2.

1.3.2 North Dam

The North Dam is approximately 15 m high with a crest elevation of 1,100 m, a crest length of about 260 m, and a crest width of 10 m. A site plan and section through the dam are shown in Figures 3 and 4. The North Dam for this report is considered a mining dam as it is a barrier constructed for the retention of tailings (CDA 2014).

Most of the tailings lie within the northern half of the TMA above the original cofferdam, which has since been removed. The tailings behind the North Dam were capped with a till cover in 2014. The cover was graded flush with the crest of the dam and graded south toward the SRS. A few small low lying areas remain within the cover that seasonally collect water, but overall the North Dam has not retained water since the mine decommissioning was completed. Given the cover grades away from the dam crest, the dam would only need to retain ponded water under extreme conditions as discussed below.

In 2016, SRK carried out a hydrological study (SRK 2017) to assess the likelihood of overtopping of the North Dam in the event of a design flood event. The results indicated that during an extreme case, such as the Probable Maximum Flood (PMF), the North Dam crest is not overtopped. Although the backwater effect arising from a blockage scenario in the central channel does result in an increased flood extent, with ponded water reaching within a few centimetres of the dam crest, an overtopping scenario is not reached. The maximum depth of water would vary from 0.5 m in the central channel to less than 0.1 m adjacent to the upstream crest of the dam. The model predicted that during the peak of the event, water would only be lapping up against the dam for about 12 hours before it dissipates. The minimum freeboard adjacent to the low point along the upstream edge of the crest at the peak of the event varied from 5 to 8 cm.

1.3.3 Sediment Retaining Structure (SRS)

The SRS was constructed by leaving in place a low-profile dike composed of the former South Dam toe material. The structure is considered temporary and Teck plans to remove the structure in the future. The primary function of the SRS is to retain any sediment that may be transported from the till cover over time. There is very little evidence that sediment has accumulated in the pond.

The dike is approximately 80 m in length and has a crest width of 4 m at an approximate elevation of 1,087.7 m. The upstream face of the SRS was graded to 2H:1V and the downstream face was graded to 2.5H:1V. While the SRS is only about 7 m high, for this report it is also considered a mining dam as it is a barrier constructed for the retention of ponded water (CDA 2014). The depth of water behind the structure is a maximum of about 1.7 m.

An emergency spillway was constructed through the dike to accommodate the 1 in 1000-year Inflow Design Flood (IDF) event (5.4m^3/s) and to convey runoff from the upstream catchment to the South Drainage Channel. The as-built spillway and drainage channel geometries are presented in Figures 5 and 6. The spillway channel invert elevation is 1,085.7 m and has a length of 33.3 m.

1.3.4 Water Management Infrastructure

Overview

Three drainage channels were built as part of the 2014 TMA decommissioning (see Figure 7). The longest of the three was constructed through the former Reclaim Dam and the pond area to route Camp Creek flows along its historical alignment. The other two drainages (the North Channel and the South Channel) were constructed to direct runoff from the covered tailings areas to the new Camp Creek Drainage Channel. There is also a drainage channel located down the middle of the cover that directs runoff from the tailings cover at the northern end of the TMA.

South Drainage Channel

The South Drainage Channel was constructed from the SRS spillway through the former South Dam and connects with the Camp Creek Drainage Channel. The channel length is about 230 m and it was installed with riprap erosion protection placed on top of a non-woven geotextile (see Figure 8). The channel is designed for the 1 in 1000-year IDF. Upstream and downstream side slopes are 2:1 (H:V). Average grade of the channel is 0.04.

Camp Creek Drainage Channel

The Camp Creek Drainage Channel was constructed through the former Reclaim Dam and pond area to route Camp Creek flows along its historical alignment (see Figure 8). The channel length is about 940 m and it was installed with riprap erosion protection placed on top of a non-woven geotextile (see Figure 8). The channel is designed for the 1 in 1000-year IDF. Upstream and downstream side slopes are 2:1 (H:V). Average grade of the channel is 0.05.

North Drainage Channel

The North Drainage Channel was constructed along the east side of the former South Pond to convey water from the North Tailings Area to the SRS. Conveyed water is detained in the SRS to allow for sediments to deposit before the water is discharged into Camp Creek (see Figure 9). The channel length is about 300 m and it was installed with riprap erosion protection placed on top of a non-woven geotextile. The channel is designed for the 1 in 1000-year (IDF). Upstream and downstream side slopes are 2:1 (H:V). Average grade of the channel is 0.03.

North Creek

During operation of the mine, a dike was built over the North Creek as a water storage facility for the mill. The dike (see Figure 1 for location) was decommissioned in 2015 and a riprapped channel was built through the old dike to convey the flow along North Creek to False Canyon Creek. A similar channel was also built downstream to convey the North Creek flow through a decommissioned access road.

1.3.5 Tailings Cover

The soil cover over the tailings discussed previously varies up to 2.2 m in thickness. It covers all the exposed deposited tailings, specifically in the North Tailings Area and the tailings deposited in South Pond area. The cover was constructed of excavated dam fill material. It provides an effective means of controlling wind erosion of tailings and a growth medium over the tailings for revegetation. The cover was sloped away from the crest of the North Dam in a southerly direction towards the SRS. Water is no longer impounded behind the dam. A shallow swale was constructed down the middle of the cover to direct surface runoff on the cover to the SRS.

The total covered area of the TMA is 155,081 m^2. The reclaimed North Tailings Area is 87,745 m^2, the reclaimed South Pond including the grassy area is 28,444 m^2, and the reclaimed Reclaim Pond is 38,892 m^2.

1.3.6 Waste Rock Dumps

During operation of the mine, waste rock dumps were developed at each of the main portals, associated with the Main Zone, the Jewelbox Zone and the Burnick Zone ore bodies. At closure, the portals were closed off with waste rock, and the dumps were resloped to direct runoff away from the openings and to provide more stable conditions.

1.4 Background Information and History

The original TMA, which extended from the North Dam to the South Dam covered an area of approximately 0.205 sq. km (Figure 2). During the operating life of the mine, approximately 700,000 tonnes of tailings were deposited into the impoundment, primarily at the northern end. The North and South dams, which impounded the tailings, were constructed between July 1990 and October 1991. The starter dams for both structures were built to a height of about 13 metres. Between the two dams, at the location of a topographic saddle, was a 2 m high cofferdam, which had a gated culvert to control the flow of water and tailings from the northern half of the impoundment to the southern half.

In addition to the North and South Dams, a Reclaim Dam was built to detain supernatant water. A decant tower, in the South Tailings Pond, was used to discharge the supernatant water in the tailings pond into the Reclaim Pond through a 0.5 m diameter corrugated steel decant pipe (CSP). The mine operation involved recycling of the detained water to the mill with a controlled discharge, when required, into the adjacent Camp Creek from April to October each year.

An open channel emergency spillway was located at the west side of the Reclaim Pond. This spillway was designed to accommodate the design flood event from the TMA catchment only. Flow through this spillway was directed to the primary spillway system, which was part of the Camp Creek diversion channel constructed along the west side of the Reclaim Pond. This primary spillway consisted of two 1,200 mm diameter CSP culverts and was designed to accommodate the 1 in 200-year Inflow Design Flood (IDF). Camp Creek was diverted into the diversion channel and discharged through the two culverts into a riprap lined exit chute.

An emergency spillway was also located in the west abutment of the South Dam and was designed to accommodate the 200-year IDF. The spillway consisted of two 900 mm diameter CSP culverts. The discharge from the spillway entered the Reclaim Pond downstream via an unlined channel.

Two additional surface water diversions, the east and west interceptor ditches, were located on both sides of the TMA to intercept surface runoff from upslope of the TMA.

In March of 1992, the previous operators, Curragh Resources, built a rockfill buttress along the toe of the Reclaim dam to provide extra protection against sloughing and erosion of the toe due to seepage.

In September 1992, work commenced on a 2-metre raise of the South Dam to El. 1098. Work on the extension was shut down on October 14, 1992 because of construction difficulties experienced due to sub-zero temperatures.

Operations at Sä Dena Hes mine, which commenced in July 1991, were suspended in December 1992 due to low lead and zinc prices.

During the care and maintenance period after the mine shut down in 1992, water was released from the tailings pond to the Reclaim Pond seasonally by way of syphons to maintain a safe operating level. Water was discharged from the Reclaim Pond to Camp Creek in accordance with the limits imposed by the Water License.

In 2003, Teck Cominco installed an HDPE pipeline through one of the spillway culverts as a siphon to facilitate the transfer of water from the South Tailings Pond.

With the 2014 decommissioning work, the TMA was significantly modified. The Reclaim Dam was completely removed, and the final excavated surface of the Reclaim Dam was graded to blend into the surrounded topography.

In 2014, most of the South Dam was removed to form the Sediment Retaining Structure (SRS). The decant tower and the pipe were decommissioned and removed to the on-site landfill. The South Dam overflow spillway was decommissioned by removing the two 900 mm diameter culverts that were disposed of at the landfill. Similarly, to the decommissioning of the Reclaim Dam, the dam footprint was excavated to original ground (with exception of the SRS) and blended into the surrounded topography.

The Camp Creek Diversion Channel, exit chute, and culverts were decommissioned in 2015. The interceptor ditches were decommissioned in 2015.

Many of the access roads at the site have been decommissioned and access to the decommissioned Main Zone, Jewelbox and Burnick areas are via all-terrain vehicle or helicopter.

2 Maintenance and Surveillance during 2018 to 2019

After the 1992 shutdown of the mine, it never reopened, and no more tailings were deposited into the TMA. Information on the decommissioning of the mine is provided in Section 1.4.

Teck conducts on-going maintenance and surveillance of the TMA and the water management infrastructure at the site including the access road from the Robert Campbell Highway. Any trees or vegetation on the downstream slope of North Dam that do not conform to the guidelines in the Sä Dena Hes OMS manual are trimmed or removed. Seepage at the toe of the North Dam is monitored monthly with sampling of water quality and measurement of flow. During the monthly inspections by the sampling team, an inspection of the North Dam and the SRS spillway is made to check for any blockages or subsidence.

3 Climate Data and Water Balance during 2018 to 2019

3.1 Review and Summary of Climate Data

This section presents the current climate data for the site. As there is no weather station at the site, the data from selected local meteorological stations was used to determine the mean annual precipitation and evaporation for the site. Below reference is made to a detailed climate characterization study that was carried out by SRK (SRK, 2017) to determine mean annual total precipitation for the Project site in absence of any site-specific data.

3.1.1 Mean Annual Precipitation

A regional and regression analysis was performed using the nearby meteorological stations from Environment and Climate Change Canada (ECCC). The data was compiled in R Studio Software, generating the mean annual precipitation (MAP) for each station. Table 3-1 presents the station locations relative to the site, as well as their respective MAP estimate. Correction for under-catch in the precipitation measurements is prepared daily by ECCC for many, but not all meteorological stations, as noted in Table 3-2.

Table 3-1: Selected Meteorological Stations Associated with the Project Site (1960 to 2016)

Station ID	Station Name	Longitude [deg]	Latitude [deg]	Elevation [m]	Dist. from Site [km]	MAP [mm]	Years of Info [yrs]	Under-Catch Factor Available
2101200	Watson Lake A	-128.82	60.12	687.4	46.66	424.0	74	YES
2101135	Tuchitua	-129.22	60.93	723.9	47.90	493.6	40	YES
2100FCG	Hour Lake	-129.13	61.18	890.0	72.93	544.8	28	NO
2101081	Swift River	-131.18	60.00	891.2	141.74	564.7	37	YES
1191440	Cassiar	-129.83	59.28	1077.5	150.35	728.2	36	YES
1197530	Smith River A	-126.43	59.90	673.0	151.68	466.9	25	NO
2203922	Tungsten	-128.25	61.95	1143.0	160.38	637.0	22	NO
2101100	Teslin A	-132.74	60.17	705.0	217.87	332.9	56	YES
1192340	Dease Lake	-130.01	58.43	806.6	243.67	419.9	61	YES
1195250	Muncho Lake	-125.77	58.93	836.5	248.96	508.1	40	NO
2100200	Carcross	-134.70	60.17	660.0	324.42	248.4	60	NO
1208202	Todagin Ranch	-130.07	57.60	899.0	334.45	419.4	18	NO
2100460	Drury Creek	-134.39	62.20	609.0	348.27	372.9	35	YES

Source:
file:///Z:\01_SITES\Sa_Dena_Hes\1CT008.061_2016_DSR_Studies\Task%20100_Hydrology\R_Analysis\Hydrology\Precipitation_Hydrology_at_Sa_Dena_Hes.docx

The regression analysis predicted a MAP for the site of 646 mm based on an elevation of 1080 masl. Monthly average precipitation for the site is summarized in Table 3-2 based on the site MAP of 646 mm and the monthly distribution from the Cassiar station (SRK 2017).

Table 3-2: Monthly Average Precipitation for the Site

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Site	58.1	49.1	39.4	23.9	33.6	47.8	60.7	63.3	71.7	75.6	58.8	64.6	646

3.1.2 2018 Analysis

An estimate of the 2018 MAP for the site was computed and used to estimate the 2018 Water Discharge Volumes at the SRS spillway.

The Watson Lake A station was used as the reference station as it is the most representative station close to the site that is currently active. Total precipitation recorded at Watson Lake A in 2018 was reported as 222 mm by ECCC. Using the undercatch correction factor of 1.13 (SRK 2017), total corrected annual precipitation for 2018 at Watson Lake was 250 mm.

A ratio of Watson Lake MAP vs. calculated Site MAP was applied to convert the 2018 Watson Lake airport precipitation to a representative MAP for the Site. Based on the corrected undercatch MAP for Watson Lake of 479.3 mm, the adjustment factor for the site is 1.42, which equates to an approximate annual precipitation of 355.6 mm in 2018 at the site as shown in Table 3-3.

Table 3-3: 2018 Monthly Precipitation for the Site (based on 2018 Watson Lake Data)

Location	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2018/Annual
Site	51.3	13.8	32.1	14.9	10.6	51.5	30.5	20.9	24.1	67.4	25.7	12.8	355.6

3.1.3 Evaporation

The network of evaporation stations is sparse in the Yukon and northern British Columbia. Potential evapotranspiration was calculated using the Morton (1983) methodology, utilising meteorological parameters measured at the nearby Watson Lake weather station, with solar radiation data obtained from the Whitehorse Airport station. Using this method, the annual lake evaporation rate was estimated to be 483 mm as shown in Table 3-4. Due to the limited variability of lake evaporation from year to year, the average annual values are applied in the annual water balance.

Table 3-4: Mean Monthly Lake Evaporation

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Morton-Shallow Lake [mm]	10.4	8.4	18.2	41.4	75.5	96.9	99.5	71.6	33.4	11.0	7.2	9.7	483.2

Source://Z:\01_SITES\Sa_Dena_Hes\1CT008.057_2016_Geotech_Inspection\!080_Deliverables\1CT008.057_Report\010_Text\2016_SDH_GeotInsp_Report_1CT008-057_20170404_pmh.docx

3.2 Review and Summary of Water Balance

The TMA at Sä Dena Hes has been decommissioned and there are no active ponds other than the small sediment pond at the SRS. The SRS pond has a maximum surface area of about 1600 m^2 during the freshet high flow period. An emergency overflow spillway was also built through the SRS to accommodate the 1 in 1000-year flood event. The catchment area for the SRS spillway is 1.33 km^2 as shown on Figure 10.

