Appendix 10

Whale Tail 2019 Annual Geotechnical Inspection

SNC·LAVALIN

Whale Tail Project 2019 Annual Geotechnical Inspection

Final Report (Rev. 01)

Agnico Eagle Mines Limited

Mining & Metallurgy

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Quebec, December 16, 2019

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Baker Lake, Nunavut, Canada
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Subject: Whale Tail Project 2019 Annual Geotechnical Inspection
Report of the Whale Tail Project 2019 Annual Geotechnical Inspection
Our file: 665888-3000-4GER-0001_01

Dear Messrs. Bolduc and Clark,

We are pleased to submit the final version (Rev. 01) of the report mentioned in the above subject.

Do not hesitate to communicate with the undersigned should you have further questions regarding the content of this report.

Truly yours,

SNC LAVALIN INC.

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YJ/bsp

List of Revisions

Revision					Revised pages	Remarks
#	Prep.	Rev.	App.	Date		
PA	MDJ			2019-08-06		Issued for internal review
PB	MDJ	YJ	YJ	2019-08-14	All	Issued for client review
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List of Acronyms and Abbreviations

AEM	Agnico Eagle Mines Limited, Meadowbank Division
BGM	Bituminous Geomembrane
CB	Cement-Bentonite
CDA	Canadian Dam Association
FFAB	Fine Filter Amended with Bentonite
masl	metre above sea level
NE (Dike)	North East (Dike)
OMS	Operation, Maintenance and Surveillance
SAA	Shape Accel Array
TARP	Trigger Action Response Plan
WRSF	Waste Rock Storage Facility
WTD	Whale Tail Dike
WTNB	Whale Tail North Basin
WTSB	Whale Tail South Basin
WTP	Water Treatment Plant

Executive Summary

SNC-Lavalin conducted a geotechnical inspection at the Whale Tail Site from July 16 to July 18, 2019. Thirteen structures were inspected: Whale Tail Dike, North East Dike, WRSF Dike, Mammoth Dike, main dewatering ramp, saline protection ditch, site haulage road, Amaruq bulk fuel storage facility, secondary fuel storage facility, water treatment plant pad, Nemo Lake pad, emulsion plant pad and diffusers. A total of 85 observations were made, one of which require immediate corrective measures. The instrumentation data was also reviewed. The main recommendation from SNC-Lavalin is to monitor the seepage at the Whale Tail Dike in terms of quantity and quality. The criteria of the Trigger Action Response Plan (TARP) should also be reviewed. The source of the seepage (within the foundation or through the cut-off wall) should be identified.

Résumé Exécutif

SNC-Lavalin a réalisé une inspection géotechnique au site Whale Tail du 16 au 18 juillet 2019. Treize structures ont été inspectées : la digue Whale Tail, la digue North East, la digue WRSF, la digue Mammoth, la rampe de dénoyage principale, le fossé de protection de l'eau saline, les routes de transport du site, l'installation de réserve de carburant en vrac, l'installation de carburant secondaire, la plate-forme de la station d'épuration, la plate-forme au lac Nemo, la plate-forme de l'usine d'émulsion ainsi que les diffuseurs. Au total, 85 observations ont été faites, parmi lesquelles une nécessite une mesure corrective immédiate. Les données d'instrumentation ont également été revues. La recommandation principale de SNC-Lavalin est d'assurer un suivi de l'écoulement de l'eau au travers de la digue Whale Tail en termes de quantité et de qualité. Les critères du déclenchement du plan d'intervention (TARP) devront aussi être revus. La source de l'écoulement (au travers de la fondation ou au travers du mur de ciment-bentonite) devrait être identifiée

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1.0 INTRODUCTION

1.1 Context

Agnico Eagle Mines Limited, Meadowbank Division (''AEM'') is developing Whale Tail Pit, a satellite deposit on the Amaruq property, as a continuation of mine operations and milling at the Meadowbank Mine. The Amaruq Exploration property is a 408 km² site located on Inuit Owned Land, approximately 150 km north of the Hamlet of Baker Lake and approximately 50 km northwest of the Meadowbank Mine in the Kivalliq region of Nunavut. The property was acquired by Agnico Eagle in April 2013 and is subject to a mineral exploration agreement with Nunavut Tunngavik Incorporated. The Meadowbank Mine is an approved mining operation and AEM is extending the life of the mine by constructing and operating Whale Tail Pit.

Water management and geotechnical infrastructures were constructed on the Amaruq property to allow mining operation of the Whale Tail Project. As part of the Type-A, Part I, Item 12 of the Water Licence, all the major earthworks have to be inspected by a qualified third party to assess their performance.

1.2 Mandate

SNC-Lavalin Inc. ("SNC-Lavalin") was retained by AEM for the Whale Tail Project annual geotechnical inspection for the year 2019. This inspection was the first one conducted by a third party on the Whale Tail Site. The inspection was conducted from July 16 to July 18, 2019.

The inspection was conducted in accordance with the Canadian Dam Association (CDA, 2013) and covered the following earthworks:

- Dewatering and water management dikes: Whale Tail Dike, North East Dike, WRSF Dike and Mammoth Dike;
- Geotechnical instrumentation of Whale Tail Dike, WRSF Dike and Mammoth Dike;
- Main dewatering ramp;
- Saline protection ditch;
- Site haulage road;
- Amaruq bulk fuel storage facility and secondary fuel storage facility;
- Main construction pads;
- Diffusers.

1.3 Content of the Study

All the recommendations made within the scope of the 2019 inspection are shown on maps included in Appendix A, summarized in Table B-1 of Appendix B and detailed in descriptive sheets in Appendix C. Recommendations and priorities are discussed in Section 3.0 and a summary analysis and interpretation of the instrumentation is presented in Section 4.0.

2.0 INFORMATION ON THE INFRASTRUCTURES

2.1 Reference Documents

Table 2-1 lists the available documentation for the 2019 geotechnical inspection. A comprehensive list of the documentation that is available to SNC-Lavalin can be found in Table E-1 to Table E-6 in Appendix E.

Table 2-1: Availability of the documentation for each component of the inspection

Infrastructure	Documentation availability					
	Design Report[6]	As-built Report[7]	Inspection forms	Instrumentation data	TARP Level	Reported situation
Whale Tail Dike	Yes	Yes	Yes	Yes	Yes	Yes[1]
North East Dike	Yes	Yes	Yes	N/A	Yes	Yes[2]
WRSF Dike	Yes	Yes	Yes	Yes	Yes	Yes[3]
Mammoth Dike	Yes	Yes	Yes	Yes	Yes	No
Main Dewatering Ramp	Drawings only	No	Yes	N/A	Yes	Yes[4]
Saline Protection Ditch	No	Drawings only	No	N/A	N/A	No
Site Haulage Road	No	No	No	N/A	N/A	No
Amaruq Bulk Fuel Storage Facility	No	Drawings only	No	N/A	N/A	No
Fuel Storage Facility #2	No	No	No	N/A	N/A	No
Construction Pads	No	No	No	N/A	N/A	No
Diffusers	Drawings only	No	No	N/A	N/A	Yes[5]

[1]AEM increased the TARP level of Whale Tail Dike to yellow on May 7, 2019.

[2]AEM increased the TARP level of North East Dike to yellow on July 5, 2019. It was then increased to orange on July 6, 2019.

[3]AEM increased the TARP level of WRSF Dike to yellow on June 28, 2019.

[4]AEM reported major sinkholes in the main dewatering ramp and decided to close the main access.

[5]AEM reported that the diffusers were floating on top of the lake surface, which is in contradiction with the Design.

[6]All these structures required a design to be submitted to the regulators 60 days prior to being constructed as per the License. Some designs were not submitted to SNC.

[7]An as-built report of each of these structures is a license requirement (90 days after construction). However, some of those are not ready yet as it is within the 90 days delay.

2.2 Water Retention and Dewatering Structures

The Amaruq mine site comprises a main dewatering dike (Whale Tail Dike) as well as three water retention dikes (North East Dike, WRSF Dike and Mammoth Dike). Each dike was inspected as part of the annual geotechnical inspection.

A general view of the Amaruq mine site including every structure inspected within the scope of this mandate is shown on Figure 2-1.

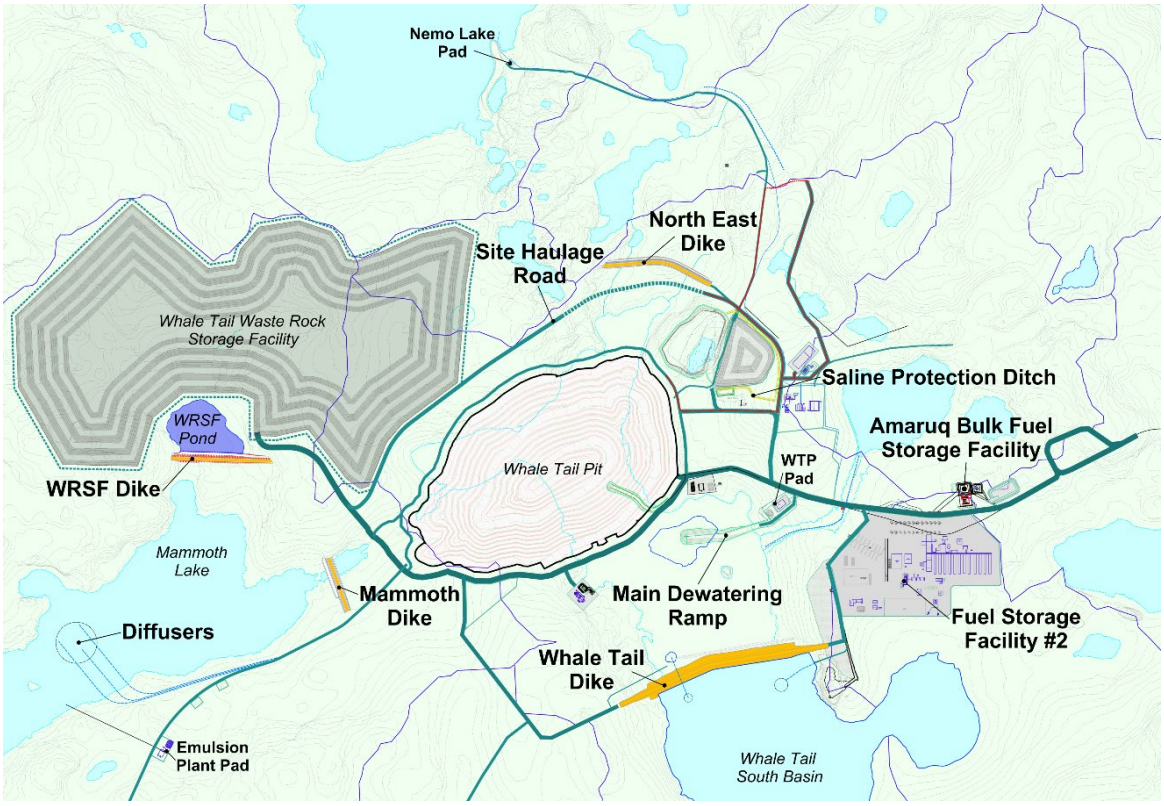


Figure 2-1: General view of the Amaruq mine site

2.2.1 Whale Tail Dike

The Whale Tail Dike (WTD) is located on a shallow plateau of the Whale Tail Lake floor with approximately two metres depth of water. This plateau is located between deeper sections of the lake with water depths of approximately 12 m.

The WTD is a zoned embankment comprising of rockfill, coarse and fine filter materials. It includes a secant pile cut-off wall made of cement-bentonite (CB) constructed through the central zone which consisted of fine filter materials that were densified by dynamic compaction. The elevation of the cut-off wall is 157.0 masl, which is one metre above the operational level of the Whale Tail South Basin. The bedrock foundation was

curtain grouted on 336 m along the western section of the dike to a depth of 10 m. The WTD is approximately 800-m long, has an average height of nine metres and a 13-m wide crest.

The construction was initiated in July 2018 and the dike was completed up to elevation 157.0 masl by February 2019, including the cut-off wall construction, curtain grouting and instrumentation installation. The structure was commissioned on March 5, 2019 with the beginning of the dewatering of the Whale Tail North Basin (WTNB). By the time of the inspection in July 2019, final earthworks were being carried out to raise the crest elevation to 159.0 masl as per design.

2.2.2 North East Dike

The North East (NE) dike is a temporary structure located northeast of the Whale Tail Pit with an estimated service life of two years. The dike construction was required ahead of the development of the Whale Tail Pit to prevent run-off of non-contact water from the northeast watershed to the pit.

The NE Dike is a rockfill dike with a maximum height of 2.6 m, comprising essentially of gentle-sloped rockfill, founded mostly on overburden materials (glacial till). The upstream slopes are lined with bituminous geomembrane (BGM), embedded within a fine filter zone on the slope. The BGM is encapsulated at the toe in a layer of fine filter amended with bentonite (FFAB) inside the key trench. The BGM and the FFAB layers were required to retain all run-off up to the design flood level of 156.7 masl, with a manageable amount of seepage towards the Whale Tail Pit.

The NE dike construction was completed in February 2019. Given the short service life of the structure, it is the only dike that is not instrumented.

2.2.3 WRSF Dike

The WRSF Dike was built to contain contact water generated by snow melt and run-off from direct precipitation on the waste rock stockpile that has the potential to be acid generating and arsenic leaching. The WRSF Dike is located west of the Whale Tail Pit and is designed to last until the water quality reaches the criterion of the Project.

As for the NE Dike, the WRSF Dike is a rockfill dike with the upstream slopes lined with BGM, embedded within a fine filter zone on the slope. The BGM is encapsulated at the toe in a layer of FFAB inside the key trench. The BGM and the FFAB layer are required to retain all runoff up to a maximum flood level (157.8 masl) with a return period of 100 years. All contact water is being collected in the WRSF Pond which has an expected operational level of 155.4 masl as per AEM's OMS Manual.

Fill placement on the WRSF Dike was completed in early March 2019. The WRSF Dike was designed to be built in winter to promote the freezing of FFAB materials to enhance its performance (SNC-Lavalin, 2018b; SNC-Lavalin, 2018c). The instrumentation installation was completed in early May 2019 with three thermistors strings located in the deepest section of the foundation.