A simplified mean annual average water balance calculation for the catchment above the SRS dike is summarized below, based on data compiled for the recent SRK hydrological study (SRK 2017) and the following assumptions:

- Inflow from the surrounding hillside catchment (1.17 km^2) based on 60% of the MAP;
- Inflow from the tailings till cover (0.16 km^2) based on 50% of the MAP;
- Direct precipitation input to the SRS pond based on 100% of the MAP; and
- Outflow from the SRS pond based on annual pond evaporation (483 mm) and seepage losses (estimated at 0.5 l/s).

The average annual water balance from the SRS Pond is the following:

- MAR from the hillside catchment above the SRS = 453,500 m^3
- MAP on the sediment pond surface = 1034 m^3
- MAR on the tailings cover material = 50,388 m^3
- Total Annual Inflow: 504,900 m^3
- Total Outflow (seepage and pond evaporation): 16,540 m^3
- Net Annual Volume (over spillway): 488,370 m^3

Using the estimated 2018 MAP for the site, the 2018 annual water balance is summarized below:

- MAR from the hillside catchment above the SRS = 249,631 m^3
- MAP on the sediment pond surface = 569 m^3
- MAR on the tailings cover material = 27,737 m^3
- Total Annual Inflow: 277,937 m^3
- Total Outflow (seepage and pond evaporation): 16,540 m^3
- Net Annual Discharge Volume (over spillway): 261,396 m^3

3.3 Freeboard and Storage

3.3.1 North Dam

The 2016 hydrological studies completed by SRK (SRK 2016a) estimated that during an "extreme worst case" Probable Maximum Precipitation (PMP) event with none of the existing drainage features such as water diversions functioning, there would still be a freeboard above the maximum ponded water of between 5 to 8 cm.

3.3.2 SRS

The SRS dike has a 1 m freeboard above the 1 in 1000 year flood event to the crest of the Dike.

3.4 Water Discharge Volumes

The current water licence does not have provision for regulating the volume of water discharging over the SRS spillway. However, with reference to the above water balance, the estimated annual water discharge volume through the SRS spillway for 2018 was 261,396 cubic metres.

3.5 Water Discharge Quality

The surface water quality discharging from the TMA is currently monitored annually under the Yukon Water Licence QZ16-051. The groundwater quality is currently monitored under the same licence. The results of the surface and groundwater quality sampling for 2019 were not available at the time this report was prepared. However, a review of the 2018 results compiled in the 2018 annual report was carried out by SRK. In 2018, samples from all the required water quality monitoring stations were collected and analysed. The results demonstrated that all the surface and groundwater stations met the standards provided in the water licence QZ16-051. It is the opinion of SRK that the current site water quality does not impact the structural integrity or factors of safety associated with stability of the North Dam or the SRS dike. Furthermore, it is the opinion of SRK that the water quality does not impact the performance of the water management structures.

4 Site Observations

4.1 Visual Observations

The weather during the DSI on September 10 and 11, 2019 was sunny and warm. Routine inspections of the TMA are made by Jeff Basarich twice a year in the spring (June 10, 2019) and the fall (October 5, 2019). Observations made by Mr. Basarich were reviewed by SRK

No safety concerns related to the North Dam and the SRS were identified during review of the photos and reports prepared by the Mr Basarich.

4.1.1 North Dam

A site plan and a section of the North Dam are presented on Figures 3 and 4.

The crest of the North Dam looking west is shown in Photo 1 (Appendix A). The dam is in good condition and shows no signs of deformation or abnormal settling. The downstream slope of the dam (Photo 2) shows no signs of surficial movement or erosion nor is there any sign of bulging at the downstream toe. While there are a few shrubs and small trees on the slope, no excessive vegetation growth beyond the guidelines in OMS was noted.

The piezometers and settlement gauges (Photos 3 and 4) on the North Dam are in good condition and continue to function as designed. Orange coloured piezometer caps provide visible identification for the monitoring team.

Along the downstream toe of the North Dam there is an 80 m long seepage zone. Seepage from this zone is collected at a monitoring station referred to as MH-02 and is a combination of groundwater discharge from the surrounding hillsides to the west and minimal seepage flow from the impoundment. The monitoring station consists of a 6-inch diameter steel pipe (Photo 5) embedded in sandbags. A section of the seepage zone along the toe is shown in Photo 6.

4.1.2 Till Tailings Cover

The till tailings cover has an overall gentle downslope gradient away from the North Dam. Photo 7 shows a view looking north of the drainage swale located down the middle of the tailings cover at the north end of the TMA. This swale was constructed to assist in directing runoff away from the crest of the North Dam. The swale was clear of any debris or vegetation and although there was evidence that water has flowed in the swale, at the time of the inspection it was dry except for one pool of water. Photo 8 shows a view of the swale at the location of the original cofferdam.

As planned, vegetation is slowly developing over the entire area of the cover as shown in Photo 11.

4.1.3 North Creek

A riprapped channel conveys the North Creek over the original location of the decommissioned North Creek Dike. It was noted during the Spring routine inspection that at the inlet of the channel, beavers had again built a dam which restricted the flow. The dam raises the water level of the pond nominally and could potentially increases the risk of a rapid release of water which could result in erosion of the riprap protection in the channel. However, there are no downstream structures that are at risk if the beaver dam were to release water. The dam was removed just after completion of this DSI. Best Practice dictates that beaver dams be removed when identified during the routine inspections.

About 150 metres east downstream of the above channel is a second riprapped channel that was reclaimed following the removal of two culverts as part of the site reclamation in 2015. The channel is stable and requires no remediation.

4.1.4 Sediment Retaining Structure

The Sediment Retaining Structure (SRS) was built during the decommissioning of the South Dam between 2014 and 2015. Figures 5 and 6 provide a site plan and sections of the SRS.

The North drainage channel upstream of the SRS (Photo 12) remains in stable condition with no noticeable subsidence.

The rock cofferdam and the sedimentation pond are functioning well. The sedimentation pond was clear at the time of our inspection with no evidence of any silt buildup (Photos 13 and 14).

The emergency spillway at the SRS is stable and has no safety concerns (Photo 15). The plunge pool shown in Photo 16 provides adequate capacity to accommodate any high flows over the spillway. Seepage from the hillside area to the east of the structure is still evident along the downstream toe of the SRS (Photo 17). A small active boil (Photo 18) that has been noted in previous inspections was still present. This boil is a remnant of pore pressures that were evident during and after the construction of the South Dam which prompted the construction of a toe buttress. The pore pressures were a result of the hydraulic gradient across the dam due to the stored water in behind the embankment. The pore pressures were accentuated by the sand and gravel zones in the foundation soils below the dam. Since the removal of the South Dam, the pore pressures have significantly reduced, but the small head of water due to the retained pond behind the SRS dike is the likely source of the small boil.

4.1.5 Drainage Channels

The riprapped drainage channels (the North channel, the Camp Creek channel and the South channel) were constructed during the TMA decommissioning in 2014. Figure 7 provides a plan view of the three channels. SRK inspected each of the channels for any signs of major subsidence and movement of the riprap erosion protection.

Photo 19 shows the Camp Creek channel looking north and Photo 20 shows the South channel. No movement of the riprap or subsidence was evident in any of these channels.

Photos 21 and 22 show location of the Camp Creek channel at the lower reach (also location of the original Reclaim Dam) and the upper reach of the Camp Creek channel.

Photo 23 show the confluence of the Camp Creek drainage channel and the original Camp Creek.

4.1.6 Burnick and Jewelbox Waste Rock Dumps

SRK inspected the resloped Main Zone and Jewelbox waste dumps (Photo 24) shown in Figure 12. It was noted that at the northeast end of the JewelBox dump, there was evidence of some erosion (Photo 25). SRK had recommended in the 2018 DSI that additional monitoring pins be installed to monitor any deepening of the gully over time. It was noted during this inspection that the gully had not deepened and there was no impact on the stability of the dump.

Two to three shallow openings were observed in the pit wall at the Main Zone area. These openings may have been caused by internal subsidence but currently do not pose a safety concern.

SRK also inspected the Burnick waste dumps at the locations of the reclaimed 1200 and 1300 portals respectively as shown in Figure 11. During the site decommissioning in 2014, the dumps were recontoured to provide added long-term stability. No further subsidence of the slopes was noted.

Minor settlement of the fill that was placed over the 1200 portal was noted during the 2017 and 2018 inspection. Minor cracking in the fill caused by the expected settlement of the fill was observed this year. No action is required.

4.2 Instrumentation Review

4.2.1 Water Levels

The water levels in the North Dam piezometers are recorded monthly and the results are reviewed by the EoR after each monitoring session. Figure B1 in Appendix B provides a plot of seasonal water levels from 2011 for Piezometers NDW-1A, 2A, 3A and 4A compared to the maximum safe levels established for the North Dam (as listed in the OMS Manual).

The piezometers are in good condition and continue to function as designed. The seasonal fluctuations recorded in latter part of 2018 and most of 2019 in the piezometers are consistent with those in previous years and are within acceptable tolerance limits. There was an anomaly in one set of readings taken on February 25, 2019 which indicated that the water levels in Piezometers 1A and 2A were about 1 m higher than expected. A second set of readings were subsequently taken on March 28, 2019 including a check on the depths to the bottom of the piezometer drill holes. The results confirmed that the February 25 readings were an anomaly as the subsequent readings were in line with expected patterns.

The peak levels recorded in June 2019 are plotted on the dam section shown on Figure 4.

In the new water license, which was issued April 2017, piezometer levels are required to be measured bi-monthly.

4.2.2 Deformation/Settlement

The readings taken of the settlement gauges in the North Dam indicate that there has been no unexpected settlement of the embankment over the 25-year period that readings have been taken.

Teck has been surveying the settlement gauges on the North Dam since 1993. Results are shown on Table 4-1. The results are elevations taken from the top of the steel pins that were set within the crest of the dam during construction. The last set of readings taken using the 1990 datum was completed in 2010. A recent set of readings was completed in 2017 based on the 2012 datum. The readings are consistent with those observed in previous years, with settlement readings varying to a maximum of 51 mm (or less than 1% of the total height of the dam) from the initial readings taken in 1993. The recorded settlements are considered normal deformation for a small earthen dam and would not compromise the structural integrity of the dam. In the last 3 years, the settlement changes have been less than 1 mm.

Table 4-1: Summary of Elevations taken at the top of the North Dam Settlement Gauges

Date	NDS3 (m)	NDS1 (m)	NDS2 (m)
August/93	1098.639	1098.501	1098.613
July/94	1098.637	1098.502	1098.589
August/95	1098.690	1098.545	1098.663
July/96	1098.637	1098.493	1098.609
August/97	1098.637	1098.496	1098.618
October/98	1098.627	1098.482	NA
October/02	1098.619	1098.481	1098.607
June/05	1098.637	1098.479	1098.587
June/06	1098.63	1098.45	1098.57
August/07	1098.786	1098.454	1098.489
June/08	1098.626	1098.482	1098.597
June/09	1098.625	1098.469	1098.587
June/10	1098.59	1098.47	1098.60
August/14	1100.572	1100.412	1100.524
September/15	1100.548	1100.391	1100.512
2016	1100.572	1100.425	1100.547
2017	1100.573	1100.427	1100.547
2018	1100.571	1100.426	1100.546
2019	1100.57	1100.427	1100.547

Note: 2014 to 2019 readings are based on the 2012 datum.

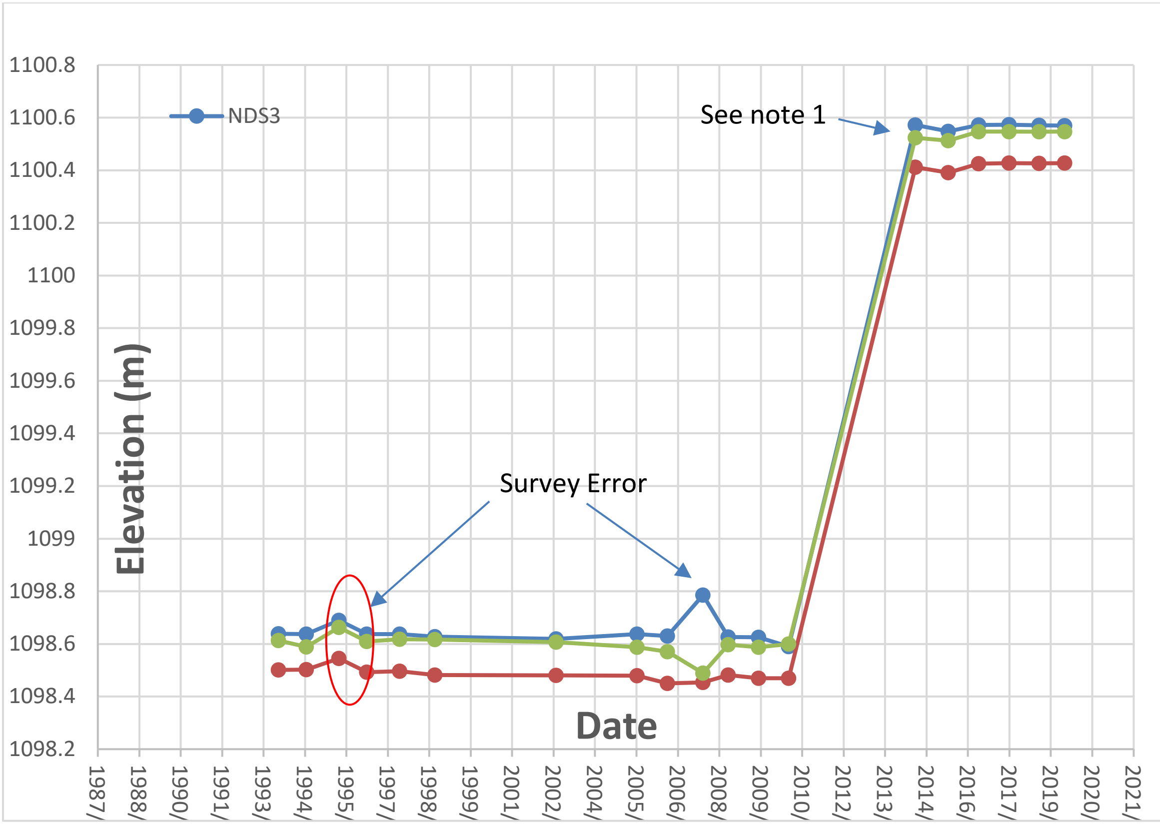

Figure 13: North Dam Settlements

Note 1: Survey Datum was changed in 2012

Figure 13 presents a graphical depiction of the settlement of the crest of the dam over time. The readings taken from 1992 to 2010 were based on the 1990 datum. The 2014 to 2019 readings were based on the 2012 datum. The results shown for 1995 and 2008 are erroneous due to survey error. Furthermore, some of the results indicate an increase in elevation. Those numbers were attributed to the inaccuracy of the survey equipment used and were consequently ignored. In general, as shown by Figure 13 above, settlement of the North Dam is performing as expected.

Given the above results and the long-term trend, settlement readings would continue to 2020 with no further readings taken beyond that point.

4.3 Photographs

A photographic log was taken during the site inspection. Photos are provided in Appendix A and are referenced in Section 4.1.

4.4 Pond and Discharge Water Quality

The Sediment pond at the SRS is the only pond associated with the TMA. Water quality in the pond was monitored as MH-01 under previous Water Licence QZ16-080 which expired on March 31, 2017. The results of the water sampling carried out for the pond under the QZ16-080 water licence met the standards in the water licence. Under the current water licence QZ016-051, water quality in the sediment pond is not required to be monitored. It is the opinion of SRK that the results would not impact the structural integrity of the North Dam or the SRS dike.

4.5 Site Inspection Forms

Every year, in accordance with the site Water Licence, the OMS manual and the EPRP, a routine inspection of the TMA is completed twice a year in the spring and the fall by Jeff Basarich.

4.6 Facility Data Sheets

Facility data sheets for the North Dam and the SRS dike are provided in Appendix C.

5 Dam Safety Assessment

5.1 Design Basis Review

5.1.1 North Dam

The original design of the starter dam for the North Dam required a crest elevation of 1,100 m with an ultimate dam design crest elevation of 1,106 m. However, this ultimate design crest elevation was modified in subsequent revisions to the mine plan to El. 1,104 m. A summary of the design criteria for the North Dam is provided in Table 5-1. The design criteria were also updated to reflect changes in the CDA 2014 Technical Bulletin, Dam Consequence Classification.

Table 5-1: Design Criteria of the North Dam (Updated)

Design Crest Elevation (Ultimate)	Not applicable
Starter Dam Crest (Existing)	1,100 m
Top of Till Core Elevation (Ultimate)	Not applicable
Maximum Operating Tailings Level (ultimate)	Not applicable
Maximum Operating Pond Level (Ultimate)	Not applicable
Spillway Invert Elevation	No emergency spillway in dam
Design Operating Freeboard	Not applicable
Design Seepage (SRK/AMCL, 2000)	35-50 L/min
Tailings Storage Capacity (Ultimate)	Not applicable
Dam Consequence Classification (2015 DSR)	Significant
Target Earthquake Level (CDA, 2014) (Passive care) Seismic Event	1 in 2475 year (PGA = 0.152g) NBC SHC 2015
Target FOS (CDA, 2014)	1.5 (static); 1.0 (pseudo-static)
Target Flood Levels (CDA, 2014)	1/3 between the 1,000-year event and the PMF

Source:://Z:\01_SITES\Sa_Dena_Hes\1CT008.057_2016_Geotech_Inspection\!080_Deliverables\1CT008.057_Report\010_Text\2016_SDH_GeotInsp_Report_1CT008-057_20170404_pmh.docx

5.1.2 Sediment Retaining Structure

The SRS spillway was designed to accommodate the 1 in 1000-year design flood. The SRS currently has a “Low” Consequence Classification. CDA (2014) recommends that the inflow design flood (IDF) for a low consequence dam class that is expected to remain in Construction, Operation & Transition Phase would be the 1 in 100-year event as referenced in Table 3-2 of the CDA 2014 Technical Bulletin. However, as the SRS will be in a “Closure-Passive Care Phase” for an extended period under infrequent surveillance, the IDF for the spillway was raised to the next highest dam classification level, the 1 in 1000-year event as referenced in Table 4-1 of the CDA 2014 Technical Bulletin.

Similarly, the target PGA for the SRS is 0.146 g.

A summary of the design criteria for the SRS is provided in Table 5-2 below.

Table 5-2: Design Criteria for the SRS

Original Design Crest Elevation	El. 1086.7 m
As Built Crest Elevation	El. 1087.7 m
Original Design Spillway Invert Elevation	El. 1085.0 m
As Built Spillway Invert Elevation	El. 1085.7 m
Crest Length	80 m
Design Operating Freeboard	1 m
As Built Operating Freeboard	1 m
Dam Consequence Classification	Low
Operating Pond Level	El. 1085 m
Target Earthquake Level (CDA 2014) (Passive Care)	1 in 1000 years (PGA = 0.082g) NBC SHC 2015
Target FOS (CDA 2014)	1.5 (static); 1.0 (pseudo-static)
Target Flood Levels (CDA 2014) (Passive Care)	1 in 1000 years

5.2 Hazards and Hypothetical Failure Modes Review

As a permanently closed site, structures at Sä Dena Hes mine site that have the potential to endanger human life or create environmental damage were either removed or upgraded to enhance long-term physical stability. This section of the DSI reviews the hazards that have been identified for the North Dam and the SRS and provides an assessment of the safety of these structures relative to the potential failure modes listed in the CDA (2014) Technical Bulletin.

Key hazards identified for the North Dam and SRS include runoff from extreme precipitation events, seismic events, ice buildup and debris in the SRS spillway, potential for liquefaction of the tailings and flow capacity of the SRS spillway. The following sections assess the potential failure modes for each structure.

5.2.1 Dam Overtopping

The hydrological studies completed by SRK in 2016 (SRK 2016a) concluded that there is no risk of overtopping of the North Dam even in an “extreme worst case” Probable Maximum

Precipitation (PMP) event with none of the existing drainage features such as water diversions functioning.

The spillway in the SRS is designed to accommodate the 1 in 1000-year IDF which meets the CDA 2014 target levels for flood hazards for “low” Dam Consequence Classification dams in the closure-passive care phase.

5.2.2 Internal Erosion

North Dam

The North Dam was built as a tailings retaining structure designed to allow seepage through the dam. The dam has three zones: an upstream low permeability compacted zone of silty till, a semi pervious compacted central zone of sandy till and a compacted outer downstream shell of pervious sand and gravel. Underlying the dam is a native sandy, gravelly silt (till). There are no indicators of fines being washed through to dam, although there is some seepage evident at the downstream toe. This seepage is mixed in with historical spring activity that was noted during the construction of the dam and the annual dam inspections. The tailings placed up against the upstream face of the dam have significantly reduced the seepage loss since initial construction. Piezometric levels in the dam and in the foundation have varied seasonally since the mine shut down in 1992 and lower levels are expected over time as the till cap consolidates.

The hydraulic gradient across the North Dam is in the range of 0.1 to 0.2. The dam material consists of a mixture of silty till to sandy till which is estimated to have a critical hydraulic gradient ranging from 1 to 13. This means the potential for internal erosion is very low to low.

SRS

The pond behind the SRS has a maximum depth of about 1.5 m and the overall hydraulic gradient through the structure is low and corresponds to no piping potential. The seepage through the dike is barely measurable. There is one small boil that has been noted at the downstream toe of the SRS dike, but no loss of fines detected.

5.2.3 Slope Stability

Table 5-3 outlines the minimum factor of safety (FoS) values for mining dams based on the guidelines in the CDA 2014 technical Bulletin.

Table 5-3: Target Levels for Earthquake Hazards/Factor of Safety, 2014 CDA Guidelines

Dam Rating	Care Type[1]	Event	AEP	Minimum Static FoS	Minimum Pseudo-Static FoS
Low	Transition	1 in 100 year	0.01	1.5	1.0
Low	Passive Care	1 in 1000 year	0.001	1.5	1.0
Significant	Transition	1 in 1000 year	0.001	1.5	1.0
Significant	Passive Care	1 in 2475 year	0.0004	1.5	1.0

Notes:

1. Active care assumes regular dam safety reviews, continual dam performance monitoring and the ability to respond to emergencies immediately. Passive care assumes no maintenance or monitoring occurs post-closure.

As the site is expected to remain in the Closure Passive Care phase for an extended period and as there is infrequent surveillance, the passive care targets have been adopted.

North Dam

As discussed above, the North Dam is composed of compacted fill with a pervious downstream shell. The downstream slope is 2.5H:1V. Several stability analyses have been performed on this dam in the last 2 years.

In 2015, SRK completed a stability analysis of the North Dam to supplement a third-party review of the Dam Consequence Category for the dam.

The results of the stability analyses completed on the North Dam, which are shown in Table 5-4, show that the structure exceeds minimum FoS requirements for long-term static and pseudo-static stability for closed dams under passive care classified as having a “Significant” consequence of failure.

Table 5-4: Stability Analysis Results

Case	FoS
Long Term Static	1.6
Pseudo-Static (1 in 100 year)	1.5
Pseudo-Static (1 in 1000 year)	1.3
Pseudo-Static (1 in 2475 year)	1.2

In the above slope stability analysis, the seismic acceleration used in the calculation was one-half of the full Peak Ground Acceleration (PGA) or 0.20 g. The application of the entire PGA value in the direction of failure is extremely conservative and represents the absolute worst-case scenario.

In 2016, SRK completed an updated post-liquefaction stability analysis of the North Dam. The stability analysis was completed to assess the stability of the North Dam following an earthquake event and assuming liquefaction of the tailings impounded by the dam during the seismic event.

The stability analysis concluded that tailings play no role in dam stability as the critical failure surface runs through the dam, which is constructed of compacted fill.

Based on the above analyses and the current water levels (maximums), the North Dam is stable under both static and seismic assessments.

It should also be noted that in March 2019, SRK completed a review of the Qualitative Performance Objections (QPO) for the North Dam. The review involved the development of threshold criteria for water levels within the piezometers and for dam crest settlement. These criteria have been incorporated into the updated OMS manual as discussed in section 5.6. The pseudo-static stability analysis completed for this study was based on the 2015 National Building

Code Seismic hazard calculator (NBC SHC) which lists the 1 in 2475 PGA as 0.14g compared to the PGA of 0.2g used in the previous analysis referenced above.

SRS

SRK also completed a stability analysis of the current configuration of the dike under both static and pseudo-static conditions. The dike has a maximum height of about 7 m and upstream and downstream slopes of 2H:1V slope and 2.5H:1V respectively. The maximum depth of the pond behind the dike is about 1.7 m.

The seismic calculation was completed using a full horizontal loading of 0.15 g (2010 NBC SHC), which was based on the target level for earthquake hazards suggested by CDA 2014 guidelines for a low consequence class dam in the passive care phase. The results of the analysis indicated both the static and pseudo-static FoSs' exceeded the target values in Table 5-3 above. It is also noted that the PGA based on the 2015 NBC SHC is now 0.08g almost 50% less than the 2010 values.

5.2.4 Surface Erosion

North Dam

SRK completed a study in 2016 to assess the erosion potential of the material on the downstream face. The study concluded that existing sand and gravel material exposed on the downstream face is adequate to withstand the runoff from the 200-year, 24-hour rainfall event without any significant erosion.

SRS

GeoJute fabric protection on the downstream face of the SRS is in good condition and provides adequate protection against surface erosion.

5.3 Review of Downstream and Upstream Conditions

5.3.1 Downstream Conditions (South)

No changes were noted downstream or south of the TMA. The original exit chute shows no sign of increased seepage since Camp Creek was redirected back into the original Camp Creek channel. The vegetation is slowly taking hold. There were no new dwellings or changes in land use noted.

5.3.2 Upstream Conditions (North)

The North Dam is located near an original catchment divide so all conditions are predominantly downstream. An inspection of the conditions north of the North Dam was carried out and no changes were noted. Similarly, to the area south of the TMA, no new dwellings or changes to land use were noted.

5.4 Dam Classification Review

The first assessment of the Dam Consequence Classification (DCC) of potential failure of the dams and spillways associated with the TMA was completed by SRK for the 2000 Detailed Decommissioning Reclamation Plan (DDRP). The assessment was completed in accordance with the guidelines presented in the “Mine Reclamation in the Northwest Territory and the Yukon” (INAC 1992) and focused on the failure of the South Dam spillway and the failure of the North Dam. The failure of South Dam and the Reclaim Dam was not considered since they would be removed upon closure. The study concluded that the failure of the North Dam and the South Dam spillway would not pose a significant risk to public health and safety; there would be no loss of life expected, no damage to buildings and no loss to roads. The design criteria established for the design of the South Dam spillway and the stability of the North Dam was therefore based on the 1 in 1000-year IDF and the PGA for the 1 in 1000 seismic event, respectively. No dam breach or inundation studies were carried out.

As part of the 2003 Dam Safety Review (DSR) completed by Klohn Crippen Berger (KCB), a screening level assessment of the DCC for the TMA was carried out so that the appropriate design criteria could be established for the DSR. The assessment was carried out in accordance with the 1999 CDA Dam Safety Guidelines and included a dam breach inundation analysis. The study concluded that all three dams (North, South and Reclaim) would be classified as Low Consequence facilities.

In 2010, a second DSR was carried out by Golder Associates, who also completed a screening level assessment so that design criteria could be established for the 2010 DSR. The assessment was completed in accordance with the CDA 2007 Dam Safety Guidelines and included a conceptual dam breach and inundation study. Overall the assessment concluded that all three dams would be in the “significant” consequence class due to the potentially significant incremental losses on False Creek and Frances River.

Given the 2014 decommissioning activities associated with the TMA, SRK completed a dam breach and inundation study for the SRS dike and the North Dam. The assessment concluded that by applying the CDA (2014) generalized guidelines shown in Table 5-5, incremental losses from a breach of the North Dam and SRS dike would place the structures in the “Low” Consequence class. The attribution of that class to the North Dam and the SRS is based on the following consequence criteria:

- There is no population at risk downstream of the facility or near the dam or in the expected path of any water releases;
- No loss of human life would be expected from the failure;
- No local or regional infrastructure or services would be impacted by a failure; and
- There would be minimal short-term loss and no long-term loss.

Table 5-5: CDA (2014) Dam Classification in Terms of Consequences of Failure

Dam Class	Population at Risk [note 1]	Incremental Losses		
		Loss of Life [note 2]	Environmental and Cultural Values	Infrastructure and Economics
Low	None	0	Minimal short-term loss No long-term loss	Low economic losses; area contains limited infrastructure or services
Significant	Temporary only	Unspecified	No significant loss or deterioration of fish or wildlife habitat Loss or marginal habitat only Restoration or compensation in kind highly possible	Losses to recreational facilities, seasonal workplaces, and infrequently used transportation routes
High	Permanent	10 or fewer	Significant loss or deterioration of i*mportant* fish or wildlife habitat. Restoration or compensation in kind highly possible	High economic losses affecting infrastructure, public transportation, and commercial facilities
Very high	Permanent	100 or fewer	Significant loss or deterioration or *critical* fish or wildlife habitat Restoration or compensation in kind possible but impractical	Very high economic losses affecting important infrastructure or services (e.g., highway, industrial facility, storage facilities for dangerous substances)
Extreme	Permanent	More than 100	Major loss of *critical* fish or wildlife habitat Restoration or compensation in kind impossible	Extreme losses affection critical infrastructure or services (e.g., hospital, major industrial complex, major storage facilities for dangerous substances)

Note 1. Definitions for population at risk:

None – There is no identifiable population at risk, so there is no possibility of loss of life other than through unforeseeable misadventure.

Temporary- People are only temporarily in the dam-breach inundation zone (e.g. seasonal cottage use, passing though on transportation routes, participating in recreational activities).

Permanent- The population at risk is ordinarily located in the dam-breach inundation zone (e.g., as permanent residents); three consequence classes (high, very high, extreme) are proposed to allow for more detailed estimates of potential loss of life (to assist in decision-making if the appropriate analysis is carried out).

Note 2. Definitions for population at risk:

Unspecified- The appropriate level of safety required at a dam where people are temporarily at risk depends on the number of people, the exposure time, the nature of their activity, and other conditions. A higher class could be appropriate, depending on the requirements. However, the design flood requirement, for example might not be higher if the temporary population is not likely to be present during the flood season.