2.2.4 Mammoth Dike

Mammoth Dike is located southwest of the Whale Tail Pit and was built to prevent flooding of the Whale Tail Pit.

The design is similar to the NE Dike and WRSF Dike; it is a rockfill dike with the upstream slopes lined with BGM, embedded within a fine filter zone on the slope. The BGM is encapsulated at the toe in a layer of FFAB inside the key trench. The BGM and the FFAB layer are required to retain water from Mammoth Lake to the design flood (153.5 masl) with a manageable amount of seepage towards the Whale Tail Pit.

Fill placement on the Mammoth Dike was completed in mid-March 2019. As for the WRSF Dike, the Mammoth Dike was designed to be built during winter to promote the freezing of FFAB materials to enhance its performance (SNC-Lavalin, 2018d; SNC-Lavalin, 2018e). The instrumentation installation was completed in early May 2019 with three thermistors strings located in the deepest section of the foundation.

2.3 Other Structures

2.3.1 Main Dewatering Ramp

The main dewatering ramp was built next to the Water Treatment Plant (WTP) pad, located east of the Whale Tail Pit. Its main purpose is to have access to the attenuation pond for the dewatering equipment required to dewater the Whale Tail North Basin. Since the dewatering was ongoing by the time of the inspection, the final access ramp was not constructed yet. The western end of the temporary pad was approximately 120 m from the initial shoreline. The ramp was constructed using run 0-1000 mm material.

AEM reported that they encountered some complications during the construction of the ramp initiated in March 2019. It is envisioned that some massive ice sheets were entrapped within the foundation during the winter construction. This may have led to the significant sinkholes that appeared at the surface of the ramp at spring time. Because the stability of the ramp was compromised, AEM decided to build a second access road location just north of the original ramp by paying great attention to clean the foundation from any snow and ice. The second access was constructed in July 2019 on unfrozen lakebed materials.

2.3.2 Saline Protection Ditch

The Saline Protection Ditch was designed to prevent runoff water, which becomes saline when coming in contact with the waste rock stockpile from the underground mining, from being released in the environment without proper treatment. The ditch engirdles the underground waste rock stockpile, collecting all runoff water from the saline generator material and redirects that water towards the attenuation pond “A-P5” located west of the stockpile.

The ditch is lined with a bituminous geomembrane that is anchored in 0-20 mm material located on the crest on each side of the ditch. Riprap with a nominal size of 150 mm covers the liner on the slopes and bottom of the ditch.

By the time of the inspection, the construction of the Saline Protection Ditch was partially completed. The 235-metre-long section of the ditch located south of the stockpile was considered final by AEM, whereas the extent of the ditch located northeast of the stockpile was not completed, thus not considered for the 2019 inspection.

2.3.3 Site Haulage Road

The Site Haulage Road of the Whale Tail Project starts at the east of the Amaruq mine site, which corresponds to the end of the 62.5-km-long haul road from Meadowbank to Amaruq. Road 20 goes from that point and reaches the easternmost point of the Whale Tail Pit expansion footprint, north of the attenuation pond. Road 20 also covers the distance from the Waste Rock Storage Facility to the southwestern end of the pit footprint, east of Mammoth Dike.

Road 10 goes from the eastern end of Whale Tail Dike and reaches Road 20 at the west end of the Whale Tail permanent camp. Road 10 also goes north from Road 20 west of the exploration camp all the way to the permanent freshwater pump station in Nemo Lake. It also encircles the north of Whale Tail Pit and reaches Road 20 west of the pit. Road 10 also covers the distance from Mammoth Dike to the emulsion plant.

Finally, Road 15 goes from the western end of Whale Tail Dike and reaches Road 20 southwest of Whale Tail Pit.

All these roads were inspected within the scope of this mandate except the section of Road 20 from the WRSF to the southwestern end of the pit footprint. It should also be noted that the haul road from Meadowbank to Amaruq was excluded from the mandate.

The road surface is made from 0-20 mm material and safety berms were constructed in accordance with AEM standards. The water on site is managed using corrugated steel pipes.

2.3.4 Amaruq Bulk Fuel Storage Facility

The main fuel storage facility at the Amaruq site is located north of the Whale Tail permanent camp. It consists of a fuel tank with a capacity of 1.5 million of litres sitting on a bedding of 0-20 mm material, which is underlain by a bituminous geomembrane. The liner covers the whole surface of the tank up to the crest of the surrounding ditch. The 0-20 mm bedding sits on a 500-mm layer of 0-150 mm underlain by 0-1000 mm rockfill material. The external slopes are globally around 1.5H:1V.

The dimensions of the confinement area around the tank are approximately 90 m by 45 m; however, the inspection focused on the fuel tank pad and its surrounding collect ditch which covers an area of 45 m by 45 m.

2.3.5 Fuel Storage Facility #2

The second fuel storage facility is located within the permanent camp area, southeast from the camp main entrance. It is a much smaller facility with 4 tanks of 50,000 litres of capacity each. A bituminous geomembrane confines the tanks in an impervious area.

2.3.6 Construction Pads

2.3.6.1 Water Treatment Plant (WTP) Pad

The WTP Pad was partly constructed using crushed rock material and from esker material, which consists of sand and small rounded cobbles. The thickness of the embankment varies from around four to seven

metres, increasing following the natural topography of the tundra going southwest. The pad houses the water treatment plant of the Whale Tail Project.

2.3.6.2 Nemo Lake Pad

The Nemo Lake Pad is a two-metre-thick construction pad made from crushed rock and esker material. It houses the freshwater pump station, the intake of which is located in Nemo Lake. The pad was constructed on the tundra.

2.3.6.3 Emulsion Plant Pad

The emulsion plant pad is located around 300 m south of Mammoth Lake. It houses the emulsion plant used for the making of explosives. The pad is around one to two metre thick. It was constructed in a field of boulders with a base layer of esker material and a surface layer of crushed rock.

2.3.7 Diffusers

The diffusers were installed in the Mammoth Lake in May 2019. As per AEM, the intended design was for the diffuser lines to stall at the bottom of Mammoth Lake. However, the pipes were floating as the surface of the water, so AEM will eventually have to reinstall the diffusers.

3.0 OBSERVATIONS MADE DURING THE INSPECTION

The inspection of the major earthworks of the Whale Tail Project was conducted from July 16 to July 18, 2019 by Yohan Jalbert and Mathieu Durand-Jézéquel from SNC-Lavalin. They were accompanied by Pier-Éric McDonald from AEM for WTD and the structures described in Section 2.3.

Figure A-1 presented in Appendix A shows the localisation of the structures inspected within the scope of this mandate as well as the localisation of the different observations made during the 2019 inspection. Figure A-2 to Figure A-9 show close-up views of the observations made on specific structures. The observations are numbered from 1 to 85 and each number gathers similar observations made on a given structure. For example, observation #1 refers to cracking observed at the surface of the WTD and appears six times on Figure A-2, which means that similar observations were made at six locations along the dike.

The four priority levels ranged from 4 to 1, the latter being the most critical. The priority level definitions and their occurrences in the 2019 inspection are listed in Table 3-1.

Table 3-1: Priority level definitions and occurrences in the 2019 inspection

Priority Level	Definition	Number of Occurrences
P-1	A high priority or actual structure safety issue considered immediately dangerous to life, health, or the environment; or a significant risk of regulatory enforcement.	1
P-2	If not corrected, could likely result in structure safety issues leading to injury, environmental impact, or significant regulatory enforcement; or a repetitive deficiency that demonstrates a systematic breakdown of procedures.	10
P-3	Single occurrences of deficiencies or non-conformance that alone would not be expected to result in structure safety issues.	27
P-4	Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.	47

Appendix B presents a table summarizing all the observations and their corresponding corrective actions recommended by SNC-Lavalin. Detailed information with regards to each observation including a description of the feature affecting the performance of the structure, recommended corrective measures with its corresponding priority level and geolocated photograph(s) are presented in the form of descriptive sheets in Appendix C. The content of Appendix A and Appendix B was sent to AEM by email on July 31, 2019.

3.1 General Points

The 2019 geotechnical inspection was the first one conducted by SNC-Lavalin for the Whale Tail Project. The construction of most of the major earthworks such as the dewatering and water management dikes were mostly completed in early 2019. All the structures were inspected by a third party for the first time.

The weather conditions during the inspection varied between 10 to 20 °C with small rain events. AEM mentioned that the Amaruq site received significant rain events in the past few weeks that led to challenges for the water management during this first year of operation.

In general, the visual conditions of the structures were considered satisfactory. As shown in Table 3-1, one observation requires an immediate action from AEM. This observation is related to the site haulage road (Section 3.3.3).

SNC-Lavalin recommends AEM to start compiling all the observations made during routine inspections in an operational register for every structure. Each register would compile the following information:

- Geolocated defects observed during the course of the periodic inspections;
- A follow up of the evolution of the defect over time (e.g. measuring the width of tension cracks or survey the elevation of settlements at periodic inspections);
- Monitoring of the corrective actions taken over time, if any.

Operational registers would ensure an effective monitoring of the major earthworks and would ease the follow up of the threshold criteria for the Trigger Action Response Plan (TARP) for every structure subject to Water Management Infrastructure TARP.

It has been mentioned previously that the alert level for the Whale Tail Dike had been raised to yellow on May 7, 2019 due to an inferred seepage rate (discrepancy between Whale Tail North water level and estimate level from pumping rate). However, on May 7, 2019, SNC-Lavalin mentioned that the alert level should have been raised to orange based on the TARP criteria in force at the time of the first evaluation of seepage. It is recommended to review/improve internal procedures so that they are more easily implemented by operators. Better procedures would allow to raise the alert level rapidly once an anomaly is detected or inferred by simplifying operators' decision making when a situation presents itself. This should be applicable for all infrastructure.

Finally, it is recommended to prepare a special training for employees who have to work nearby these infrastructures. A trained employee may be able to detect and report abnormal situations.

3.2 Water Retention and Dewatering Structures

Some recommendations can be extended to all the dikes such as the installation of a stake in the upstream slope of the dike to monitor the upstream water level during routine inspections. The operational and maximum water levels should be clearly indicated on the stake. This best practice would allow all the AEM personnel to be able to monitor the water level during site visits and react if unexpected rise or drop of the water level occurred. In addition, some instrumentation shelter doors are not equipped with a proper handle and they are kept shut using steel wires. The installation of handles to properly secure shelter doors especially during winter blizzards is recommended.

3.2.1 Whale Tail Dike

As mentioned in Section 2.2.1, fill placement was not completed up to the final elevation of the dike (159.0 masl per design). By the time of the inspection, rockfill placement was ongoing from the west

abutment proceeding eastward. Most of the observations on the crest where thus made at the cut-off wall elevation of 157.0 masl.

There was a significant amount of crushed rock contaminated with cement due to the construction of the secant pile cut-off wall and curtain grouting activities. Cleaning of deleterious materials was ongoing by the time of the inspection. Therefore, some part of the observations on the platform at 157.0 masl can be attributed to the presence of cementitious materials in the soil matrix (e.g. cracking due to desiccation at the surface). Most of the cracking occurred several metres upstream or downstream from the cut-off wall, except for shrinkage cracks around CB piles and cracking along the grout casings located 0.7 m upstream from the centerline. SNC-Lavalin recommends proceeding with final earthworks up to the final elevation of the dike as soon as possible in order to protect the cut-off wall from thawing.

Several seepage pathways were observed along the Whale Tail Dike, mostly from 0+420 to 0+680 m. Some of the seepage flows were turbid especially in the easternmost section of the dike (in the 0+680 m area). Water was flowing through the lakebed material and some v-notch weirs were installed in the major pathways to monitor seepage rate.

Four observations with a priority level of P-2, which are related to seepage monitoring, were noted for the Whale Tail Dike. They can be summarized as follows:

- Monitor and quantify the seepage rate flowing through the WTD. This can be done by digging a ditch along the downstream toe of the dike to collect all seepage waters and estimating the seepage rate by installing V-notch weirs;
- Evaluate the water quality of seepage water, especially around station 0+675 where greyish water was observed. Confirm if the water actually contains cement particles and monitor any change of water quality over time.

The presence of a dump of waste CB material was noted in the vicinity of observed greyish seepage. AEM should clean the area from cement and contaminated water as the dump is a potential source for migration of cement through the V-notch weirs used to monitor seepage water.

The full list of observations and suggested corrective actions for the Whale Tail Dike can be found in Appendix C in observation sheets 1 to 22.

3.2.2 North East Dike

The general condition of North East Dike is good, even though is the TARP level was Orange for “High Risk Situation” during the inspection. Per AEM, the TARP level of the NE Dike was increased to Yellow on July 5, 2019 due to the upstream water level being above the maximum normal operating level. The next day, the TARP level was increased to Orange due to potential liner overtopping.

AEM mentioned that the presence of water ponding at the downstream toe may be due to local overtopping of the bituminous geomembrane when the upstream water level reached its maximum level. The water level had dropped to 156.47 masl on July 14, 2019 and no visual evidence could allow to conclude that the liner had been overtopped at the time of the inspection. No seepage was observed during the inspection; nevertheless, SNC-Lavalin recommends promoting drainage at the downstream toe area of the dike to be able to monitor potential seepage channels (if any) and to protect the permafrost close to the infrastructure.

During the inspection, the water was pumped from the upstream to the downstream. The discharge point of the pump was far enough from the structure to avoid any permafrost disturbance locally.

Minor deformations such as tension cracking along the upstream berm most likely due to thawing of the underlying tundra were observed. However, some settlements were observed on the crest close to the upstream safety berm. AEM should locate the position of the settlement with regards to the position of the bituminous geomembrane underneath to assess if the liner could be subject to tensile stresses. Some deformations along the downstream slope should also be monitored, especially where water is ponding at the downstream toe of the structure.

It is expected that most of the foundation was still in the frozen state by the time of the inspection. Therefore, additional deformations are expected within the next few weeks as the thaw front penetration continues.

The full list of observations and suggested corrective actions for the North East Dike can be found in Appendix C in observation sheets 23 to 31.

3.2.3 WRSF Dike

In general, the condition of the WRSF Dike was also good despite the water level in the WRSF Pond being above its operational level of 155.4 masl. This leaded to an increase of the TARP level to Yellow for “Areas of concern” on June 28, 2019.