The last DSR was carried out by AMECFW in 2015 and based on this review, the CDA Dam Consequence Classification of the North Dam was changed from “Low” to “Significant”. The change was based on an issue raised by AMECFW noting that there was a potential for liquefaction of the tailings if the dam were to fail and that during a flood event there was a potential for overtopping of the dam. Because of this classification change, the IDF for the North Dam under passive care was changed to 1/3 between the 1,000-year event and the PMF and the design earthquake event was changed from the 1 in 1,000-year event to the 1 in 2,475-year event, respectively (based on passive care guidelines in CDA 2014).

As discussed in Section 5.2, there is no risk of overtopping of the North Dam even in an “extreme worst case” Probable Maximum Precipitation (PMP) event (SRK 2016a) and the recent stability analysis completed by SRK concluded liquefied tailings play no role in dam stability as the critical failure surface runs through the dam, which is constructed of compacted fill.

It is SRK's opinion that the Dam Consequence Classification (DCC) of "Significant" for the North Dam is overly conservative and should remain as "Low". The next DSR is scheduled for 2025 and the DCC for the North Dam should be reviewed at that time

5.5 Physical and Operational Performance

As the mine is currently closed in passive care, operational performance is not applicable. The North Dam is currently stable and does not retain any water. There are no signs of any instability on the crest or the downstream slope. The SRS dike is also stable with no indication of cracks along the crest or sloughing on the upstream and downstream slopes.

The spillway shows no sign of movement of the riprap or instability. It is functioning in accordance with the design parameters.

5.6 Operations, Maintenance and Surveillance (OMS) Manual Review

The current OMS Manual was prepared by SRK in 2015 and was updated in February 2018. The manual was reviewed as part of this 2019 DSI.

A list of changes to the 2015 OMS manual are provided below:

February 2018 changes:

1. Section 1.1 *The SRS and the North Dam are in a "passive" care phase of closure with some surveillance and monitoring. Design criteria for both structures are governed by the target levels for flood and earthquake hazards based on the passive care phase of closure*.
2. Section 2.1 *Details in the Key Roles and Responsibility Table 1 have been updated including key contact information.*
3. Section 2.2 *Org Chart Figure 6 has been updated*.
4. Section 3.3.4 *Dam Consequence Category. Added discussion on the DCC for the North Dam and added reference to a scheduled Risk Assessment in Dec 2018. Frequency of DSR's for the SDH TMA.*
5. Section 5.2 *Added comment about a review of the Dam Consequence Category for the North Dam and the frequency of DSR's for the site.*
6. Section 5.3.2 *Added comment about Piezometer caps and labels*.
7. Section 6.1 *Added comment about the frequency of Routine maintenance inspections (Fall and Spring).*
8. Section 6.5.2 *Added requirement to remove Beaver dams as soon as they are identified during routine inspections.*

9. Section 6.5.6 *Added comments about erosion monitoring pins at the toe of the Jewelbox Waste Rock dump.*

October 2019 Changes:

1. *Section 3.4.7 The 2018 monthly precipitation estimates for the site in table 13 were updated based on 2018 Watson Lake data.*

2. *Section 3.3.3 Target Earthquake PGA for the SRS in Table 5 was reduced from 0.15 g to 0.08 g based on the 2015 NBC SHC.*

3. *Section 3.3.4 Target Earthquake PGA for the North Dam in Table 7 was reduced from 0.2 g to 0.14 g based on the 2015 NBC SHC.*

4. *Section 3.4.9 PGA's for the Sä Dena Hes site were updated based on the 2015 NBC SHC.*

5. *Section 5.3.2 New tables were added to this section providing trigger levels for North Dam Piezometers and settlement gauges.*

5.7 Emergency Preparedness and Response Plan (EPRP) Review

The current EPRP was prepared by SRK in 2015. The manual was reviewed as part of the 2018 DSI.

A list of changes to the EPRP is provided below:

1. Section 2.1 *Details in the Key Roles and Responsibility Table 1 have been updated including key contact information.*

2. Section 2.2 *Org Chart Figure 6 has been updated*.

Teck is currently updating the requirements for EPRs at all legacy sites. The ERP for the Sä Dena Hes will be updated once these guidelines have been finalized.

6 Summary and Recommendations

6.1 Summary of Construction and Operations Activities

The site is currently closed and there are no construction or operation activities.

6.2 Summary of Climate and Water Balance

The MAP for the site is 646 mm based on a recent regional and regression analysis performed by SRK using the nearby meteorological stations from Environment and Climate Change Canada (ECCC). An estimate of the 2018 annual precipitation was calculated to be 356 mm based on the 2018 annual precipitation recorded at the Watson Lake airport.

The mean annual lake evaporation for the site remains unchanged at the estimated 483 mm.

6.3 Summary of Performance

Per previous inspections, the North Dam is currently stable and does not retain any water. There are no signs of any instability on the crest or the downstream slope. The vegetation on the till cover is slowly taking hold and the drainage channel in the middle of the cover is functioning as designed.

The SRS dike is also stable with no indication of cracks along the crest or sloughing on the upstream and downstream slopes.

The spillway shows no signs of movement of the riprap or instability. It is functioning in accordance with the design parameters

6.4 Summary of Changes to Facility or Upstream or Downstream Conditions

There were no significant changes noted of the North Dam or the SRS dike. Similarly, there were no changes to the upstream and downstream conditions to the north and south of the North Dam.

6.5 Consequence Classification

The consequence of failure category for North Dam and the SRS Dike is currently “significant” and “low” respectively. It is SRK’s opinion that the Dam Consequence Classification (DCC) of “Significant” for the North Dam is overly conservative and should remain as “Low”. The next DSR is scheduled for 2025 and the DCC for the North Dam should be reviewed at that time

6.6 Table of Deficiencies and Non Conformances

SRK has completed the 2019 DSI of Sä Dena Hes mine, TMA and water management infrastructure and concluded that the North Dam, the SRS, the diversion channels and the waste rock dumps are in good condition, and there was no evidence of any dam safety issues or concerns.

Table 6-1 provides a summary of deficiencies and non conformances noted during the 2019 dam safety inspection (DSI). There are no outstanding deficiencies or non-conformances from the 2018 or earlier DSI’s.

Table 6-1: Summary of Deficiencies and Non-Conformances

Structure	ID No.	Deficiency or Non-Conformance	Applicable Regulatory or OMS Reference	Recommended Action	Priority (Teck 2019)	Recommended Deadline/ Status
North Creek Channel	2019-1	Beaver Dam at inlet to channel		Remove beaver dam in channel	3	Before end of 2019 Completed September 5, 2019 Closed

General Description of Priority Rankings[2]

Priority	Description
1	A high probability or actual dam safety issue considered immediately dangerous to life, health or the environment, or a significant regulatory concern.
2	If not corrected, could likely result in dam safety issues leading to injury, environmental impact or significant regulatory action; or, a repetitive deficiency that demonstrates a systematic breakdown of procedures.
3	Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.
4	Best Management Practice as a suggestion for continuous improvement towards industry best practices that could further reduce potential risks. This typically includes ongoing construction items within the appropriate construction cycle.

[2] Based on the Health, Safety and Reclamation Code (HSRC) for Mines in British Columbia (2016 revision).

This final report, 2019 Sä Dena Hes Annual Dam Safety Inspection, was prepared by SRK Consulting (Canada) Inc.

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Peter Healey, PEng
Associate

All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

7 References

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Morton, F.I. 1983. "Operation Estimated of Areal Evapotranspiration and their significance to the science and practice of hydrology." *Journal of Hydrology* 66: 1-76

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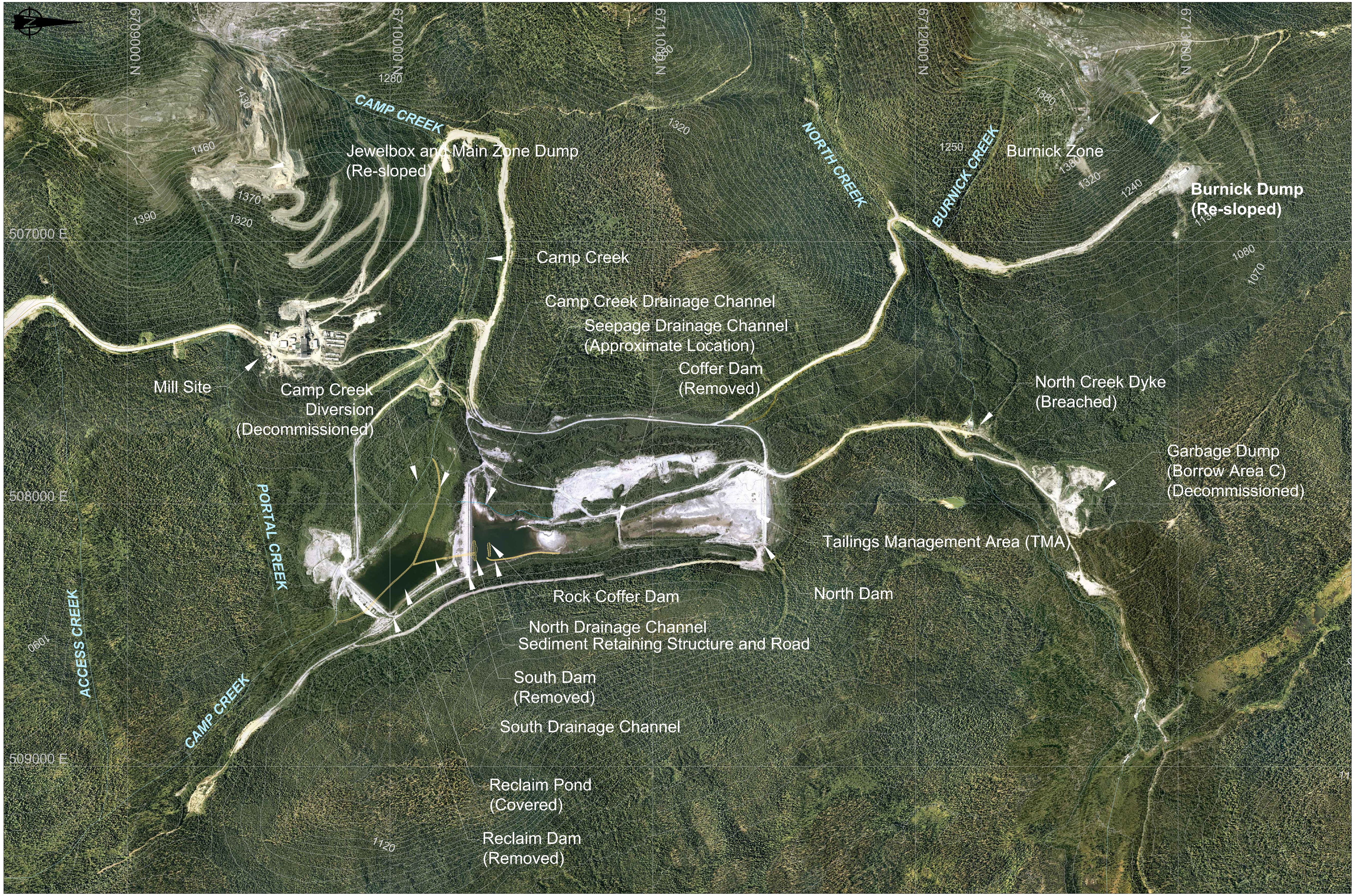
SRK Consulting (Canada) Inc., 2018. 2018 Dam Safety Inspection, Tailings Management Area SDH, YT, November 2018

SRK Consulting (Canada) Inc., 2019 Qualitative Performance Objectives, North Dam, SDH, YT, March 2019

Teck Resources Limited, 2019. Guideline for Tailings and Water Retaining Structures, January 2019.

Yukon Territory Water Board Water License QZ99-045 for SDH mine (YTWB 2002), and its amendments (YTWB 2005 and YTWB 2010)

Figures



NOTES

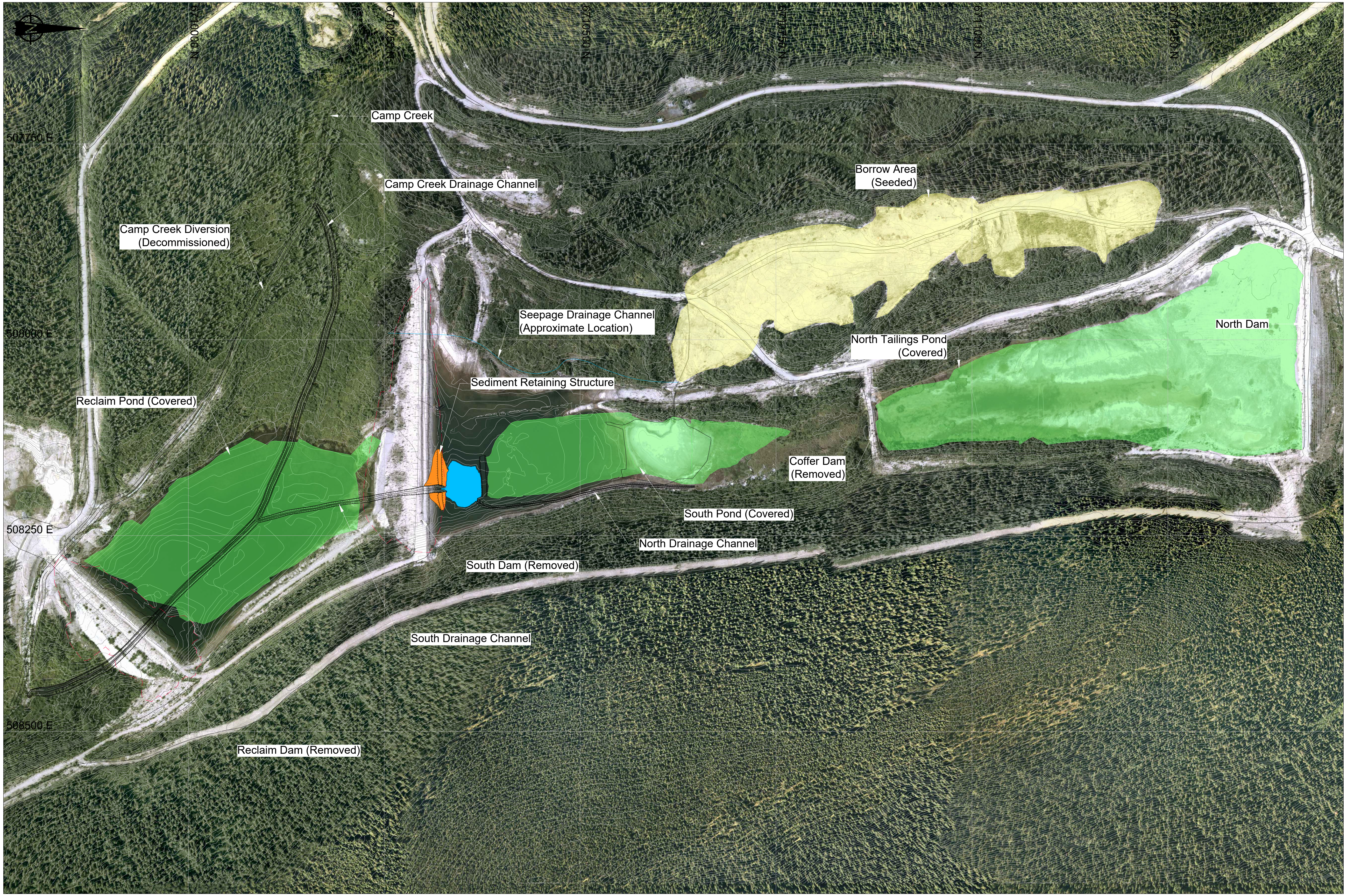
1. Topographic contour data and aerial photos were obtained from McElhanney and are based on August 15, 2012 LiDAR survey. Coordinate system is UTM NAD 83CSRS zone 9V.
2. Orthographic photo depicts pre-decommissioned surface.

0 100 200 300 400 500

Scale in Metres

CONTOUR INTERVAL=10m

srk consulting	Teck	2019 Dam Safety Inspection
		Vicinity Map
SRK JOB NO.: 1CT008.072	Sä Dena Hes Project	DATE: September 2019
FILE NAME: 1CT008_072_fig_01 - Vicinity Map.dwg		APPROVED: PH
		FIGURE: 1



LEGEND

- Major Contour (5m interval)
- Minor Contour (1m interval)
- Edge of Road
- Design Edge of Road
- Camp Creek Drainage Channel
- Dam Excavation Extent
- Sedimentation Pond
- Capped Areas
- Seeded Area

NOTES

1. Preconstruction topographical contour data was obtained from McElhanney and is based on August 15, 2012 LiDAR Survey.
2. As-built survey data was collected by Yukon Engineering Services and Amec Foster Wheeler.
3. Coordinate system is UTM NAD 83 CSRS Zone 9V.
4. Tailings characterization work conducted by Golder and Associates determined the location of capping at the South Pond and Reclaim Pond areas.

0m 50 100 150 200

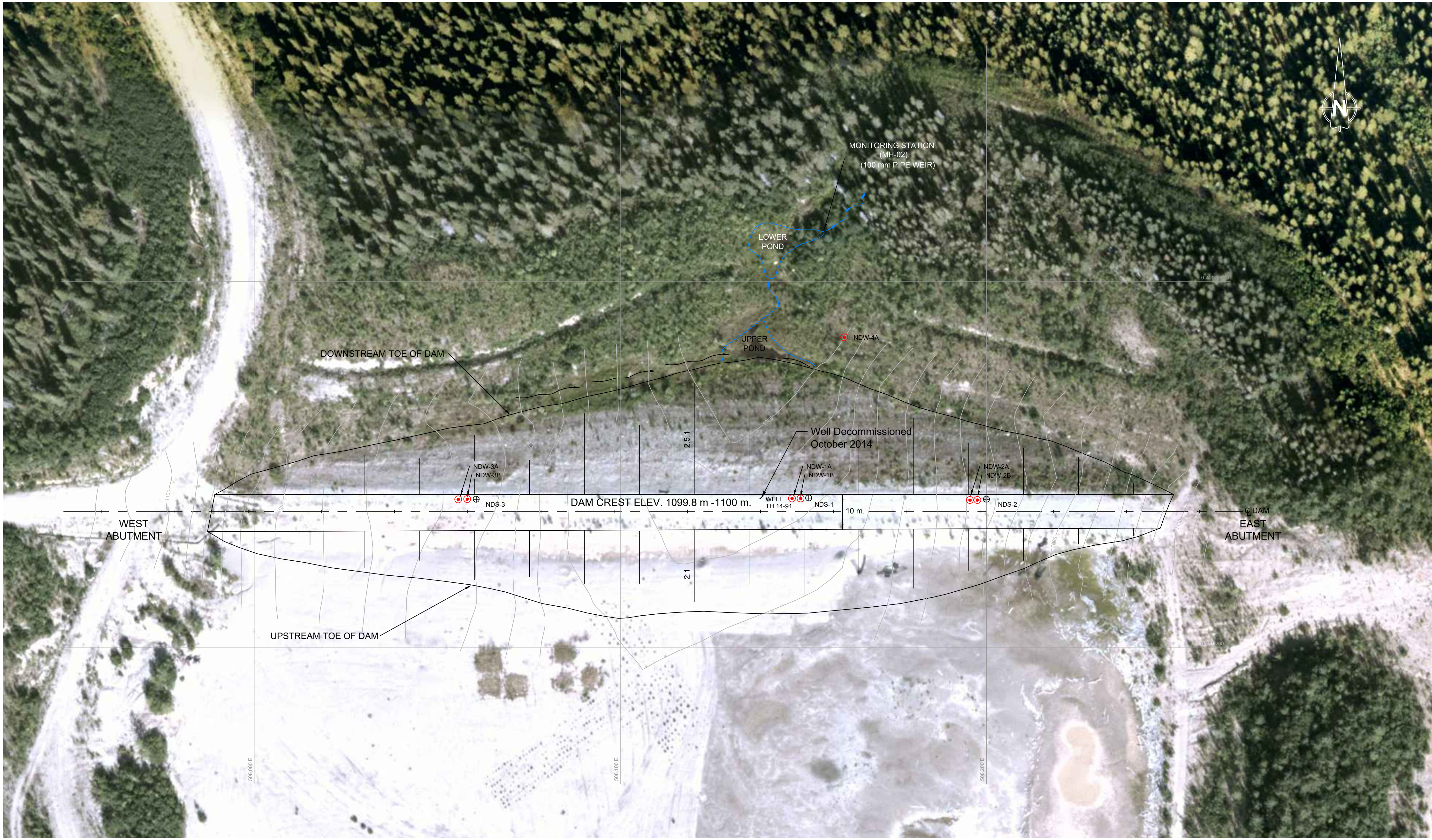
srk consulting

Teck

2019 Dam Safety Inspection

TMA General Arrangement Map

SRK JOB NO.: 1CT008.072	Sä Dena Hes Project	DATE: September 2019	APPROVED: PMH	FIGURE: 2
FILE NAME: 1CT008_072_fig_02 - General Arrangement.dwg				



KEY

NDW-1 ⊙ PIEZOMETERS INSTALLED (NOV., 1991)

NDS-1 ⊕ SETTLEMENT GAUGE INSTALLED (NOV., 1991)

SEEPAGE

NOTES:

1. Topographic contour data and aerial photos were obtained from McElhanney and are based on August 15, 2012 LiDAR survey and October 2013 YES Survey. Coordinate system is UTM NAD 83CSRS zone 9V.

srk consulting

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2019 Dam Safety Inspection

North Dam
Site Plan

SRK JOB NO.: 1CT008.072

FILE NAME: 1CT008_072_fig_03 – North Dam–plan.dwg

Sa Dena Hes Project

DATE:	APPROVED:	FIGURE:
September 2019	P.M.H.	3

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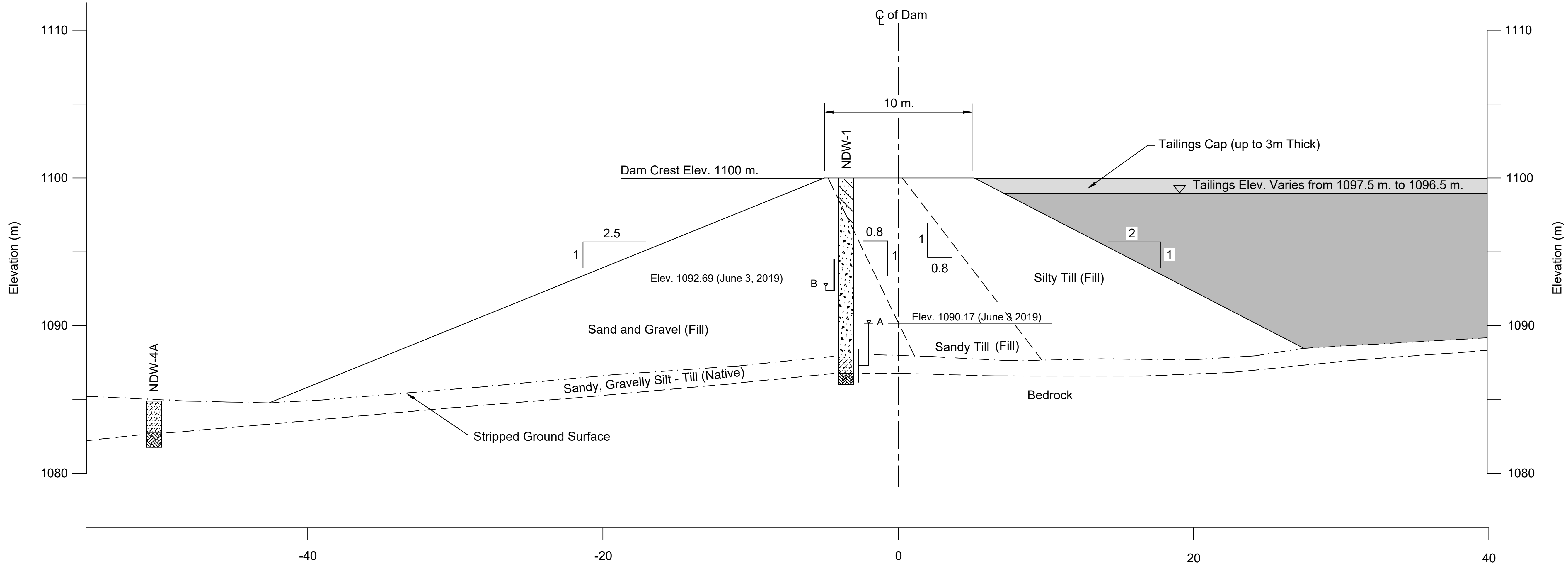


Date	Piezometer	Borehole depth (mBTOC)	Piezometer Interval (mBTOC)	Soil Type	Top of Casing Elev. (mamsl)	Ground Elevation (mamsl)	Water Reading (mBTOC)	Top of water (mamsl)	Depth to Bottom (mBTOC)	Bottom of hole (mamsl)	Piezometer Interval (mamsl)
3-Jun-19	NDW-1A	14.44	12.34-14.44	Bedrock	1100.74	1100.00	10.57	1090.17	14.48	1086.26	1086.3-1088.4
3-Jun-19	NDW-1B	8.30	6.2-8.3	Sandy Till	1100.70	1100.00	8.015	1092.69	8.05	1092.65	1092.4-1094.5

LEGEND

Sandy Till (Fill)

Silty Till (Fill)

Sand & Gravel(Fill)

Silty Sand (Till)

Gravelly Silty Sand (Till)

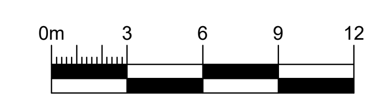
Sand & Gravel (Native)

Bedrock

Piezometric Head for Filter Zone Indicated

Tailings

Tailings Cap



NOTES

1. Topographic contour data and aerial photos were obtained from McElhanney and are based on August 15, 2012 LiDAR survey. Coordinate system is UTM NAD 83CSRS zone 9V.

srk consulting

SRK JOB NO.: 1CT008.072

FILE NAME: 1CT008_072_fig_04 - North Dam-XS.dwg

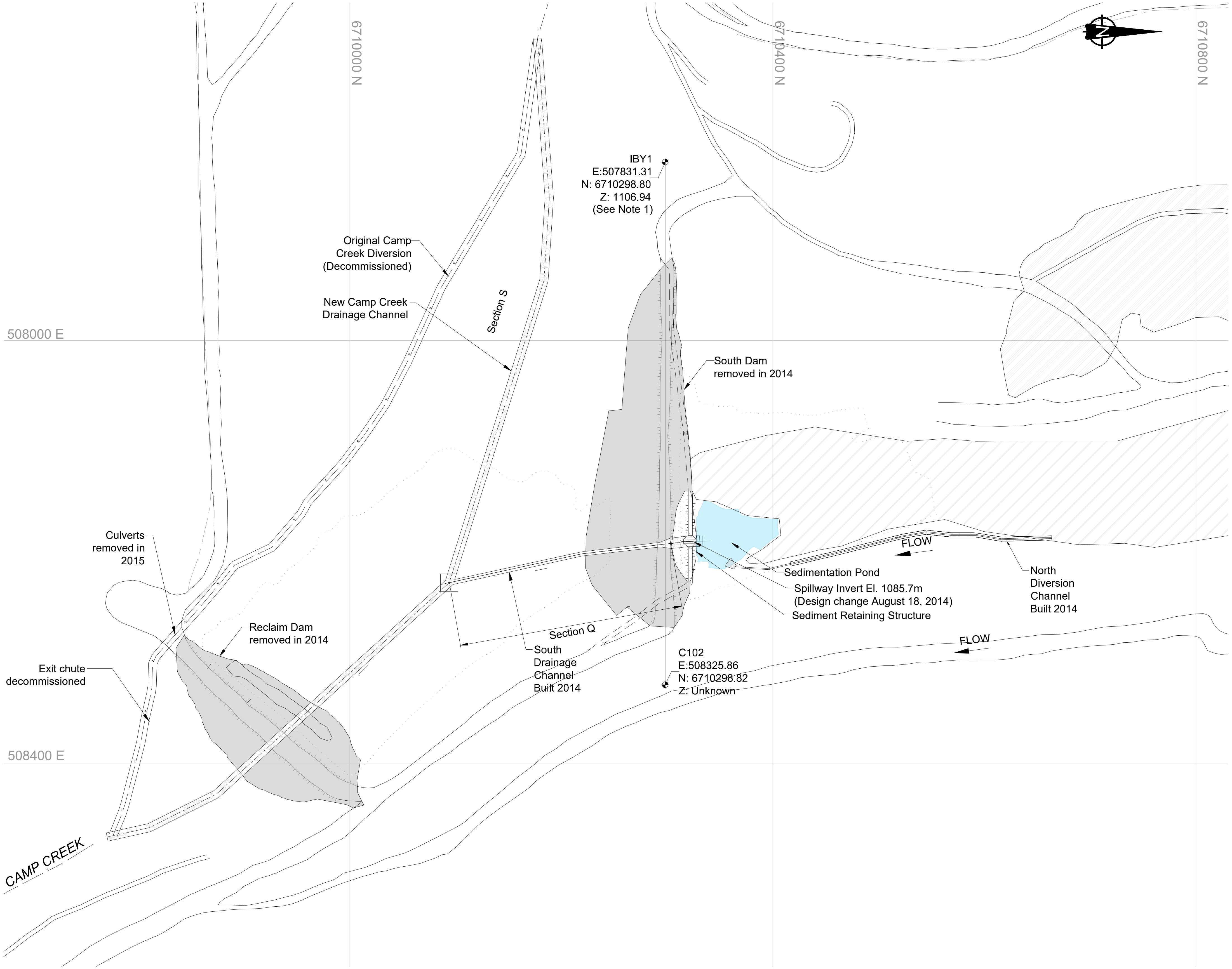
Teck

Sä Dena Hes Project

2019 Dam Safety Inspection

North Dam
Section 0+400

DATE: September 2019 | APPROVED: PMH | FIGURE: 4



LEGEND

- Covered Tailings
- Removed Dams
- Sedimentation Pond
- Minor Contours (1m interval)
- Major Contours (5m interval)
- Camp Creek
- Drainage Channel

NOTES

1. This Benchmark datum is currently used to monitor settlement gauges on the dam and was used as the benchmark in construction of the dam. The elevation has been adjusted from 1103.54m to the current LiDAR Survey elevation.