As for the NE Dike, minor deformations were noted along the upstream platform of the WRSF Dike. AEM should monitor the evolution of cracking along the HDPE dewatering pipe during periodic inspections. If additional deformations are noted or if a slip surface is initiated, the berm may need to be reprofiled or the slope gentled once the WRSF pond is emptied.

On the crest, most of the cracking is located around the instrumentation shelter. There was also an exposed thermistor cable with some visible damage on the cable sheath that should be protected shortly.

Small amounts of water ponding were observed at the downstream toe of the dike. There was no evidence of any seepage in the downstream. However, it is recommended to construct channels downstream of the dike to collect any seepage of contaminated water, if appropriate. According to the thermistor string installed in the foundation, the WRSF Dike is still in frozen conditions. More deformations are thus expected within the next few weeks as the thaw front penetration continues.

The full list of observations and suggested corrective actions for the WRSF Dike can be found in Appendix C in observation sheets 32 to 41.

3.2.4 Mammoth Dike

Very minor deformations were noted on the Mammoth Dike, which is overall in very good conditions. However, there was a significant amount of water ponding against the downstream toe. Water infiltrating from the pervious side of the structure may lead to thawing of the dike that is currently frozen and impact its performance with time, in addition to increasing seepage into the Whale Tail Pit. It is recommended to dry the downstream toe of the structure by pumping or draining the water out.

The Mammoth Dike is operated within normal operating range.

The full list of observations and suggested corrective actions for the Mammoth Dike can be found in Appendix C in observation sheets 42 to 49.

3.3 Other Structures

3.3.1 Main Dewatering Ramp

As mentioned in Section 2.3.1, the dewatering of the WTNB was ongoing by the time of the inspection. The ramp leaded to a temporary pad used for the pumps and pipes required to lower the water level of the WTNB.

During the inspection, the WTNB water level was approximately eight metres above its operational level. According to AEM, the height of the embankment was approximately 10 m with a freeboard of about 2-3 m. It is envisioned that the construction of the pad in these conditions led to steeper slopes underwater due to the higher angle of repose of submerged rockfill material. SNC-Lavalin believes that these conditions make the current configuration of the dewatering ramp unstable. The dewatering of the WTNB could lead to screes and superficial rockfill slope failures that will compromise the safety close to the embankment slopes. It is recommended that AEM reviews the design of the main dewatering ramp. The stability of the ramp should be monitored closely and the ramp should be rerouted if instability conditions are confirmed.

The full list of observations and suggested corrective actions for the main dewatering ramp can be found in Appendix C in observation sheets 50 to 52.

3.3.2 Saline Protection Ditch

As mentioned in Section 2.3.2, observations were made on the completed part of the saline ditch located south of the underground waste rock stockpile.

Significant cracking was observed along the ditch in the 0-20 mm material with cracks more than 100-mm wide. These instabilities may be due to the steep slopes in the ditch or lack of compaction in the 0-20 mm material. There were also some locations were the end of liner panel was exposed. The design should be reviewed to validate the side slopes, 0-20 mm compaction and anchor requirements.

Toward the outlet of the ditch, there was a blocked culvert that caused water accumulation southwest from the stockpile. Despite the two PVC pipes going through the pipe, the culvert should allow water to flow freely toward the AP5 pond to avoid permafrost degradation.

The full list of observations and suggested corrective actions for the saline protection ditch can be found in Appendix C in observation sheets 53 to 57.

3.3.3 Site Haulage Road

The overall conditions of haul roads at the Amaruq site was very good; running surface was smooth, the slope of the crown promoted drainage and safety was ensured by appropriate road signs and safety berms.

Most of the culverts used to manage water under the road were performing well even if minor corrective measures can be brought to improve the layout of the structures. Considering the previous rain events, the site haulage road was very well drained, and the surface was smooth. However, some areas needed a

review of the local water management plan due to blocked culverts following the widening of the road, for example.

In particular, the area south of the west abutment of North East Dike was not well drained. There was water ponding against the north side of the road and two significant depressions were observed on the north edge of the road at this location. These depressions should be corrected immediately as this is a priority 1 due to health and safety concern of using this side of the road. Water management should be reviewed in this area since the adverse conditions caused by lack of drainage may have caused significant subsidence of the haul road.

The full list of observations and suggested corrective actions for the site haulage road can be found in Appendix C in observation sheets 58 to 65.

3.3.4 Amaruq Bulk Fuel Storage Facility

A common observation made for the two fuel storage facilities is that the liner was exposed and left unprotected to weather conditions. The design of the facilities should be reviewed to make sure that the liner was meant to stay unprotected, which could depend on the service life of these infrastructures.

Nevertheless, it is best practice to cover the bituminous geomembrane with fine material such as 0-20 mm crushed rock to protect the liner from weathering (including thermal expansion associated with solar radiation), debris or wildlife.

In general, the 0-20 mm bedding of the fuel tank seemed in good conditions without any significant settlement or cracking. However, many signs of instability were observed on the external slopes (e.g., west, north and east fill slopes). The 0-20 mm material appeared to be in the loose state that could have contributed to the significant cracking observed on the crest and within the slopes. Moreover, the slopes looked sometimes steeper than the angle of repose of the uncompacted 0-20 m material which lead to minor slope failures. AEM should monitor the stability of the crest and the external slopes and consider re-profiling with gentler slopes and compacting the 0-20 mm material, if required.

Lack of material was also noticed on the crest for the anchor of the liner and under the liner as well, where tensions in the liner were observed at some locations. The geomembrane should be properly anchored in compacted 0-20 mm material to prevent crest instabilities and high winds to lift the liner from the ground.

Water ponding was observed at the northwest end of the facility at the toe of the external slope. If possible, a small ditch should be dug to promote drainage away from the toe to avoid permafrost degradation in that area that could potentially lead to additional slope instability. The discharge point of the pump should also be further from the slope in the tundra to avoid water ponding (and permafrost degradation) close to the structure.

The full list of observations and suggested corrective actions for the Amaruq bulk fuel storage facility can be found in Appendix C in observation sheets 66 to 75.

3.3.5 Fuel Storage Facility #2

Most of the liner surface of the second fuel storage facility located close to the permanent camp was exposed. The liner was damaged at some locations (in the slope) and the membrane should be patched. The objects that may damage the liner should be removed from the surface of the membrane.

It was also noted that there was very little freeboard between the water ponding at the southwest corner of the structure and the fuel tanks. The design of the facility should be reviewed for the operating water level and the minimum freeboard requirements.

The full list of observations and suggested corrective actions for the secondary fuel storage facility can be found in Appendix C in observation sheets 76 to 79.

3.3.6 Construction Pads

3.3.6.1 Water Treatment Plant (WTP) Pad

In general, the pad was straight without significant deformations except for some cracking observed close to the northwest slope. Some instabilities were noted in the slopes made of round boulders from the esker material, which requires a gentler slope compared with the use of crushed rock. The stability of the slope should be monitored and reprofiled using a gentler slope, if required.

Some small puddles of water were also noticed at the toe of the unstable slopes, which could lead to permafrost degradation locally. The drainage at the toe of the slopes should be promoted to avoid additional instability of the slopes.

The full list of observations and suggested corrective actions for the WTP pad can be found in Appendix C in observation sheets 80 to 82.

3.3.6.2 Nemo Lake Pad

The pad was straight and slopes were stable. No evidence of deformation was observed. More details are presented in observation sheet 83 in Appendix C.

3.3.6.3 Emulsion Plant Pad

The pad was straight and slopes were stable. No evidence of deformation was observed. More details are presented in observation sheet 84 in Appendix C.

3.3.7 Diffusers

Because the diffusers will have to be reinstalled, no observations were made within the scope of the inspection. More details are presented in observation sheet 85 in Appendix C.

4.0 INSTRUMENTATION DATA ANALYSIS

The instrumentation data analysis presented in this section, including thermistor, inclinometer and piezometer data, is based on AEM's Amaruq Instrumentation Report attached in Appendix D. The data are available up to August 22, 2019. The water level raw data were transmitted to SNC-Lavalin on July 15, 2019.

4.1 Whale Tail Dike

4.1.1 Whale Tail Lake Water Level

On July 14, 2019, the upstream water level (Whale Tail South) was 155.40 masl and the downstream water level (Whale Tail North) was 149.92 masl. The water levels of South and North basins compared with the water balance provided by Golder are shown on Figure 4-1.

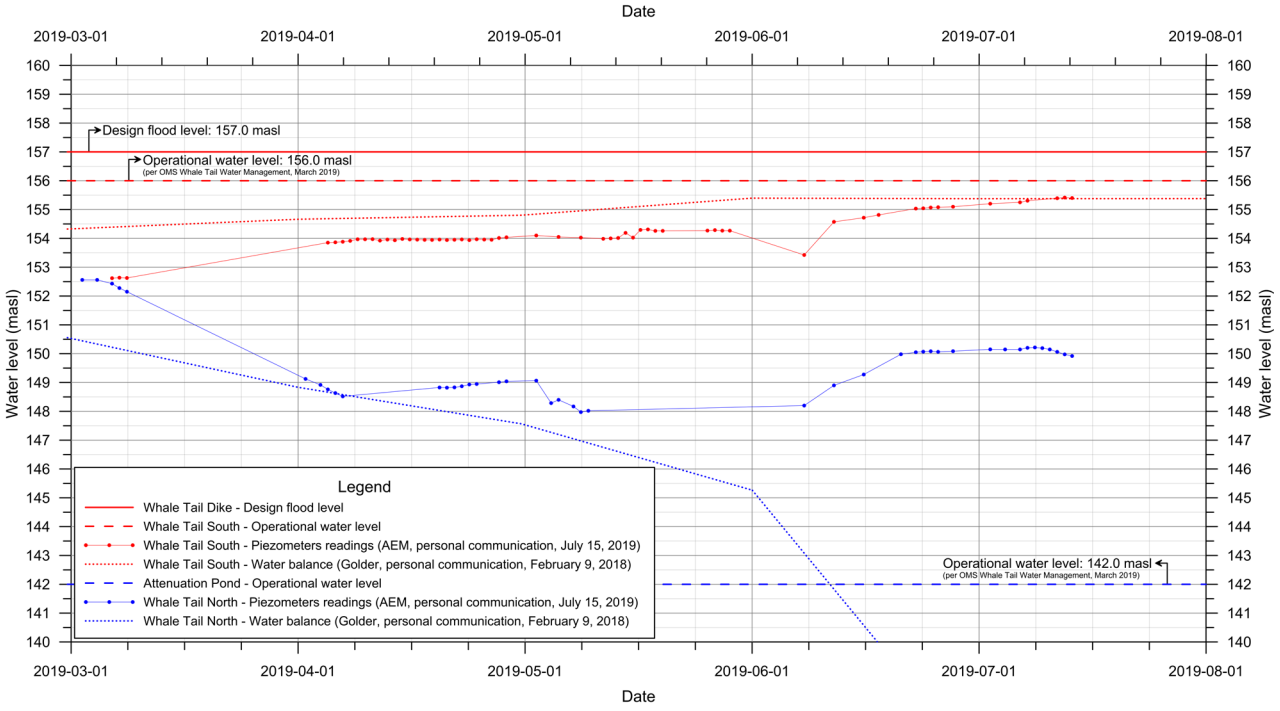


Figure 4-1: Water level of Whale Tail Lake (North and South basins)

The water balance provided by Golder shows the expected water levels of the North and South basins over time. Monthly water level data are based on several assumptions, such as the start of the dewatering of Whale Tail Lake (North Basin) in March 2019.

The latest data show that the upstream water level was 0.60 m below its operational level. Since April 2019, the water level of Whale Tail South was generally following the model from Golder. The downstream water level is still approximately eight metres above the operational water level of the attenuation pond.

4.1.2 Inclinometers (SAA)

Four inclinometers were installed within the CB cut-off wall, from the top of the secant pile wall and socketed several metres in bedrock. The inclinometers were the only instruments that were installed directly within the cut-off wall, whereas the other instruments were installed either upstream or downstream of the wall.

In general, the deflections observed within the cut-off wall occurred within the last month of data recording (July-August 2019) and were under 20 mm.

The inclinometer located close to the west abutment (station 0+205) shows a trend of the cut-off wall tilting toward the west abutment but deformations are still small (generally under five millimetres). In the other axis, the readings show that the wall was slightly tilting upstream in April/May. However, a clear trend of the whole wall tilting downstream can be observed since June/July with the base of the inclinometer at elevation 144 masl acting as a pivot point. The maximum deformation of 17 mm is observed at the top of the cut-off wall.

The inclinometer installed in the deepest part of the cut-off wall at station 0+366 showed the most stable readings; only a slight trend of the cut-off wall tilting downstream was noted. Incremental displacement readings were under three millimetres along the whole cut-off wall.

At station 0+560, the inclinometer was stable until July, then shows a clear trend of the wall tilting upstream (marked above bedrock) and toward the east abutment. The maximum deflection of the inclinometer was approximately 11 mm, 2.5 m below the pile surface. In addition, displacements were observed in bedrock in August, which correspond to the rapid thawing that occurred within the foundation during that period as shown on the thermal profile of the inclinometer.

At the east abutment (station 0+726), the top part of the cut-off wall (above elevation 152 masl) was tilting upstream until August, then stabilized at a deflection close to 20 mm at the top part of the wall. On the other hand, the wall is generally tilting downstream below 152 masl especially at the surface elevation of the bedrock. In the longitudinal axis, since August, the top two metres of the cut-off wall is tilting westward whereas the wall tilts eastward under elevation 154 masl.

Minor deflections of the cut-off wall were monitored during the first thawing season after the construction of the dike. The stress analyses conducted on the WTD (SNC-Lavalin, 2018a) predicted marginal deflections of the wall in the centre section of the dike. However, deflections up to 45 mm were computed for the dike located close to the east abutment. The deflections recorded by the inclinometers are within the expected operational range for the WTD. However, in light of these early readings, deflection rates should be evaluated during periodic interpretations of the data.

It should be noted that except for SAA 0+366, all inclinometers show movement for sectors anchored into the bedrock where it is expected to have little to no displacement. SAA 0+726 shows displacements up to 8 mm in the upper bedrock.