srk consulting	Teck	2019 Dam Safety Inspection
SRK JOB NO.: 1CT008.072		Sediment Retaining Structure Location Map
FILE NAME: 1CT008_072_fig_05 – TMF.dwg	Sä Dena Hes Project	DATE: September 2018 / APPROVED: PMH / FIGURE: 5

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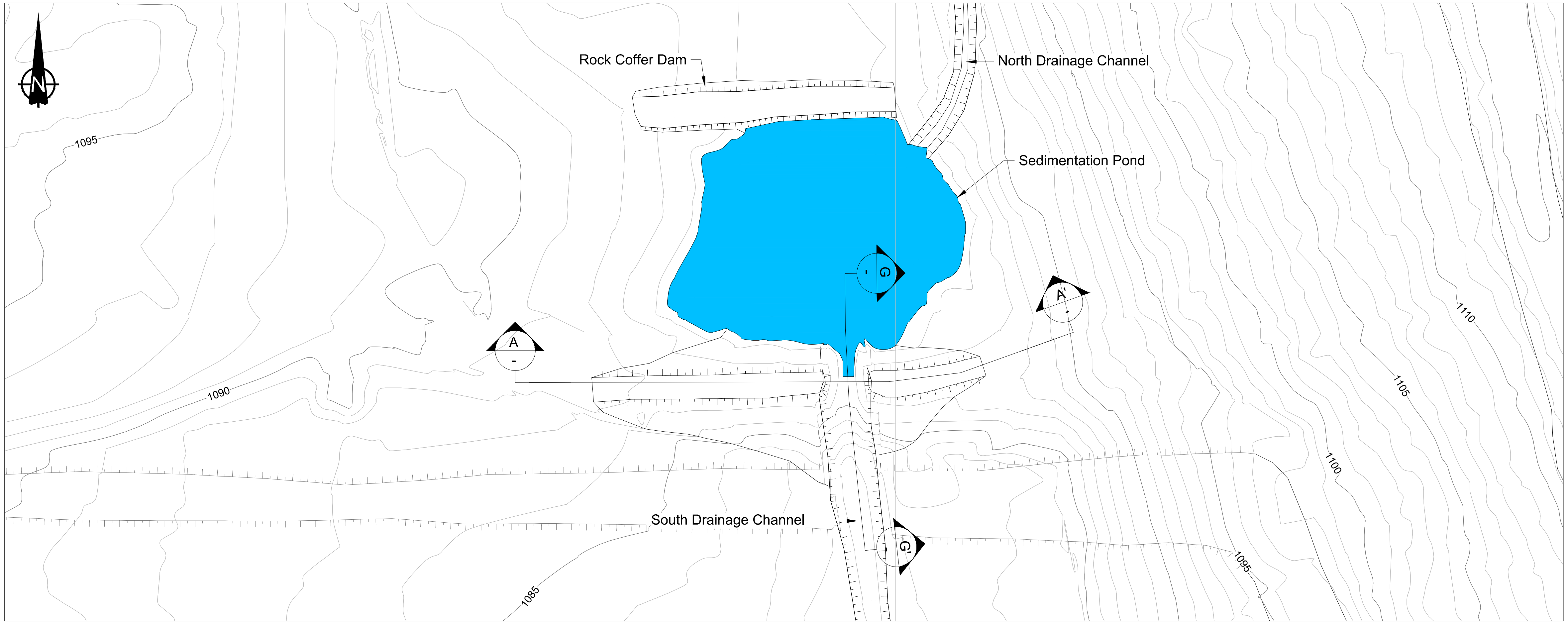


Plan

0m 10 20 30 40

LEGEND

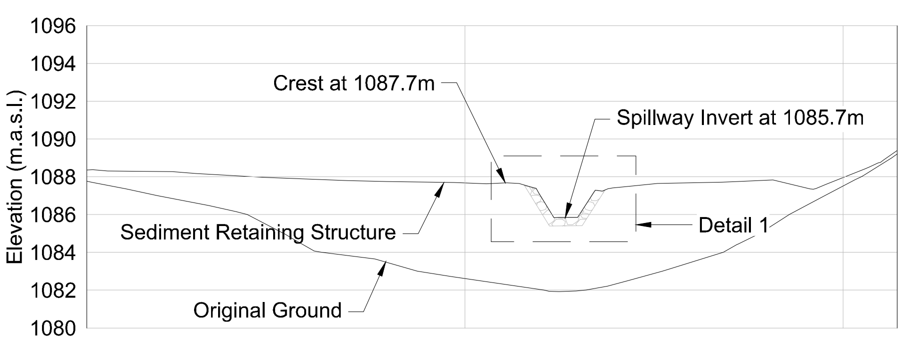
- Major Contour (5m)
- Minor Contour (1m)
- Dam Crest
- Dam Toe
- Edge of Road
- Sediment Pond

PROFILE AND DETAIL LEGEND

- Original Ground
- Non-woven Geotextile
- Riprap

NOTES

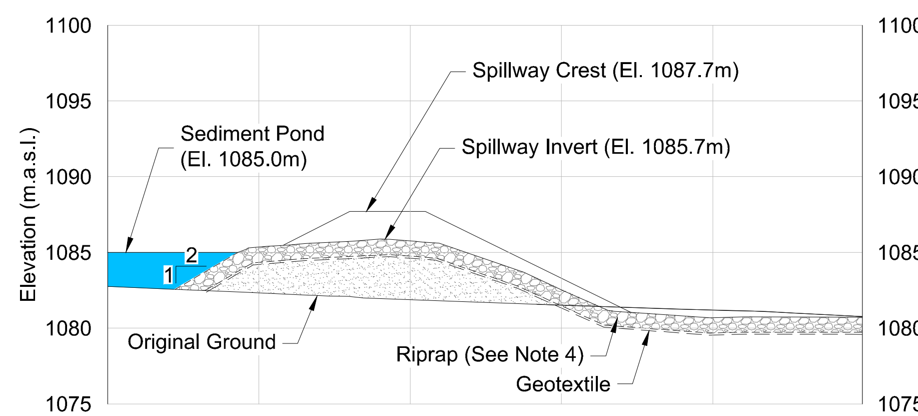
1. Excavated dam fill material was used to cap tailings. The final excavated surface was graded to promote drainage and blended topography into adjacent natural topography.
2. Rip rap from downstream toe buttress was salvaged and reused during channel construction.
3. The decant tower was demolished down to the foundation. Steel reinforced concrete was deposited in the onsite landfill located in Borrow Area C. The remaining concrete foundation was covered with dam fill material and graded to blend into topography.
4. Design extents of rip rap and geotextile, as no as-built survey.



A - Profile A-A'

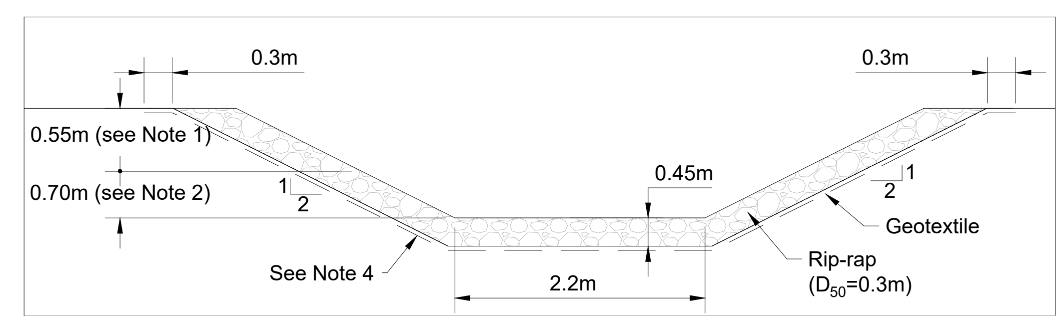
Horizontal: 0m 10 20 30 40

Vertical: 0m 4 8 12 16



G - Section G-G'

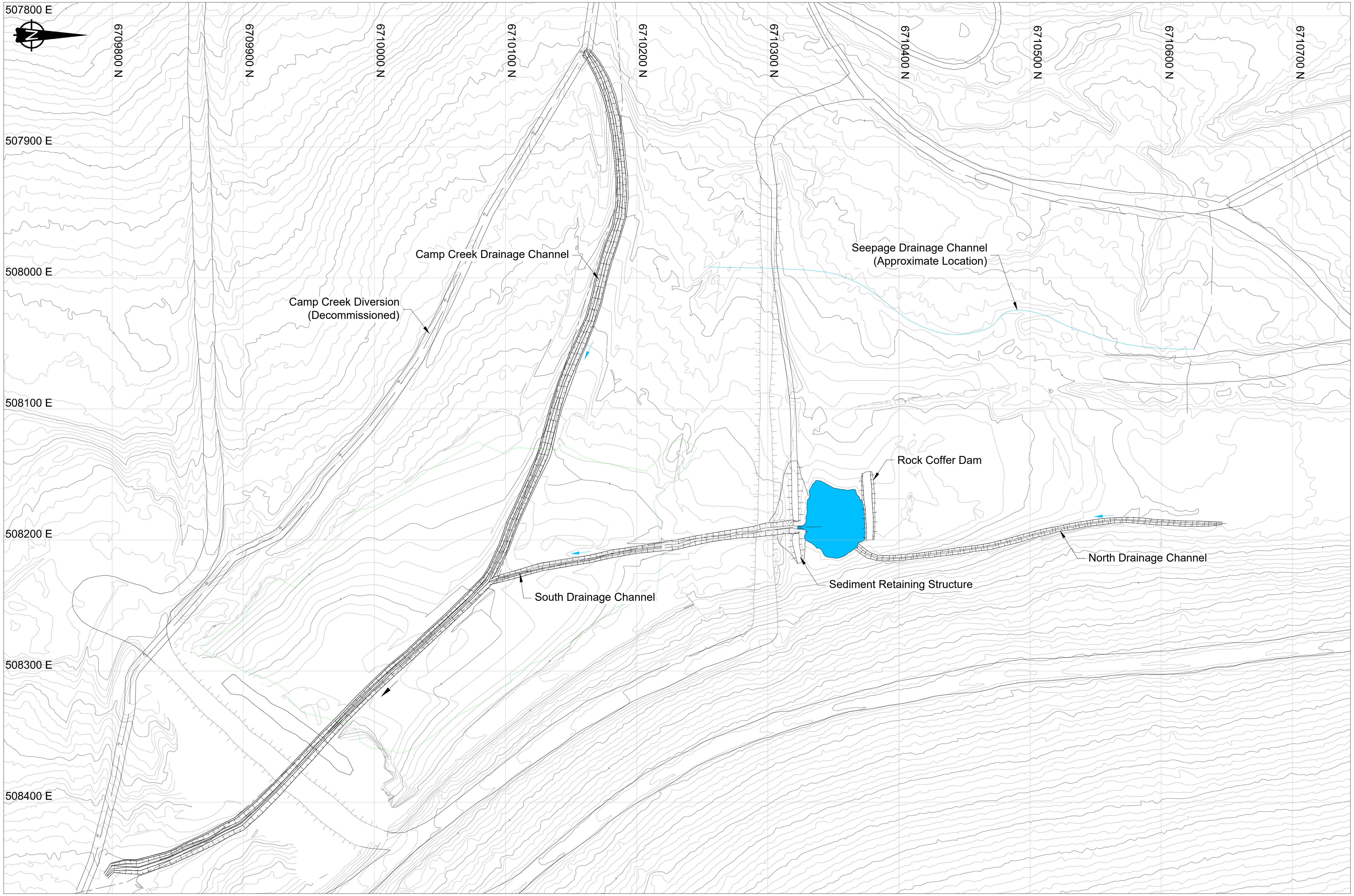
0m 5 10 15 20



1 - Detail 1 - Design Spillway Typical Section

N.T.S.

srk consulting	Teck	2019 Dam Safety Investigation
		Sediment Retaining Structure Plan and Profile
SRK JOB NO.: 1CT008.072	Sä Dena Hes Project	DATE: September 2019 / APPROVED: PMH / DRAWING: 6
FILE NAME: 1CT008_072_fig_06 - Sediment Retaining Struct.dwg		



LEGEND

- Major Contour (5m)
- Minor Contour (1m)
- Dam Crest
- Dam Toe
- Edge of Road
- Direction of Flow
- Sediment Pond

NOTES

1. As-built Camp Creek Drainage Channel upstream and downstream tie-in locations and North Drainage Channel alignments were modified from the design by Amec foster wheeler, with consultation from SRK and Teck, based on field conditions.

0m 30 60 90 120

srk consulting

Teck

2019 Dam Safety Investigation

Drainage Channel Plan

SRK JOB NO.: 1CT008.072

FILE NAME: 1CT008_072_fig_07 - Drainage Channel.dwg

Sä Dena Hes Project

DATE: September 2019

APPROVED: PMH

DRAWING: 7

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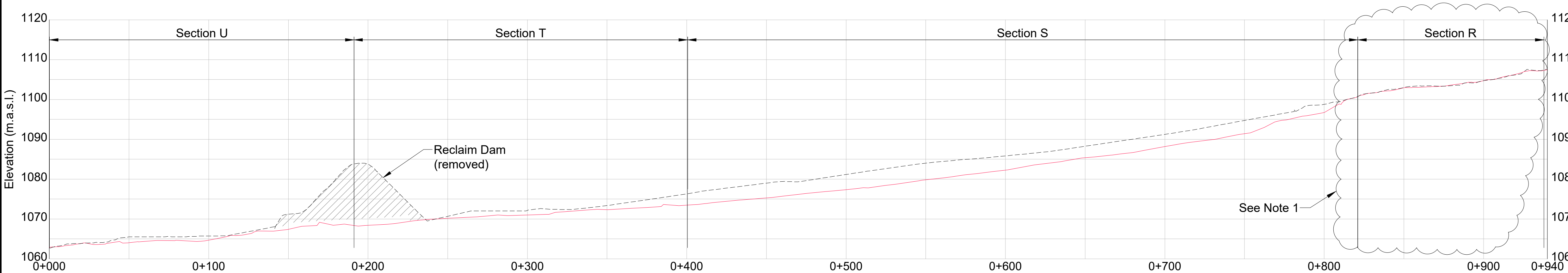
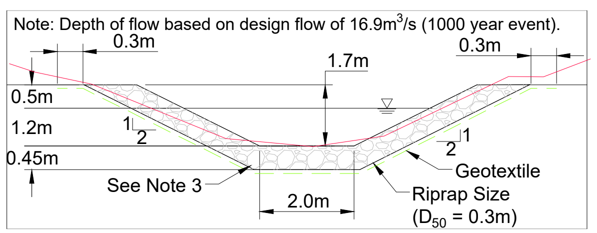
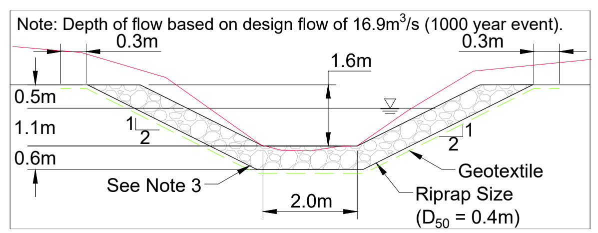


W 09 Profile W - W'
Camp Creek Channel

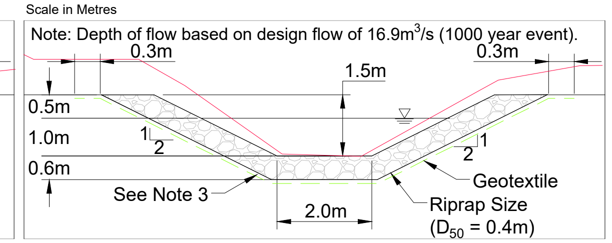
Horizontal: 0 10 20 30 40 50 Scale in Metres
Vertical: 0 5 10 15 20 25 Scale in Metres



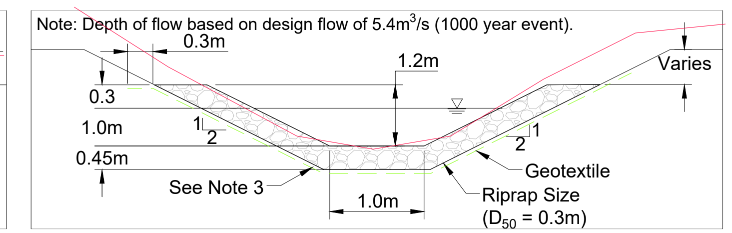
U 09 DESIGN SECTION U- U'
Camp Creek Drainage Channel
N.T.S.