4.1.3 Piezometers

Three lines of piezometers (two located downstream and the third located upstream) were installed at three chainages along the WTD. Each line has three piezometers at three different depths generally located (A) below the grout curtain base elevation, (B) at mid-depth of the grout curtain and (C) at the bedrock surface.

Piezometers were installed in the talik zone from station 0+260 to 0+440. The intent was to avoid the installation of piezometers in permafrost that would lead to malfunction due to freezing.

For the section at 0+260, the downstream piezometers (P1 and P2 series) show similar trends with water head varying from approximately 150.7 to 152 masl since April 2019. The downstream piezometers roughly follow the downstream water level variation with time. On the upstream side, the top piezometer (PZ-3C) follows the upstream water level evolution, whereas the deeper piezometers (PZ-3A and PZ-3B) follow the downstream water level trend. Piezometers located at similar elevations (A and B series) show very similar water head evolution, regardless of being located upstream or downstream of the cut-off wall. Starting mid-July 2019, noise can be observed in the signal from piezometer PZ-1C; it is envisioned that the piezometer can be either dry or frozen.

Piezometers at station 0+360 show similar trends compared with those at station 0+260; the A and B series roughly follow the downstream water level, even for the piezometers located upstream of the cut-off wall. PZ-1C readings do not follow neither the upstream nor the downstream water level since the beginning of the monitoring. PZ-3C gave expected readings at the very beginning of the dewatering in March. However, since mid-March 2019, the trend and the stability of PZ-3C are uncertain. For both piezometers PZ-1C and PZ-3C, it is recommended to continue the monitoring of these piezometers; but keeping a certain doubt about the data.

In general, the downstream piezometers at 0+440 roughly follow the downstream water level apart from PZ-1B which does not follow any clear trend. This piezometer, along with PZ-1A and PZ-2C, have noise in their signals. It should also be noted that the data from the PZ-2 piezometers were not available for around eight days at the end of July – beginning of August 2019. For the upstream piezometers (P3 series), the bottom piezometer PZ-3A seems to follow the downstream basin elevation whereas PZ-3B and PZ-3C follow the upstream water level. It should be noted that a pressure spike was observed for PZ-3B at 0+440 at the same date than PZ-1C and PZ-3C at 0+360 but at a much lower amplitude.

Following the piezometer data analysis, SNC-Lavalin does not foresee major deficiencies indicated by piezometer readings as of August 22, 2019.

4.1.4 Thermistors

The Whale Tail Dike is instrumented with 20 permanent thermistor strings, four of which are located directly within the cut-off wall (built-in beads within the SAA). They are listed in Table 4-1.

Thermistor string at station 0+142 shows that the west abutment is still in the frozen state downstream of the cut-off wall. The bedrock temperature is stable since June 2019 at approximately -3 °C.

At station 0+190, the bedrock has warmed up significantly since July; the bedrock temperature has risen from around 0 °C in May to 13 °C in August. Since the thermistor string is located upstream of the cut-off wall in pervious material, the heat intake may come from the rise of the water level in Whale Tail South Basin.

The thermal profile located within the CB cut-off wall at 0+205 is obtained with the inclinometer and shows a warming trend since July 2019, especially in shallow bedrock at elevation 147 masl where a flow through the foundation can be inferred. However, the top four metres of the cut-off wall is still frozen as of August 22, 2019.

Table 4-1: List of permanent thermistor strings installed at the WTD

Station	Offset from centerline† (m)	Base elevation (masl)	# capacitive beads‡ / # active beads
0+142	-1.91	144.75	2 / 13
0+190	1.93	140.42	0 / 11
0+205	0	144.14	0 / 28
0+210	-2.18	142.00	6 / 13
0+260	-1.87	127.00	3 / 13
0+276	10.12	145.31	0 / 13
0+310	-1.96	127.00	0 / 13
0+336	2.25	142.40	0 / 13
0+360	-1.97	127.00	2 / 13
0+366	0	139.91	0 / 36
0+407	-1.95	127.00	4 / 13
0+453	-1.99	126.90	1 / 13
0+520	-1.97	127.00	2 / 13
0+560	0	141.68	0 / 32
0+607	-1.99	127.00	4 / 13
0+675	-2.00	142.01	0 / 13
0+710	1.97	142.07	1 / 16
0+726	0	142.26	0 / 30
0+750	1.96	142.00	0 / 16
0+772	-1.98	142.00	3 / 13

†Negative value (blue) = downstream; positive value (red) = upstream; 0 = within the CB cut-off wall

‡Capacitive effect in thermistor beads leads to incorrect readings generally resulting in higher values

The next thermistor string located five metres east at station 0+210 cannot be interpreted properly since there are too many beads associated with capacitive effect. It is recommended to add another thermistor string at that location.

At station 0+260, the readings are quite stable and do not seem to be linked with warm water from the upstream basin; only a slight warming trend can be observed in upper bedrock. The bedrock temperature varies from two to three degrees Celsius.

The thermistor string at station 0+276 is located in the rockfill material around ten metres upstream of the cut-off wall. The temperature profile is strongly affected by the nearby open water temperature as most of the beads are below the WTSB water level. The warming trend is similar to 0+190 where most of the heat intake was observed in July following the spring freshet. As of August 22, 2019, the embankment temperature is in the 12-13 °C range, whereas shallow bedrock ranges from five to ten degrees Celsius.

At station 0+310, a warming trend can be observed in shallow bedrock since July 2019. The highest temperature is observed at elevation 149.0 masl, which corresponds to the first bead located under the rock socket of the cut-off wall. Because the thermistors are located downstream of the dike, this could indicate seepage in the bedrock foundation just under the impervious cut-off wall. However, the maximum temperature recorded as of August 22, 2019 is around eight degrees Celsius, which is lower than the upstream rockfill temperature recorded at 0+276 at the same date.

At 0+360, the downstream thermistor string shows a warming trend of around two degrees Celsius within a month in the embankment and shallow bedrock. However, the thermistor string located six metres east within the cut-off wall at station 0+366 shows a significant warming at two locations:

- the first one at elevation 146 masl (two metres above bedrock surface) of approximately five degrees Celsius within a month;
- the bedrock is also warming up significantly under the bottom of the secant pile at elevation ~ 140 masl.

If the latter could indicate seepage in the bedrock foundation under the secant pile wall, the former would rather indicate seepage through the CB cut-off wall. Thermistor readings may not on their own indicate with certainty a seepage flow; however, indications of seepage should be investigated in the 0+366 area.

The thermistor string at 0+407 shows a constant temperature profile since June 2019 with a shallow bedrock temperature around two degrees Celsius. The deeper bedrock temperatures cannot be analysed since the four bottom beads are related to capacitive effect.

Thermistors located downstream at 0+453 and 0+520 show a similar warming trend where the highest temperatures are observed in shallow bedrock under the bottom of the cut-off wall. Most of the warming occurred in July-August 2019 and the temperature reach the 12-13 °C range as recorded by upstream thermistor string at 0+276. This seems to follow the upstream basin temperature and may be indicative of seepage flow in the shallow bedrock foundation at these chainages.

A peculiar temperature profile was observed within the cut-off wall at station 0+560. The readings from July 23, 2019 show that the WTD was built on permafrost at a temperature of around -1.5 °C at elevation 142 masl. However, as of August 22, 2019, the temperature at elevation 142 masl rose to 12 °C within a single month at a depth of 15 m from the top of the cut-off wall. The temperature profile in bedrock in August suggests the presence of a flow of warm water at elevation 142 masl.

The thermistor string located downstream at 0+607 cannot be interpreted properly as many beads are related to capacitive effects. It is recommended to add another thermistor string at that location.

The next downstream thermistor string at 0+675 shows a warming trend since June on the whole depth, similar to the thermal profile of the upstream thermistor string located at 0+710. These two thermistor strings

indicate permafrost degradation on the eastern part of the dike and more investigation to understand the mechanism of this degradation would be required.

The easternmost thermal profile within the cut-off wall is obtained by the inclinometer and is located at station 0+726. Results show a stable temperature profile since May but a significant rise in bedrock temperature was noted in August. The rise is so drastic that the graph does not show the extent of the warm up from elevation 145 to 148.5 masl (temperatures above 10 °C are not shown on the graph). It is envisioned that the maximum temperatures should be around 12-13 °C as shown in the temperature profile of the upstream thermistor at 0+276 in August. The sudden temperature increase in bedrock could be due to warm water flowing through an open fracture as mentioned for thermistor string at 0+560. Nevertheless, the cut-off wall is still in the frozen state from 156.5 to 152.5 masl and the bedrock is frozen under elevation 143 masl.

Finally, the thermistor strings at 0+750 and 0+772 show a quite stable temperature profile since April 2019. There is no clear sign of permafrost degradation at the east end of the WTD.

In summary, the observations can be summarized according to the following points:

- The temperature is stable at the west abutment from station 0+142 going west, at the east abutment from station 0+750 going east and at station 0+407;
- A general heating trend was observed from station 0+190 to 0+366 and from 0+453 to 0+726;
- Possible seepage pathways within the bedrock foundation under the secant pile cut-off wall were noted at stations 0+310, 0+366, 0+453, 0+520, 0+560 and 0+726;
- The temperature profile from the inclinometer located at station 0+366 within the CB secant pile wall may indicate a defect of the cut-off wall as a temperature peak was noted in August 2019 two metres above the bedrock elevation.

Complementary investigations should be conducted by AEM to identify exact locations and causes of seepage within the WTD. Moreover, damaged thermistors should be replaced. The extension of the permafrost degradation in the abutments should be well monitored and understood.

4.2 North East Dike

4.2.1 North East Pond Water Level

According to the information sent by AEM, the maximum water level reached at the North East Pond was 156.66 masl on July 5, 2019. The elevation of the liner in NE Dike is 156.7 masl, which implies that the water level was at only 0.04 m below the design flood elevation. The evolution of the North East Pond water level over time is shown on Figure 4-2.

Since July 5, 2019, the water level of the North East Pond has been decreasing steadily. By July 14, 2019, the water level reached the expected elevation as per Golder's water balance. However, the water level of North East Pond has been consistently above its operational level since the start of data recording on June 14, 2019.

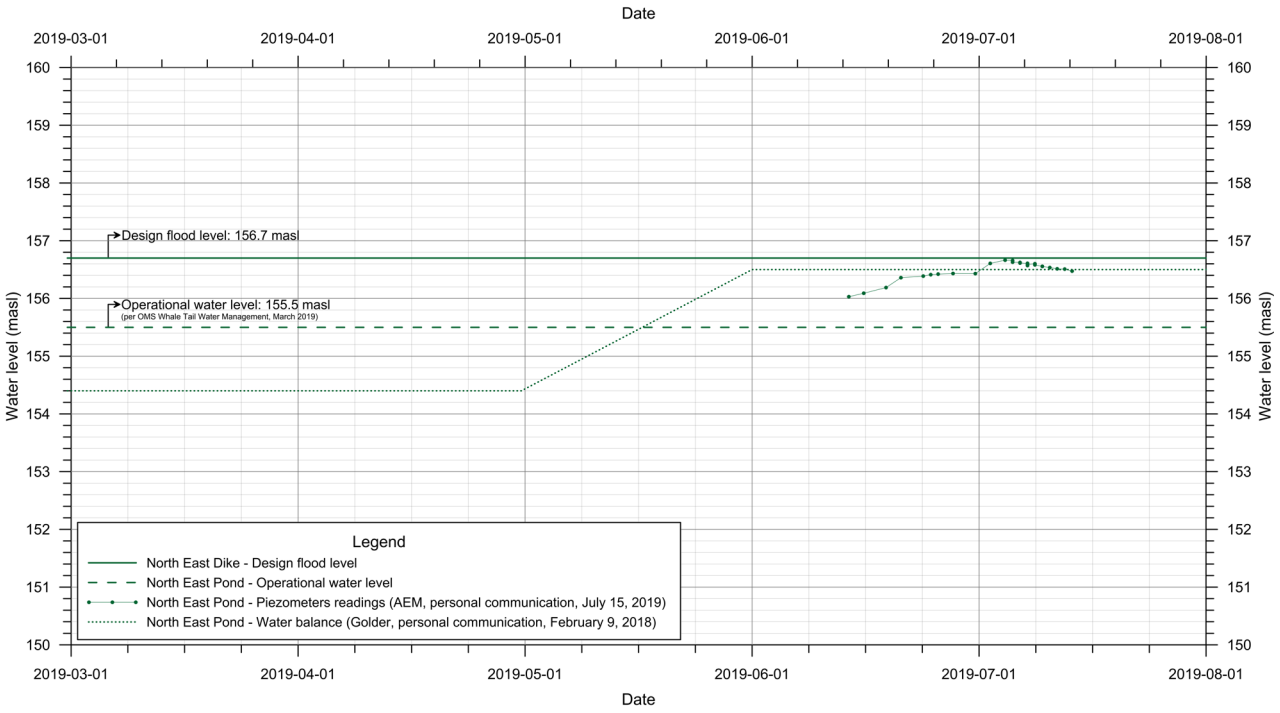


Figure 4-2: North East Pond water level

4.3 WRSF Dike

4.3.1 WRSF Pond Water Level

The WRSF Pond water level exceeded the operational elevation of 155.4 masl on June 28, 2019. The maximum water level of 155.86 masl was reached on July 7, 2019. Following this, it was agreed with SNC-Lavalin to temporarily raise the operating level in the WRSF Pond to collect runoff water from site. By July 14, 2019, the water level was at 155.73 masl. The pump was not working during the inspection of the WRSF Dike. The evolution of the WRSF Pond water level over time is shown on Figure 4-3.

Pumping of the WRSF Pond was ongoing on July 6, 2019 and allowed the water level to decrease by 0.13 m in seven days. The water level was still around two metres under the design flood elevation of 157.8 masl of the WRSF Dike.