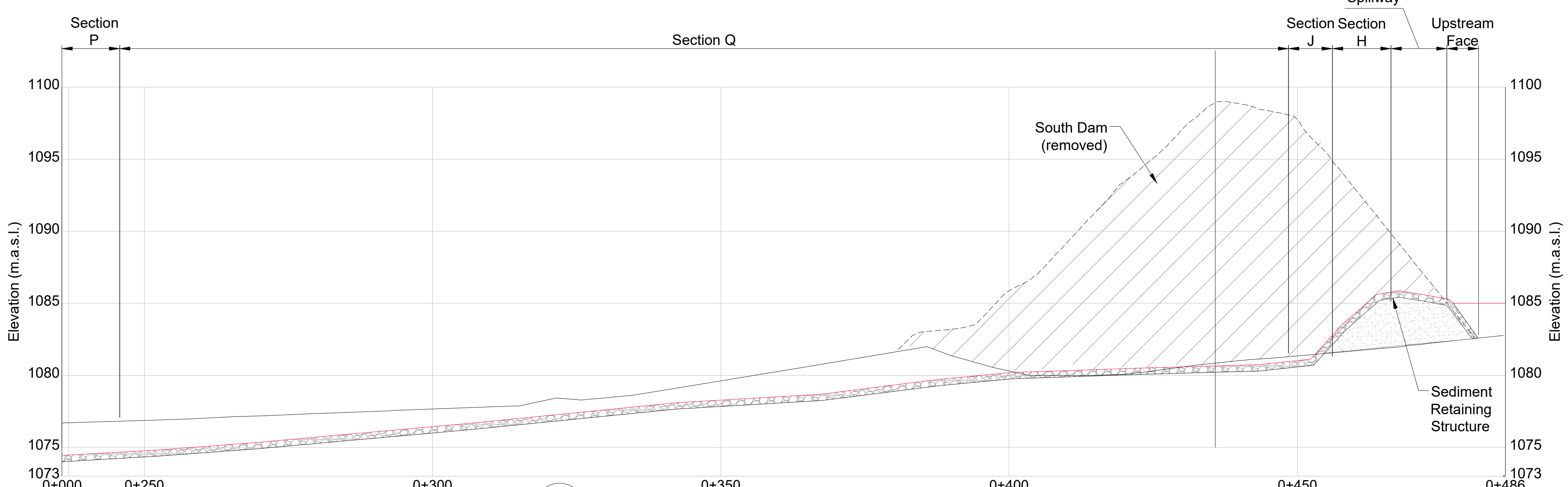
T 09 DESIGN SECTION T- T'
Camp Creek Drainage Channel
N.T.S.



S 09 DESIGN SECTION S - S'
Camp Creek Drainage Channel
N.T.S.

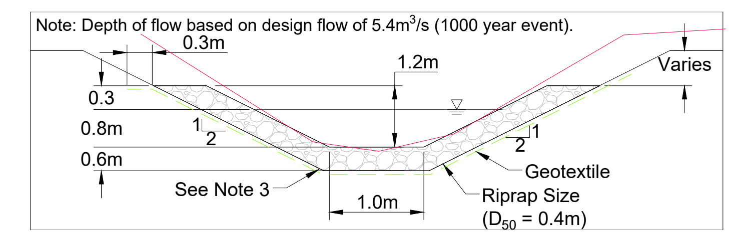


Q 09 DESIGN SECTION Q - Q'
South Drainage Channel
N.T.S.



V 09 Profile V - V'
South Drainage Channel

Horizontal: 0 5 10 15 20 25 Scale in Metres
Vertical: 0 2 4 6 8 10 Scale in Metres



P 09 DESIGN SECTION P - P'
South Dam Drainage Channel
N.T.S.

LEGEND

- Top of Drainage Channel Profile
- Pre-existing Ground
- Pre-Construction Ground
- Sediment Retaining Structure
- Non-woven Geotextile
- Material to be removed
- Rip Rap
- Till (left in place from Original Dam)
- As-built Surface

NOTES

1. Based on field conditions Section R was removed from the design and the upstream tie-in location was modified.
2. Design extents of rip rap and geotextile, as no as-built survey.

Design Drainage Channel
Riprap Volume Summary Table

Location	D_{50} (m)	Armoring Depth (m)	Volume (m^3)
Section U	0.3	0.45	993
Section T	0.4	0.6	1409
Section S	0.4	0.6	2875
Section P	0.4	0.6	52

AS-BUILT EXCAVATED RIPRAP QUANTITIES USED FOR CHANNEL CONSTRUCTION

Material	Units	Quantity	Notes
Riprap developed from the Quarry	m^3	5,492	Volume tracked by Amec Foster Wheeler
Riprap salvaged from Toe Buttresses	m^3	3,592	Volume tracked by Amec Foster Wheeler

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DRAWING TITLE: Drainage Channel Sections

SRK JOB NO: 1CT008.072

FILE NAME: 1CT008_072_fig_08-09-AB_Asbuilt.dwg

Sä Dena Hes Project

DATE: September 2019 | APPROVED: PMH | FIGURE NO. 8

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PLAN

0 5 10 15 20 25
Scale in Metres

NOTES

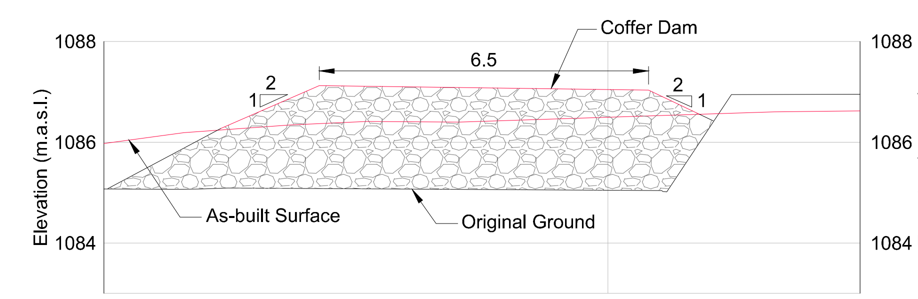
1. Based on field conditions the North Drainage Channel was realigned to avoid constructing the channel through deposited tailings.
2. Based on field conditions a Rock Cofferdam was constructed to retain soft tailings from sliding into the sediment retention pond during cover construction.
3. The decant tower was demolished down to the foundation. Steel reinforced concrete was deposited in the onsite landfill located in Borrow Area C. The remaining concrete foundation was covered with dam fill material and graded to blend into topography.
4. Design extents of rip rap and geotextile, as no as-built survey.

Design North Tailings Drainage Channel Riprap Volume Summary Table:

Location	D_{50} (m)	Armoring Depth (m)	Volume (m^3)
Y	0.3	0.45	638
Discharge Area	0.3	0.45	25

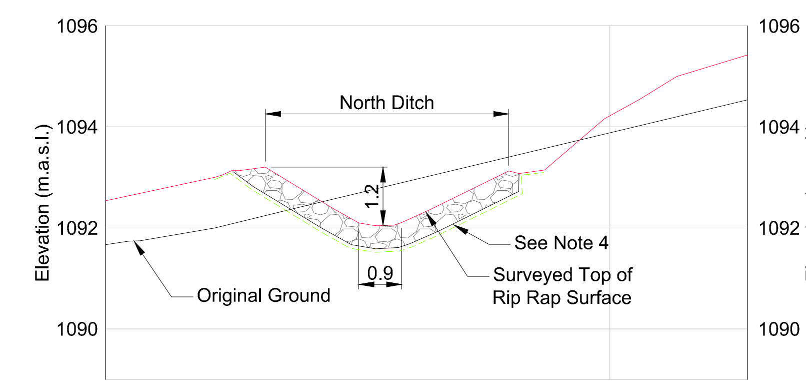
LEGEND

- Major Contours (5m)
- Minor Contours (1m)
- Edge of Road
- Tailings Pipeline
- Existing Ground (Profile)
- Non-woven Geotextile
- Covered Tailings (Proposed in Design)
- Rip Rap
- Sediment Pond (As-built)
- As-built Toe
- As-built Crest
- As-built Extent of Excavation / Fill



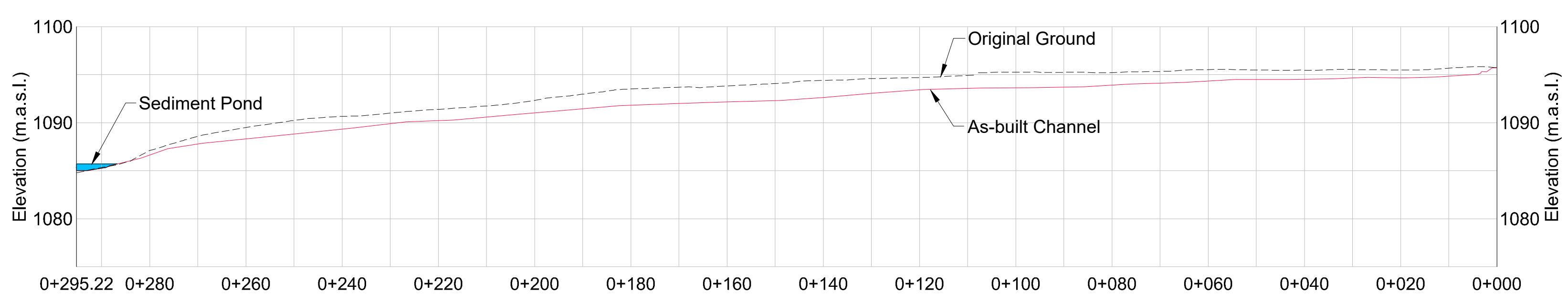
Section Z - Z'

0 1 2 3 4 5
Scale in Metres



Section Y - Y'

0 1 2 3 4 5
Scale in Metres



ND - **Profile ND - ND'**
2x Vertical Exaggeration

Horizontal: 0 5 10 15 20 25 Scale in Metres

Vertical: 0 2.5 5 7.5 10 12.5 Scale in Metres

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SRK JOB NO: 1CT008.072

FILE NAME: 1CT008_072_fig_08-09-AB_Asbuilt.dwg

Sä Dena Hes Project

2019 Dam Safety Inspection

DRAWING TITLE:

North Drainage Channel Plan, Profile and Section

DATE: September 2019 | APPROVED: PMH | FIGURE NO. 9

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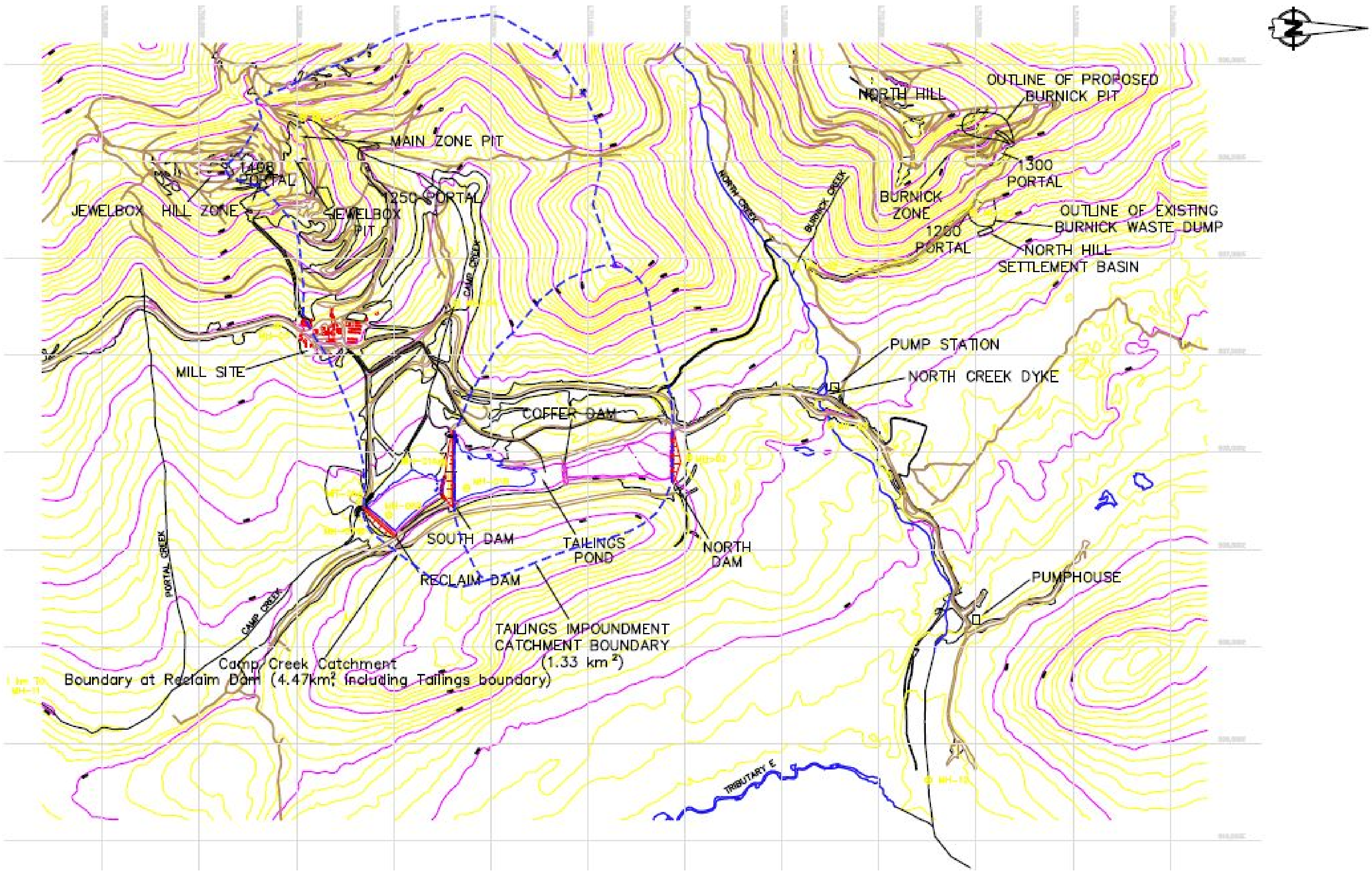

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2019 Dam Safety Inspection

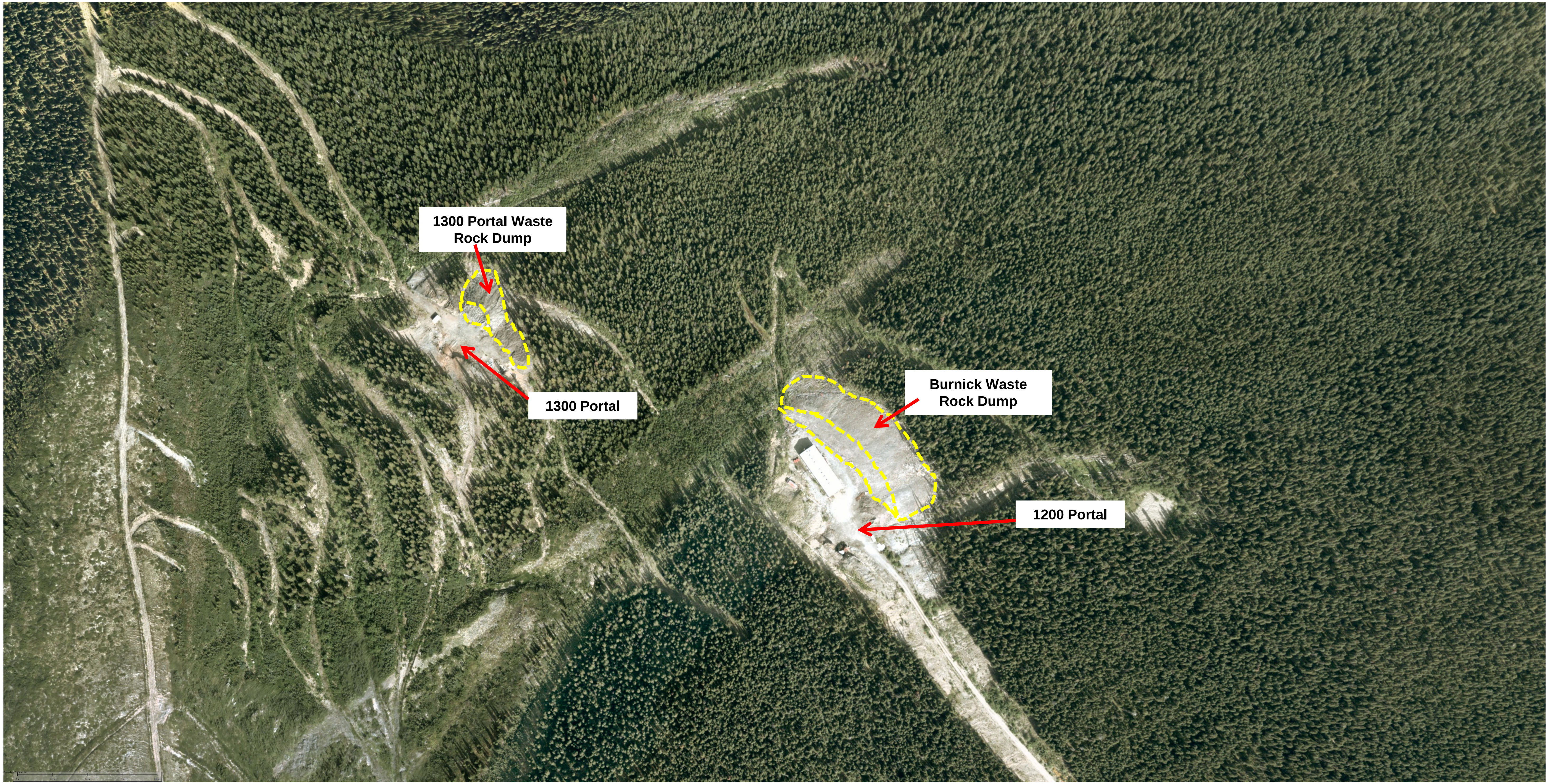
Catchment Areas

Job No: 1CT008.072

Filename: 1CT008_072_fig_10 - CatchmentMap.pptx

Sä Dena Hes Project

Date:	Approved:	Figure:
September 2019	PH	10



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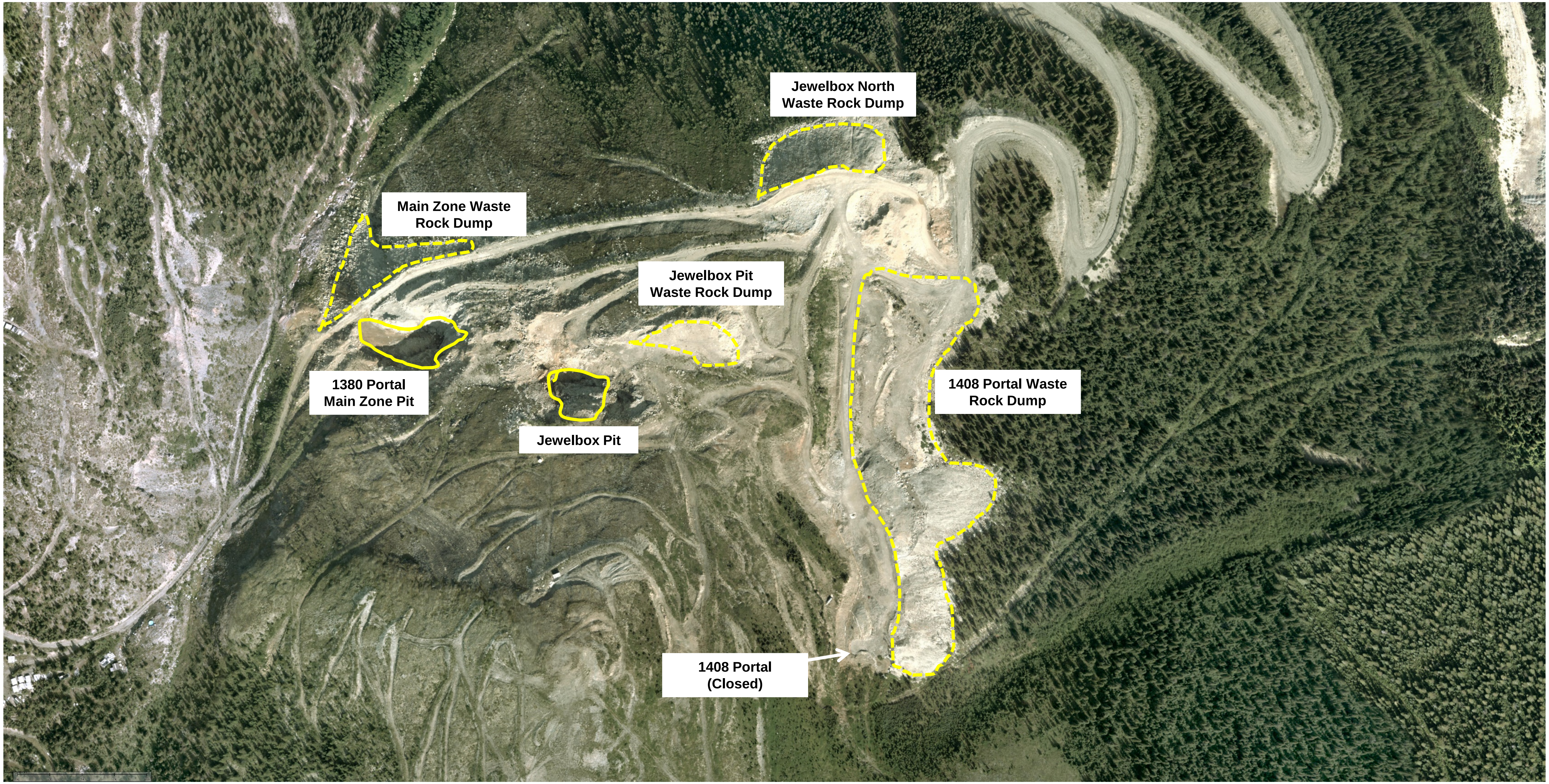
srk consulting	Teck	2019 Dam Safety Inspection
		Burnick Zone Plan View
Job No: 1CT008.072 Filename: 1CT008_072_fig_11 - Burnick Zone.pptx	Sä Dena Hes	Date: September 2019 / Approved: PMH / Figure: 11



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srk consulting	Teck	2019 Dam Safety Inspection
		Main Zone and Jewelbox Zone Plan View
Job No: 1CT008.072 Filename: 1CT008_072_fig_12 - Main Zone and JB Zone.pptx	Sä Dena Hes	Date: September 2019 · Approved: PMH · Figure: 12

Appendix A – Photo Log

Photo 1: North Dam Crest looking west

Photo 2: Downstream slope of the North Dam looking east

Photo 3: Typical North Dam Piezometer

Photo 4: Typical Settlement Gauge.

Photo 5: MH-02 Flow Gauge

Photo 6: Seepage at toe of North Dam, mainly due to hillside springs

Photo 9: View looking north of drainage swale on tailings till cover

Photo 10: View of the southern end of the tailings till cover at location of original cofferdam

Photo 11: Vegetation on tailings cover looking north

Photo 12: View south at the SRS pond in background with North Diversion on the left

Photo 13: SRS and the rock cofferdam

Photo 14: Rock Cofferdam above SRS looking west

Photo 15: View looking north (upstream) of the SRS emergency spillway

Photo 16: Plunge pool below SRS spillway

Photo 17: View of the rock protection along the downstream toe of the SRS on east side

Photo 18: small boils at toe of SRS. Due mainly to local spring activity.

Photo 19: View west along the Camp Creek Drainage Channel

Photo 20: View north at the SRS dike and the south drainage channel

Photo 21: View east over the location of the original Reclaim Dam (removed)

Photo 22: View downstream of the Camp Creek drainage channel

Photo 23: Confluence of the Camp Creek Drainage channel and the original Camp Creek

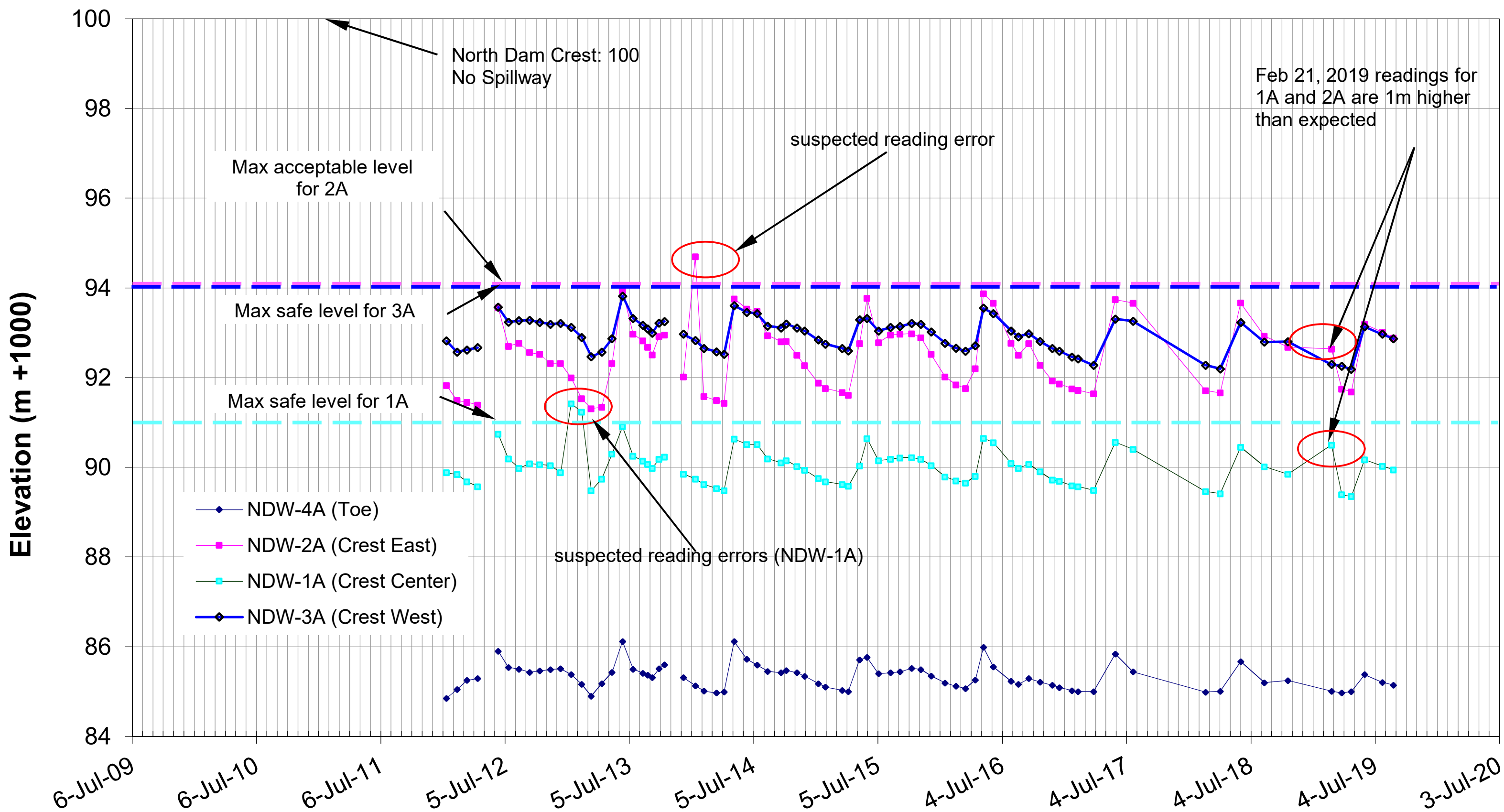
Photo 24: Regraded slopes of Jewelbox waste rock dump

Photo 25: Erosion gully at toe of Jewelbox Waste rock dump

Photo 26: Pit wall above the 1380 Portal at the Main Zone

Photo 27 Burnick waste rock dump at 1200 level

Appendix B – Piezometric Levels



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srk consulting	Teck	2019 Dam Safety Inspection
		North Dam Piezometric Levels vs. Time
Job No: 1CT008.072 File: NDMPiezolevels_1CT008 072_PMH_20191009	Sa Dena Hes Mine	Date: October 9, 2018 · Approved: PMH · Figure: B1

Appendix C – Facility Data Sheet

Appendix C

Facility Data Sheet

North Dam and SRS Dyke

Physical Description

North Dam	
Dam Type	Earth Dam, Single Stage, three zones
Maximum Dam Height	15m
Dam Crest Width	10m
Impoundment Area	0.16 km^2
Volume of Tailings	400,000 m^3
Reservoir Capacity	NA
Consequence Classification	Significant, Passive care
Inflow Design Flood (IDF)	1/3 between the 1,000-year event and the PMF
Design Earthquake	1: 2475- year event
Spillway Capacity	NA
Catchment Area	NA till cover slopes (drains) to south towards SRS
Access to Dam	Vehicles via roads or helicopter in winter
SRS Dyke	
Dam Type	Earth Dam, Single Stage, one zone
Maximum Dam Height	5m
Dam Crest Width	4m
Impoundment Area	Pond area is 1600m^2
Volume of Tailings	400,000 m^3
Reservoir Capacity	800 m^3
Consequence Classification	Low, Passive care
Inflow Design Flood (IDF)	1,000-year event
Design Earthquake	1,000-year event
Spillway Capacity	5.4m^3/s
Catchment Area	1.33 sq km
Access to Dam	Vehicles via roads or helicopter in winter