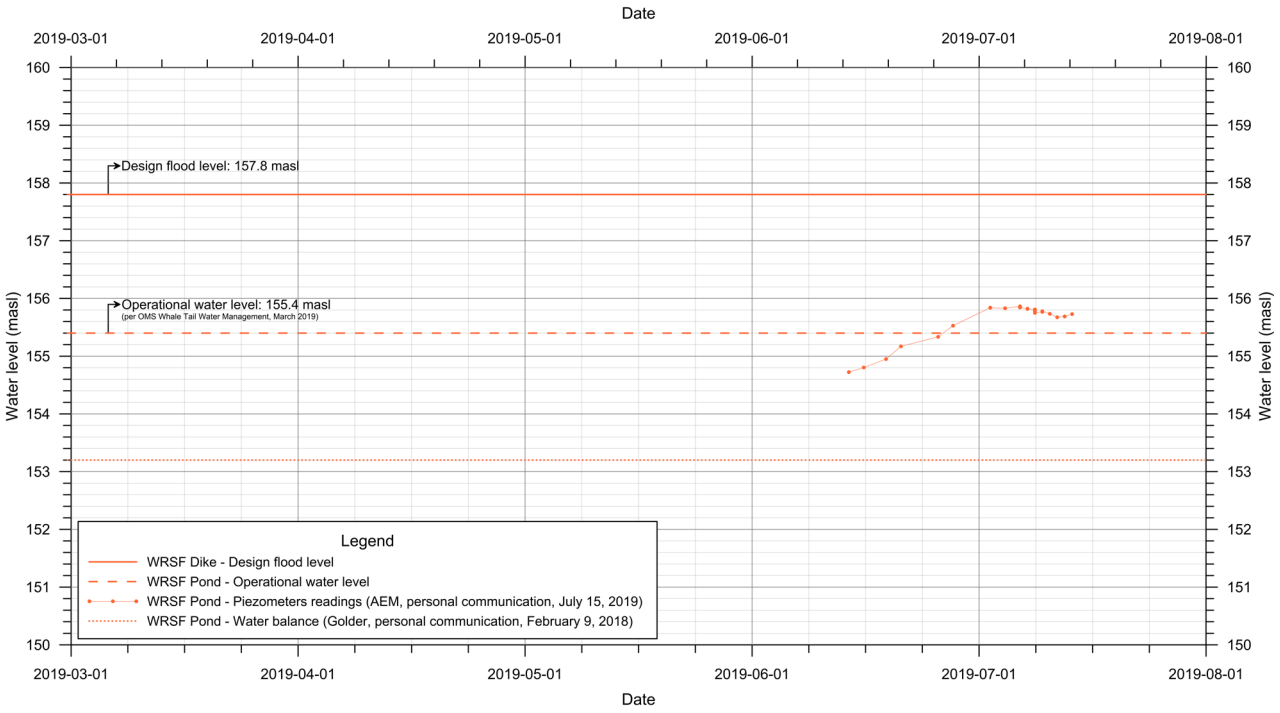


Figure 4-3: WRSF Pond water level

4.3.2 Thermistors

The latest thermistor data show that in TH-02 located on the crest, the rockfill embankment completely thawed down to the foundation as of August 22, 2019. This may suggest a certain quantity of water within the embankment as the maximum temperature was recorded at the base of the embankment. Shallow bedrock temperature increased since June 2019 but the foundation is still frozen one metre under the foundation floor.

The thermistor string TH-01 located in the fine filter slope under the BGM shows that the upstream slope thawed in July 2019. However, the FFAB in the key trench is still frozen over its thickness as also shown on TH-03, which denotes a good performance of the structure.

SNC-Lavalin would recommend to install additional instrumentation if seepage or instabilities are observed at the WRSF Dike.

4.4 Mammoth Dike

4.4.1 Mammoth Lake Water Level

The Mammoth Lake elevation is approximately one metre under the design flood of Mammoth Dike and right on its operational water level as shown on Figure 4-4.

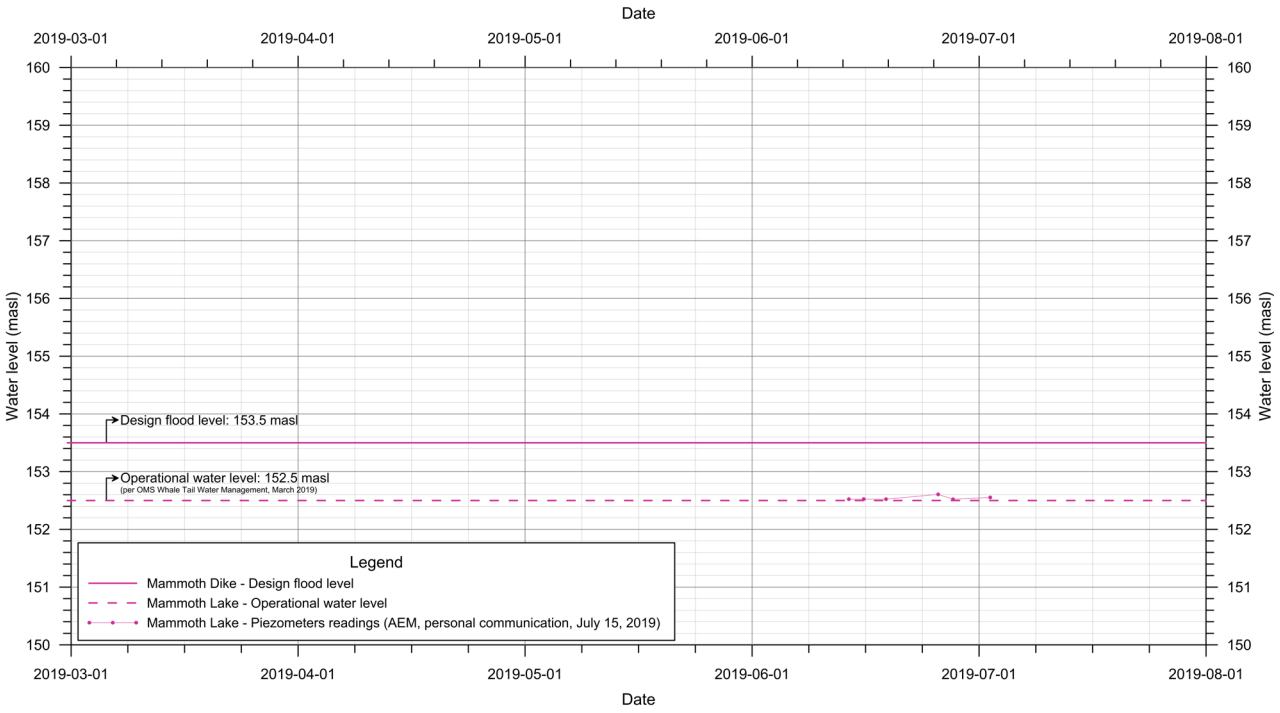


Figure 4-4: Mammoth Lake water level

4.4.2 Thermistors

According to the latest data, the thaw front penetrated the rockfill crest by about four metres in the embankment (down to elevation 151 masl), whereas the base of the embankment and the foundation are still in the frozen state. The upstream slope also thawed down to elevation 151 masl but MD TH-02 shows that the bottom of the upstream slope under the BGM is still frozen.

As for the WRSF Dike, the thermistor string located within the key trench shows that the FFAB layer is frozen over its thickness which denotes a good performance of the structure. The upper bedrock temperature profile shifted to warmer temperature but the bead at elevation 143 masl shows constant temperature since June.

Nevertheless, the overall condition of the dike cannot be assessed using thermistor readings since only a single section of the Mammoth Dike at station 0+144 is currently instrumented. SNC-Lavalin would recommend to install additional instrumentation if seepage or instabilities are observed at the Mammoth Dike.

5.0 CONCLUSION AND RECOMMENDATIONS

The Whale Tail Project 2019 annual geotechnical inspection conducted from July 16 to July 18, 2019 included the dewatering and water management dikes (Whale Tail Dike, North East Dike, WRSF Dike and Mammoth Dike) as well as other major earthworks (main dewatering ramp, saline protection ditch, site haulage road, fuel storage facilities, construction pads and diffusers).

The construction of the dikes was completed in early 2019 and their general condition was good. The dikes are well instrumented and AEM ensures a close monitoring of the instrumentation data, especially for the Whale Tail Dike.

However, some recommendations were proposed in this inspection report and the main ones are listed below:

- Start compiling all the observations made during routine inspections in an operational register for every structure (Section 3.1);
- Review internal procedures to raise the alert level rapidly once an anomaly is detected or inferred (Section 3.1);
- Prepare a special training for employees who have to work nearby these infrastructures (Section 3.1);
- Installation of a stake in the upstream slope of the dike to monitor the water level during routine inspections (Section 3.2);
- Monitor and quantify the seepage rate flowing through the WTD (Section 3.2.1);
- Evaluate the water quality of seepage water flowing through the WTD (Section 3.2.1);
- Monitor if any deformation occurs within the footprint of the BGM of North East Dike (Section 3.2.2);
- Construct channels downstream of the WRSF Dike to collect any seepage of contaminated water, if appropriate (Section 3.2.3);
- Dry the downstream toe of the Mammoth Dike by pumping or draining the water out (Section 3.2.4);
- Reviews the design of the main dewatering ramp and reroute the ramp if instability conditions are confirmed (Section 3.3.1);
- The design of the saline protection ditch should be reviewed to validate the side slopes, 0-20 mm compaction and anchor requirements (Section 3.3.2);
- Depressions observed on the site haulage road south of the west abutment of North East Dike should be corrected immediately as this a health and safety concern using this side of the road (Section 3.3.3);
- Design of the fuel storage facilities should be reviewed to make sure that the liner was meant to stay unprotected (Sections 3.3.4 and 3.3.5);
- Complementary investigations should be conducted by AEM to identify exact locations and causes of seepage within the WTD and damaged thermistors should be replaced (Section 4.1.4).

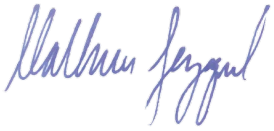
6.0 PERSONNEL

This report has been prepared by M. Mathieu Durand-Jézéquel, P.Eng., M.Sc. and revised by M. Yohan Jalbert, P.Eng.

We trust that this report is to your satisfaction. Should you have any question, please do not hesitate on contacting the undersigned.

SNC LAVALIN INC.

Prepared by:



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7.0 REFERENCES

CDA. (2013). *Canadian Dam Association, Dam Safety Guidelines.*

SNC-Lavalin. (2018a). *Updated WTD Stress Analyses.* Technical Note 651298-2300-4GER-0002_00, December 2018.

SNC-Lavalin. (2018b). *Thermal Analyses at the WRSF Dike.* Technical Note 651298-6000-4GER-0001_00, August 2018.

SNC-Lavalin. (2018c). *Design Report of WRSF Dike.* Technical Report 651298-6000-40ER-0001_00, August 2018.

SNC-Lavalin. (2018d). *Thermal Analyses at Mammoth Dike.* Technical Note 651298-5000-4GER-0001_00, October 2018.

SNC-Lavalin. (2018e). *Design Report of Mammoth Dike.* Technical Report 651298-5000-40ER-0001_01, October 2018.

Appendix A

Maps of Observations Made During the Inspection

605 000 606 000 607 000 608 000

7 257 000 7 256 000 7 255 000

N

Nemo Lake
C38
Nemo Lake Pad
84
C44
A-P47
A113
61
A40
C41
C42
A48
A-P38
C39
A-P37
A47
C40
A-P49
C-P1
A-P21
A49
Figure A-3
North East Pond
W.L. 156.47 m
2019-07-14
North East Dike
62
63
63
60
59
A50
A51
Figure A-7
Whale Tail Waste Rock
Storage Facility
A-P5
Waste Rock
Exploration Pad
58
Saline
Protection
Ditch
A53
A53
Figure A-4
WRSF Pond
W.L. 155.73 m
2019-07-14
WRSF Dike
Ore
Stockpile 1
Ore
Stockpile 2
Figure A-6
Figure A-8
Whale Tail Pit
Water Treatment
Plant Pad
Amaruq Bulk
Fuel Storage Facility
59
58
Figure A-5
64
65
Mammoth
Dike
Whale Tail
Attenuation Pond
Main
Dewatering
Ramp
Figure A-9
Whale Tail Camp
Fuel Storage
Facility #2
Figure A-2
W.L. 152.55 m
2019-07-03
Mammoth Lake
A16
Diffusers
W.L. 149.92 m
2019-07-14
Whale Tail Dike
85
W.L. 155.40 m
2019-07-14
Emulsion Plant Pad
A-P39
83
Whale Tail Lake
(South basin)
A17

PRIORITY LEVEL

- P-1 - A high priority or actual structure safety issue considered immediately dangerous to life, health, or the environment; or a significant risk of regulatory enforcement.
- P-2 - If not corrected, could likely result in structure safety issues leading to injury, environmental impact, or significant regulatory enforcement; or a repetitive deficiency that demonstrates a systematic breakdown of procedures.
- P-3 - Single occurrences of deficiencies or non-conformance that alone would not be expected to result in structure safety issues.
- P-4 - Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.

PROJECT COMPONENTS

- Dike
- Modified waterbody or pond
- Collection ditch
- Diversion ditch
- Pipe
- Open pit
- Storage facility
- Industrial area
- Road

HYDROGRAPHY

- Watercourse
- Lake

NOTES:

1. ALL COORDINATES ARE IN METRES.
2. THIS FIGURE MUST BE INTERPRETED ALONG WITH THE INSPECTION REPORT.
3. OBSERVATIONS FOR THE SITE HAULAGE ROAD, EMULSION PLANT PAD, NEMO LAKE PAD AND DIFFUSERS ONLY ARE SHOWN. REFER TO FIGURE A-2 TO FIGURE A-9 FOR SITE-SPECIFIC OBSERVATION MAPS.

AGNICO EAGLE

SNC·LAVALIN

WHALE TAIL PROJECT
2019 Annual Geotechnical Inspection

Reported Observations
General View

Sources:
Satellite image, WorldView-2, August 2015
Topography, PhotoSat, 2015
Project components : July 2019

Project: 665888
File: 665888-EG-FA1-General-191202-00.mxd

0 125 250 m
1:12 500
UTM projection, Zone 14, NAD83 (CSRS)

Rev.	Date	Drawn	Verif.	Approv.	Figure A-1
00	2019-12-02	A.C.	M.D.J.	Y.J.	

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PRIORITY LEVEL

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WHALE TAIL PROJECT
2019 Annual Geotechnical Inspection

Reported Observations
Whale Tail Dike

Sources:
Drone image, AEM, August 2019

Project: 665888
File: 665888-EG-FA2-WTDike-191202-00.mxd

0 30 60 m
1:3 000
UTM projection, Zone 14, NAD83 (CSRS)

Rev.	Date	Drawn	Verif.	Approv.	Figure A-2
00	2019-12-02	A.C.	M.D.J.	Y.J.	

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607 000 607 100 607 200 607 300 607 400

7 256 400 7 256 300 7 256 200 7 256 100

A47

North East Pond

W.L. 156.47 m
2019-07-14

North East Dike

North East Dike

N

PRIORITY LEVEL

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WHALE TAIL PROJECT
2019 Annual Geotechnical Inspection

Reported Observations
North East Dike

Sources:
Drone image, AEM, August 2019

Project: 665888
File: 665888-EG-FA3-NEDike-191202-00.mxd

0 15 30 m
1:1 500
UTM projection, Zone 14, NAD83 (CSRS)

Rev.	Date	Drawn	Verif.	Approv.	Figure A-3
00	2019-12-02	A.C.	M.D.J.	Y.J.	

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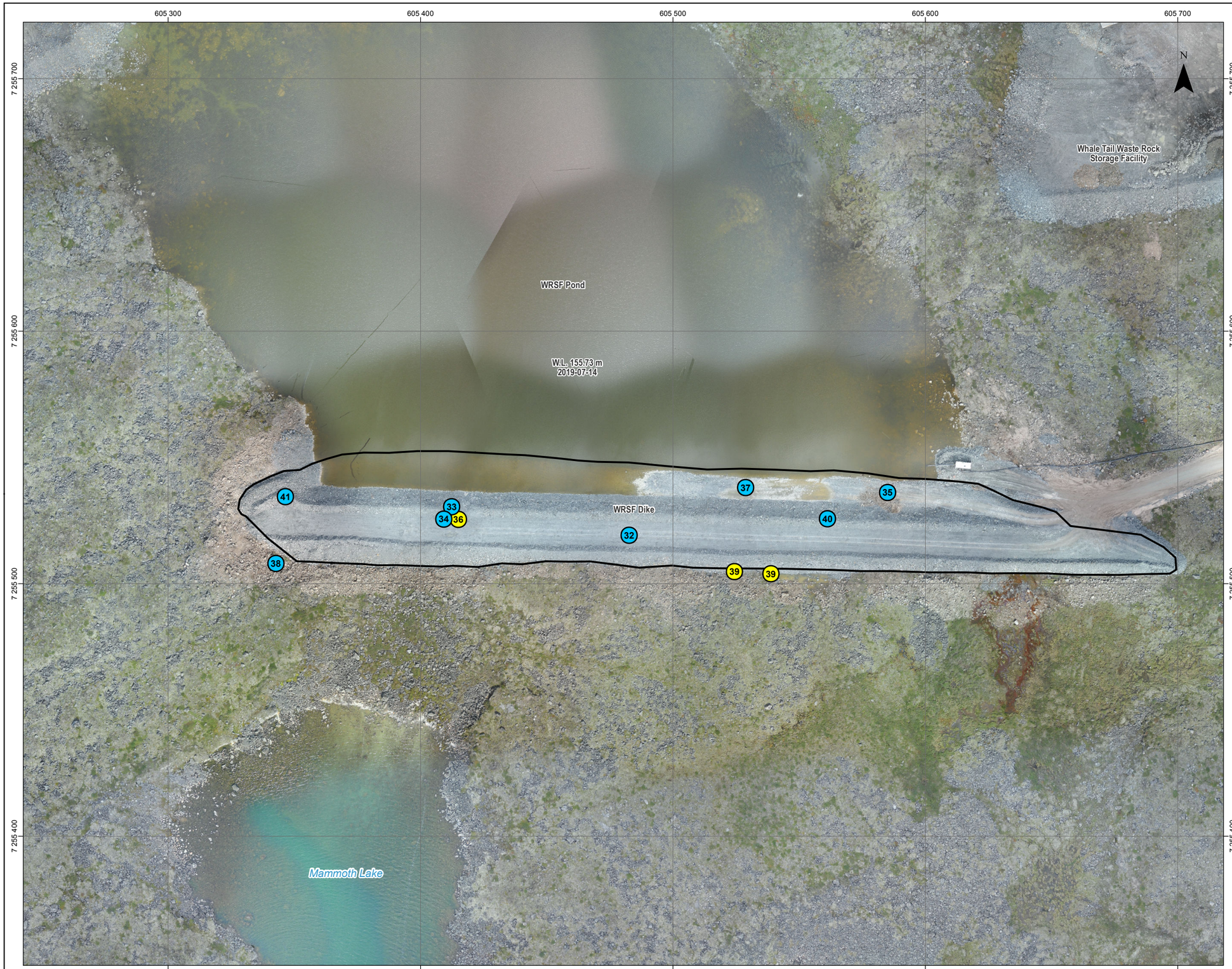

PRIORITY LEVEL

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WHALE TAIL PROJECT
2019 Annual Geotechnical Inspection

Reported Observations
WRSF Dike

Sources:
Drone image, AEM, August 2019

Project: 665888
File: 665888-EG-FA4-WRSFDike-191202-00.mxd

0 15 30 m
1:1 500
UTM projection, Zone 14, NAD83 (CSRS)

Rev.	Date	Drawn	Verif.	Approv.	Figure A-4
00	2019-12-02	A.C.	M.D.J.	Y.J.	

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605 800 605 900 606 000 606 100 606 200

7 255 200 7 255 100 7 255 000 7 254 900

N

45 44 46 49 47 48 43 42 42

Unknown Water Level

Mammoth Dike

W.L. 152.55 m 2019-07-03

Mammoth Lake

PRIORITY LEVEL

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WHALE TAIL PROJECT
2019 Annual Geotechnical Inspection

Reported Observations Mammoth Dike

Sources:
Drone image, AEM, August 2019

Project: 665888
File: 665888-EG-FA5-MammothDike-191202-00.mxd

0 15 30 m
1:1 500
UTM projection, Zone 14, NAD83 (CSRS)

Rev.	Date	Drawn	Verif.	Approv.	Figure A-5
00	2019-12-02	A.C.	M.D.J.	Y.J.	

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PRIORITY LEVEL

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WHALE TAIL PROJECT
2019 Annual Geotechnical Inspection

Reported Observations
Main Dewatering Ramp and Water Treatment Plant Pad

Sources:
Drone image, AEM, August 2019

Project: 665888
File: 665888-EG-FA6-DewaterRamp-191202-00.mxd

0 15 30 m
1:1 500
UTM projection, Zone 14, NAD83 (CSRS)

Rev.	Date	Drawn	Verif.	Approv.	
00	2019-12-02	A.C.	M.D.J.	Y.J.	**Figure A-6**

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607 300 607 400 607 500 607 600 607 700

7 256 000

7 255 900

7 255 800

A-P5

A51

N

Waste Rock
Exploration Pad

Saline
Protection Ditch

Saline
Protection Ditch

Exploration Ramp

53 53 57 55 54 56

PRIORITY LEVEL

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Diversion ditch

NOTES:

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WHALE TAIL PROJECT
2019 Annual Geotechnical Inspection

Reported Observations
Saline Protection Ditch

Sources:
Drone image, AEM, August 2019

Project: 665888
File: 665888-EG-FA7-SalineDitch-191202-00.mxd

0 15 30 m

1:1 500

UTM projection, Zone 14, NAD83 (CSRS)

Rev.	Date	Drawn	Verif.	Approv.	Figure A-7
00	2019-12-02	A.C.	M.D.J.	Y.J.	

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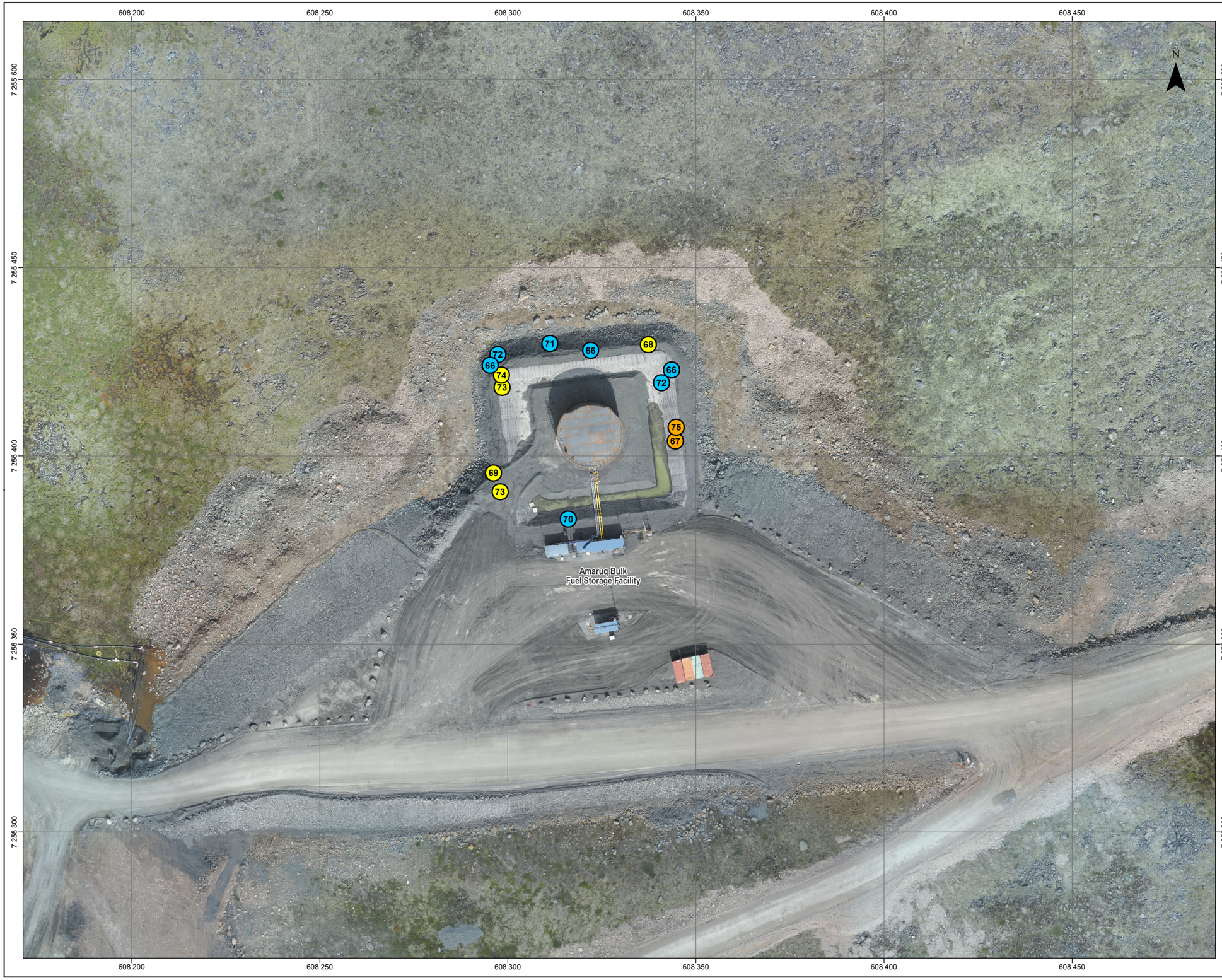

PRIORITY LEVEL

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NOTES:

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2. THIS FIGURE MUST BE INTERPRETED ALONG WITH THE INSPECTION REPORT.

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WHALE TAIL PROJECT
2019 Annual Geotechnical Inspection

Reported Observations
Amaruq Bulk Fuel Storage Facility

Sources:
Drone image, AEM, August 2019

Project: 665888
File: 665888-EG-FA8-Fuel-191202-00.mxd

0 10 20 m
1:1 000
UTM projection, Zone 14, NAD83 (CSRS)

Rev.	Date	Drawn	Verif.	Approv.	Figure A-8
00	2019-12-02	A.C.	M.D.J.	Y.J.	

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PRIORITY LEVEL

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- P-3 - Single occurrences of deficiencies or non-conformance that alone would not be expected to result in structure safety issues.
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NOTES:

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AGNICO EAGLE

SNC·LAVALIN

WHALE TAIL PROJECT
2019 Annual Geotechnical Inspection

Reported Observations
Fuel Storage Facility #2

Sources:
Drone image, AEM, August 2019

Project: 665888
File: 665888-EG-FA9-Fuel2-191202-00.mxd

0 10 20 m
1:1 000
UTM projection, Zone 14, NAD83 (CSRS)

Rev.	Date	Drawn	Verif.	Approv.	
00	2019-12-02	A.C.	M.D.J.	Y.J.	**Figure A-9**

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Appendix B

Summary Table of Observations Made During the Inspection

TABLE B-1: SUMMARY TABLE OF OBSERVATIONS MADE DURING THE INSPECTION

Whale Tail Project 2019 Annual Geotechnical Inspection
Table B-1: Summary Table of Observations Made During the Inspection

Date of the inspection: July 16-18, 2019
Inspectors: Yohan Jalbert & Mathieu Durand-Jézéquel

Definition of Priority Levels	
Priority 1	A high priority or actual structure safety issue considered immediately dangerous to life, health, or the environment; or a significant risk of regulatory enforcement
Priority 2	If not corrected, could likely result in structure safety issues leading to injury, environmental impact, or significant regulatory enforcement; or a repetitive deficiency that demonstrates a systematic breakdown of procedures
Priority 3	Single occurrences of deficiencies or non-conformance that alone would not be expected to result in structure safety issues
Priority 4	Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks

Structure	Observation #	Reported Observation	Preventive or corrective actions to take	Priority
Whale Tail Dike	1	Cracking	Monitor any cracking evolution, reprofile if required	4
	2	Cracks downstream of the cutoff wall	Cracks are closer to the cutoff wall on the downstream side. Monitor any cracking evolution, reprofile if required	4
	3	Subsidence and cracks	Monitor any evolution of subsidence and cracking. Remove any deleterious materials and compact the additional rockfill layer	4
	4	Differential settlement along the downstream edge of the western end of the crest	Add some rockfill material and compact	3
	5	Small holes located close to the downstream safety berm	Follow up any settlement at that location once the rockfill material is added on top	4
	6	Presence of deleterious materials above elevation 157.0 m	Remove deleterious materials above elevation 157.0 m	3
	7	Shrinkage cracks around CB piles	Procede with final earthworks by adding rockfill on top of the cutoff wall before the thaw front reaches the top of the cement-bentonite piles	3
	8	Crest materials require profiling and compaction (east abutment)	Procede with final grade and compaction on the crest	3
	9	Instrumentation cables well protected	-	4
	10	Instrumentation facility well built, protection is adequate	-	4
	11	Missing a handle	Add a handle to properly secure the door	4
	12	Instability (cracks with local subsidence)	Re-slope this section and complete earthworks (add and compact rockfill to final lines and grades)	3
	13	Unknown upstream water level	A stake showing the operational and maximum water levels shall be installed to monitor the water level in real time	4
	14	Small amount of material is blocking the upstream platform of WTD	Confirm with safety staff that this blockage meets AEM safety requirements for the type of equipement used at Amaruq	3
	15	Water accumulation	Re-profile the platform toward the downstream so the water can drain away	4
	16	Presence of cement on the downstream platform and access road	Remove the cement material from the surface	3

Structure	Observation #	Reported Observation	Preventive or corrective actions to take	Priority
Whale Tail Dike (continued)	17	Water is contaminated with cement (located on waste CB material).	Empty the basin by pumping the water out and cap the hole to prevent runoff of contaminated water	3
	18	Trapped snow	Follow up settlement of the downstream platform due to snow melt close to the dewatering pipes	4
	19	Cement-like deposits close to seepage channels	Take samples to identify if cement is flowing along seepage water or if there is any increase of total suspended solids with time	2
	20	Seepage	Follow up seepage at 0+276 once the downstream water level drops	2
	21	Seepage monitoring using a V-notch weir	Continue seepage rate monitoring	2
	22	Seepage	Monitor channels (e.g. using V-notch weirs) to assess any change of seepage rate with time	2
North East Dike	23	Cracking	Monitor any cracking evolution, reprofile if required	4
	24	Sink holes	Add rockfill material to fill the holes and continue monitoring at that location	3
	25	Potholes	Monitor potholes, reprofile the crest if required	4
	26	Settlement close to the upstream safety berm	Review as-built survey and confirm that little or no deformations occur in the area the geomembrane is installed	3
	27	Minor differential settlement toward the downstream slope	Monitor for any evolution of the settlement and reprofile if required	4
	28	Circular network of cracks located where water is ponding at the downstream toe	Cracking observed on a pattern of approximately 17 m x 7 m; promote drainage at the toe area, monitor for any evolution of the settlement and reprofile if required	3
	29	Settlement	Monitor for any evolution of the settlement and reprofile if required	4
	30	Water ponding	Promote drainage away from the toe and monitor for any sign of seepage	3
	31	Unknown water level	Water was pumped from the upstream to the downstream by the time of the inspection. A stake showing the operational and maximum water levels shall be installed to monitor the water level in real time	4
WRSF Dike	32	Minor deformations	Monitor deformations and reprofile if required	4
	33	Cracking	Monitor cracking around the instrumentation shelter and reprofile if required	4
	34	Missing a handle	Add a handle to properly secure the door	4
	35	Cracking	Monitor cracking along the pipe and reprofile if required	4
	36	Exposed thermistor cable	Protect the cable from weather and animals	3
	37	Water ponding	Re-profile the platform so that the water drains in the basin	4
	38	Variability in the slope angle	Monitor and profile the slope if any unstability	4
	39	Water ponding	Monitor water ponding for any signs of seepage water	3
	40	Water elevation is above its operational level	Continue monitoring on a daily basis until the water level decreases to its operational level	4
	41	Lack of operating stake	Install a stake showing operating and maximum water levels	4

Structure	Observation #	Reported Observation	Preventive or corrective actions to take	Priority
Mammoth Dike	42	Cracking	Monitor any cracking evolution, reprofile if required	4
	43	Slightly uneven surface	As the crest is not used as a road, continue monitoring deformations of the crest periodically and reprofile if required	4
	44	Potholes	Monitor potholes, reprofile the crest if required	4
	45	No deformation observed	Monitor for any deformation in the downstream pond area	4
	46	Water ponding	Dry the downstream area of Mammoth Dike by pumping the water out	3
	47	Instrumentation facility installed properly	-	4
	48	Missing a handle	Add a handle to properly secure the door	4
	49	Unknown water level	Install a stake showing operating and maximum water levels	4
Main Dewatering Ramp	50	Potentially constructed on ice or fill material may contain massive ice sheets	Monitor closely the stability of the slope as the water level decreases in Whale Tail North basin	2
	51	Probable instability of the ten-metre-high embankment during dewatering	Review the design and reroute the ramp if instability conditions are confirmed	2
	52	Ice trapped under the access ramp	Ramp was closed by AEM, another ramp located north was built right beside. Continue monitoring for any sign of instability as the water level decreases in Whale Tail North basin	4
Saline Protection Ditch	53	Cracking	Monitor any cracking evolution, reprofile if required	4
	54	Hole in the 0-20 mm material	Fill the hole with 0-20 mm material and monitor any subsequent settlement	3
	55	Exposed geomembrane	Review the anchor design of the liner and cover the geomembrane with 0-20 mm material accordingly	2
	56	Cobbles falling in the ditch on the liner	AEM requested the construction of a berm to the right to prevent snow/road material falling into the ditch	3
	57	Water ponding	Unblock the culvert to allow water flowing toward AP5	3
Site Haulage Road	58	Blocked culvert	Remove materials to free the flow of water	3
	59	Deformartions of the corrugated steel pipe	Water is still flowing through the culvert. Monitor for any excess deformation	4
	60	Culverts buried following the widening of the road	Consider other solutions to ensure proper drainage in that area. Review water management plan for the sector	3
	61	Culvert is too short/slope is too steep	Consider reprofiling the road with rockfill material around the culvert for a more stable structure	4
	62	Sink holes located on the edge of the road	Reprofile by adding and compacting material on top of the sinkholes; continue monitoring for further deformations	3
	63	Significant subsidence on the edge of the road	Potential safety hazard; re-profile that area and monitor any subsequent settlement. Review water management plan for that section	1
	64	Water collected in a pond on the west side of the road	Small pond used as a contingency basin (last catch basin before entering the open pit). Water to be transferred at an adequate location	4
	65	As per AEM, the watershed shown on the photograph is flooding the downstream area of Mammoth Dike	Add culverts to promote drainage and reduce permafrost degradation	3

Structure	Observation #	Reported Observation	Preventive or corrective actions to take	Priority
Amaruq Bulk Fuel Storage Facility	66	Cracking	Monitor any cracking evolution, reprofile if required	4
	67	Tensile and circular cracking	Review the design for the downstream slope requirements. Some steep sections should be more gentle. Monitor any cracking evolution, reprofile if required	2
	68	Settlement and cracks on the 0-20 mm material	Add 0-20 mm material on the crest and compact it	3
	69	Cracking and instability	Review the design. Slopes appear to be steep and instabilities are clearly visible at many locations. Densification of the 0-20 mm material may be required	3
	70	Instability	Reprofile with gentler slope if required	4
	71	Cavities that may be associated with lack of compaction	Monitor any evolution of the cavities, reprofile if required	4
	72	Lack of material	Review design for the anchor requirements. Add 0-20 mm material on top of the liner if required and compact it	3
	73	Exposed liner	Review the design to validate if the geomembrane is intended to be left exposed. Add material on top if needed	4
	74	Water ponding	Drain the water further away from the embankment	4
	75	Discharge point of the pump is located within the slope	Discharge point should be moved further of the toe to minimize risks of permafrost degradation under the embankment which could lead to instability	2
Fuel Storage Facility #2	76	Horizontal seam, should have been welded perpendicular to the slope	Monitor the structure for any deformation that may affect the seams of the geosynthetic	4
	77	Damaged liner	Patch the holes using the same type of liner	3
	78	Material on liner	Review the design to validate that the liner can stay exposed and unprotected. Remove any object in contact with the liner which could damage and perforate the membrane	2
	79	Very little freeboard observed	Review the design for the operating water level and its minimum freeboard requirement. Monitor the water level ponding at the southwest corner of the structure and pump the water out if required	4
Water Treatment Plant Pad	80	Cracking	Monitor any cracking evolution, reprofile if required	4
	81	Raveling	Soften the slope and compact with crushed rock	4
	82	Instability and puddles of water at the toe	Gentle the slope using esker material (rounded cobbles) or use crushed rock material which is more stable. Monitor the water ponding at the toe which could also contribute to instability	4
Emulsion Plant Pad	83	Pad and slopes are straight, uniform and show no evidence of deformation	-	4
Nemo Lake Pad	84	Pad and slopes are straight and show no sign of deformation	-	4
Diffuser	85	As per AEM, diffuser should have stalled in the bottom of Mammoth Lake	As per AEM, the diffuser will be reinstalled this year	3

Appendix C

Descriptive Sheets of Observations Made During the Inspection

OBSERVATIONS SHEETS #1 TO 22: WHALE TAIL DIKE

OBSERVATIONS SHEETS #23 TO 31: NORTH EAST DIKE

OBSERVATIONS SHEETS #32 TO 41: WRSF DIKE

OBSERVATIONS SHEETS #42 TO 49: MAMMOTH DIKE

OBSERVATIONS SHEETS #50 TO 52: MAIN DEWATERING RAMP

OBSERVATIONS SHEETS #53 TO 57: SALINE PROTECTION DITCH

OBSERVATIONS SHEETS #58 TO 65: SITE HAULAGE ROAD

OBSERVATIONS SHEETS #66 TO 75: AMARUQ BULK FUEL STORAGE FACILITY

OBSERVATIONS SHEETS #76 TO 79: FUEL STORAGE FACILITY #2

OBSERVATIONS SHEETS #80 TO 82: WATER TREATMENT PLANT PAD

OBSERVATIONS SHEET #83: EMULSION PLANT PAD

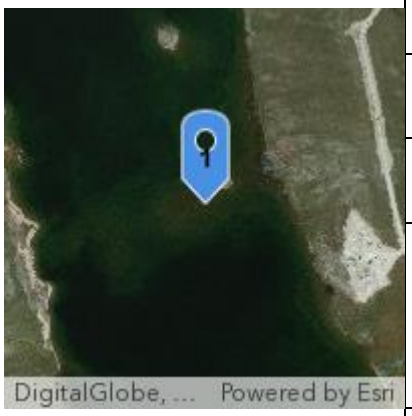
OBSERVATIONS SHEET #84: NEMO LAKE PAD

OBSERVATIONS SHEET #85: DIFFUSERS

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 1**	
 Internal ID: 190717-112047-DURAM16	**Location and component**	**Whale Tail Dike** Crest
	Reported observation	Cracking
	Preventive or corrective actions to take	Monitor any cracking evolution, reprofile if required
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-17

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 1**	
 Internal ID: 190717-110755-DURAM16	**Location and component**	**Whale Tail Dike** Crest
	Reported observation	Cracking
	Preventive or corrective actions to take	Monitor any cracking evolution, reprofile if required
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-17

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 1**

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 1**	
 Internal ID: 190717-110424-DURAM16	**Location and component**	**Whale Tail Dike** Crest
	Reported observation	Cracking
	Preventive or corrective actions to take	Monitor any cracking evolution, reprofile if required
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-17

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 1**

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 1**	
 Internal ID: 190717-105858-DURAM16	**Location and component**	**Whale Tail Dike** Crest
	Reported observation	Cracking
	Preventive or corrective actions to take	Monitor any cracking evolution, reprofile if required
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-17

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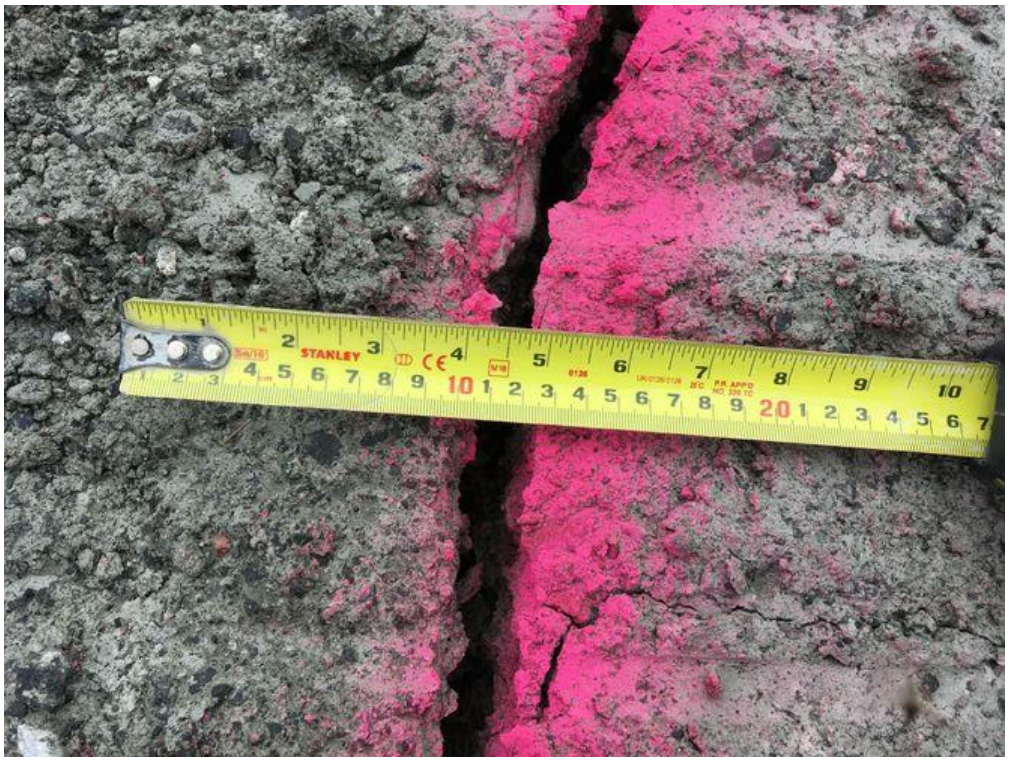
Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations

Observation 1



SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 1**	
 Internal ID: 190717-104758-DURAM16	**Location and component**	**Whale Tail Dike** Crest
	Reported observation	Cracking
	Preventive or corrective actions to take	Monitor cracking on the top platform
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-17

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 1**	
 Internal ID: 190717-104608-DURAM16	**Location and component**	**Whale Tail Dike** Crest
	Reported observation	Cracking
	Preventive or corrective actions to take	Follow up for cracks once the top rockfill platform is constructed up to elevation 159.0 m
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-17

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 1**

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 2**	
 Internal ID: 190717-105010-DURAM16	**Location and component**	**Whale Tail Dike** Crest
	Reported observation	Cracks downstream of the cutoff wall
	Preventive or corrective actions to take	Cracks are closer to the cutoff wall on the downstream side. Monitor any cracking evolution, reprofile if required
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-17

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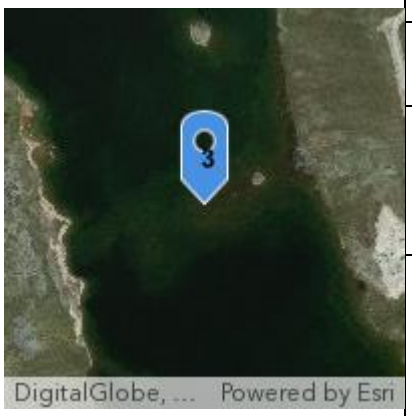
Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations

Observation 2

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 3**	
 Internal ID: 190717-105513-DURAM16	**Location and component**	**Whale Tail Dike** Crest
	Reported observation	Subsidence and cracks
	Preventive or corrective actions to take	Monitor any evolution of subsidence and cracking. Remove any deleterious materials and compact the additional rockfill layer
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-17

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 4**	
 Internal ID: 190717-100551-DURAM16	**Location and component**	**Whale Tail Dike** Crest
	Reported observation	Differential settlement along the downstream edge of the western end of the crest
	Preventive or corrective actions to take	Add some rockfill material and compact
	Priority level	**P-3:** Single occurrences of deficiencies or non-conformance that alone would not be expected to result in structure safety issues.
	Observation date	2019-07-17

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 5**	
 Internal ID: 190717-103206-DURAM16	**Location and component**	**Whale Tail Dike** Crest
	Reported observation	Small holes located close to the downstream safety berm
	Preventive or corrective actions to take	Follow up any settlement at that location once the rockfill material is added on top
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-17

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 6**	
 Internal ID: 190717-112326-DURAM16	**Location and component**	**Whale Tail Dike** Crest
	Reported observation	Presence of deleterious materials above elevation 157.0 m
	Preventive or corrective actions to take	Remove deleterious materials above elevation 157.0 m
	Priority level	**P-3:** Single occurrences of deficiencies or non-conformance that alone would not be expected to result in structure safety issues.
	Observation date	2019-07-17

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 6**	
 Internal ID: 190717-111056-DURAM16	**Location and component**	**Whale Tail Dike** Crest
	Reported observation	Presence of deleterious materials above elevation 157.0 m
	Preventive or corrective actions to take	Remove deleterious materials above elevation 157.0 m
	Priority level	**P-3:** Single occurrences of deficiencies or non-conformance that alone would not be expected to result in structure safety issues.
	Observation date	2019-07-17

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 6**

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 7**	
 Internal ID: 190716-192427-DURAM16	**Location and component**	**Whale Tail Dike** Crest
	Reported observation	Shrinkage cracks around CB piles
	Preventive or corrective actions to take	Procede with final earthworks by adding rockfill on top of the cutoff wall before the thaw front reaches the top of the cement-bentonite piles
	Priority level	**P-3:** Single occurrences of deficiencies or non-conformance that alone would not be expected to result in structure safety issues.
	Observation date	2019-07-16

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 8**	
 Internal ID: 190716-192956-DURAM16	**Location and component**	**Whale Tail Dike** Crest
	Reported observation	Crest materials require profiling and compaction (east abutment)
	Preventive or corrective actions to take	Procede with final grade and compaction on the crest
	Priority level	**P-3:** Single occurrences of deficiencies or non-conformance that alone would not be expected to result in structure safety issues.
	Observation date	2019-07-16

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 9**	
 Internal ID: 190717-101753-DURAM16	**Location and component**	**Whale Tail Dike** Instrumentation shelter
	Reported observation	Instrumentation cables well protected
	Preventive or corrective actions to take	
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-17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SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 10**	
 Internal ID: 190717-101251-DURAM16	**Location and component**	**Whale Tail Dike** Inclinometer
	Reported observation	Instrumentation facility well built, protection is adequate
	Preventive or corrective actions to take	
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-17

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 10**

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 11**	
 Internal ID: 190717-112518-DURAM16	**Location and component**	**Whale Tail Dike** Instrumentation shelter
	Reported observation	Missing a handle
	Preventive or corrective actions to take	Add a handle to properly secure the door
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-17

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 12**	
 Internal ID: 190717-111817-DURAM16	**Location and component**	**Whale Tail Dike** Downstream slope
	Reported observation	Instability (cracks with local subsidence)
	Preventive or corrective actions to take	Re-slope this section and complete earthworks (add and compact rockfill to final lines and grades)
	Priority level	**P-3:** Single occurrences of deficiencies or non-conformance that alone would not be expected to result in structure safety issues.
	Observation date	2019-07-17

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 13**	
 Internal ID: 190717-112738-DURAM16	**Location and component**	**Whale Tail Dike** Upstream water level
	Reported observation	Unknown water level
	Preventive or corrective actions to take	A stake showing the operational and maximum water levels should be installed to monitor the water level in real time
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-17

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 14**	
 Internal ID: 190717-095913-DURAM16	**Location and component**	**Whale Tail Dike** Upstream slope
	Reported observation	Small amount of material is blocking the upstream platform of WTD
	Preventive or corrective actions to take	Confirm with safety staff that this blockage meets AEM safety requirements for the type of equipement used at Amaruq
	Priority level	**P-3:** Single occurrences of deficiencies or non-conformance that alone would not be expected to result in structure safety issues.
	Observation date	2019-07-17

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 15**	
 Internal ID: 190717-113610-DURAM16	**Location and component**	**Whale Tail Dike** Downstream platform
	Reported observation	Water accumulation
	Preventive or corrective actions to take	Re-profile the platform toward the downstream so the water can drain away
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-17

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 16**	
 Internal ID: 190716-193825-DURAM16	**Location and component**	**Whale Tail Dike** Access road
	Reported observation	Presence of cement on the downstream platform and access road
	Preventive or corrective actions to take	Remove the cement material from the surface
	Priority level	**P-3:** Single occurrences of deficiencies or non-conformance that alone would not be expected to result in structure safety issues.
	Observation date	2019-07-16

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 17**	
 Internal ID: 190716-193330-DURAM16	**Location and component**	**Whale Tail Dike** Downstream basin
	Reported observation	Water is contaminated with cement (located on waste CB material).
	Preventive or corrective actions to take	Empty the basin by pumping the water out and cap the hole to prevent runoff of contaminated water
	Priority level	**P-3:** Single occurrences of deficiencies or non-conformance that alone would not be expected to result in structure safety issues.
	Observation date	2019-07-16

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 18**	
 Internal ID: 190716-200553-DURAM16	**Location and component**	**Whale Tail Dike** Downstream toe
	Reported observation	Trapped snow
	Preventive or corrective actions to take	Follow up settlement of the downstream platform due to snow melt close to the dewatering pipes
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-16

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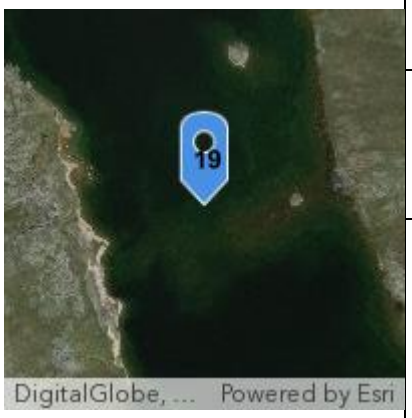
Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations

Observation 18

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 19**	
 Internal ID: 190716-201121-DURAM16	**Location and component**	**Whale Tail Dike** Downstream toe
	Reported observation	Cement-like deposits close to seepage channels
	Preventive or corrective actions to take	Take samples to identify if cement is flowing along seepage water or if there is any increase of total suspended solids with time
	Priority level	**P-2:** If not corrected, could likely result in structure safety issues leading to injury, environmental impact, or significant regulatory enforcement; or a repetitive deficiency that demonstrates a systematic breakdown of procedures.
	Observation date	2019-07-16

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 19**

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 20**	
 Internal ID: 190716-202206-DURAM16	**Location and component**	**Whale Tail Dike** Downstream toe
	Reported observation	Seepage
	Preventive or corrective actions to take	Follow up seepage at 0+276 once the downstream water level drops
	Priority level	**P-2:** If not corrected, could likely result in structure safety issues leading to injury, environmental impact, or significant regulatory enforcement; or a repetitive deficiency that demonstrates a systematic breakdown of procedures.
	Observation date	2019-07-16

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 21**	
 Internal ID: 190716-200317-DURAM16	**Location and component**	**Whale Tail Dike** Downstream toe
	Reported observation	Seepage monitoring using a V-notch weir
	Preventive or corrective actions to take	Continue seepage rate monitoring
	Priority level	**P-2:** If not corrected, could likely result in structure safety issues leading to injury, environmental impact, or significant regulatory enforcement; or a repetitive deficiency that demonstrates a systematic breakdown of procedures.
	Observation date	2019-07-16

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 21**	
 Internal ID: 190730-101629-DURAM16	**Location and component**	**Whale Tail Dike** Downstream toe
	Reported observation	Seepage monitoring using a V-notch weir
	Preventive or corrective actions to take	Continue seepage rate monitoring
	Priority level	**P-2:** If not corrected, could likely result in structure safety issues leading to injury, environmental impact, or significant regulatory enforcement; or a repetitive deficiency that demonstrates a systematic breakdown of procedures.
	Observation date	2019-07-16

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Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations

Observation 22

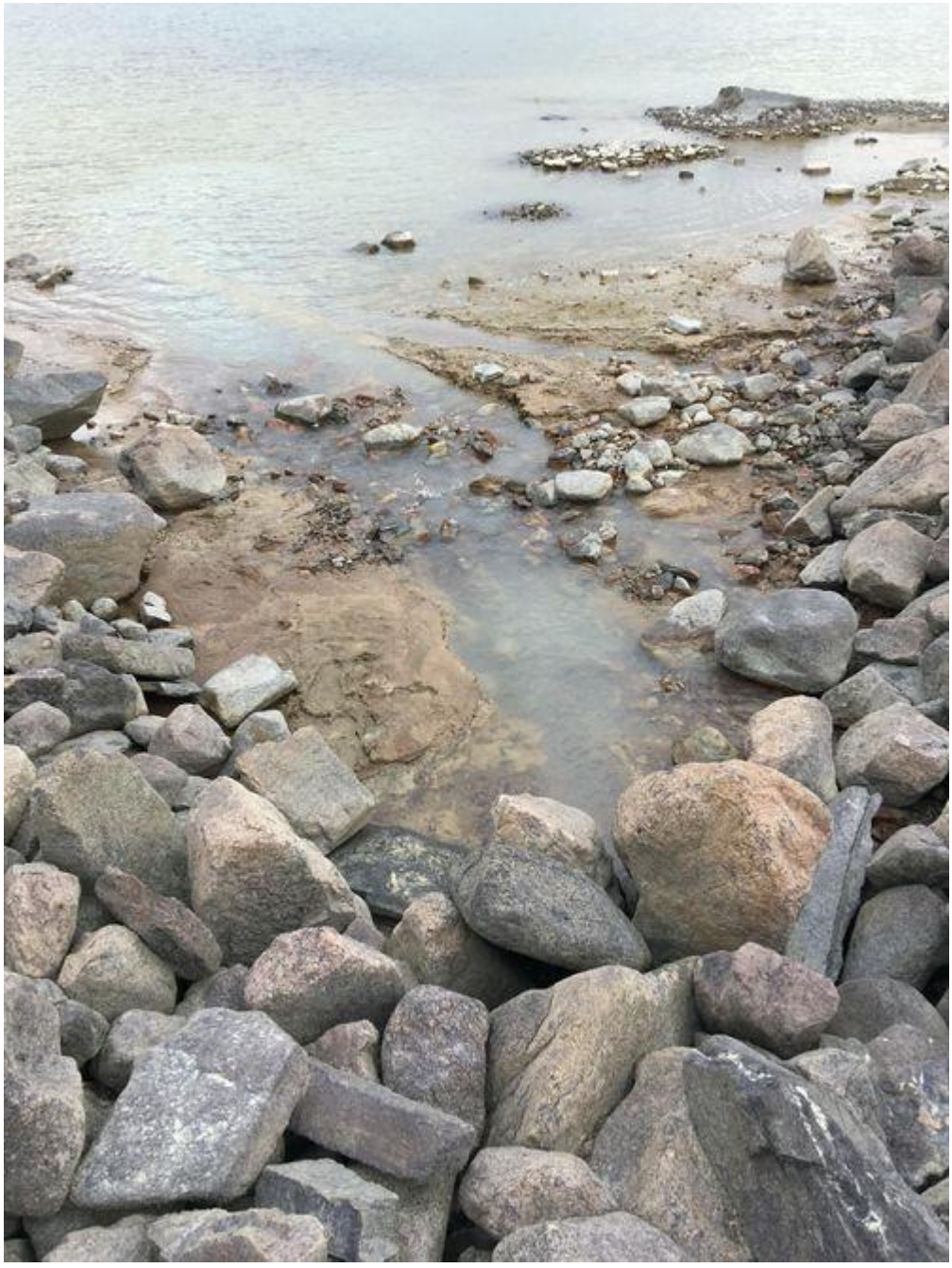
Internal ID: 190716-201830-DURAM16

Location and component	**Whale Tail Dike** Seepage channels
Reported observation	Seepage
Preventive or corrective actions to take	Monitor minor channels to assess any change of seepage rate with time
Priority level	**P-2:** If not corrected, could likely result in structure safety issues leading to injury, environmental impact, or significant regulatory enforcement; or a repetitive deficiency that demonstrates a systematic breakdown of procedures.
Observation date	2019-07-16

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 22**	
 Internal ID: 190716-200144-DURAM16	**Location and component**	**Whale Tail Dike** Seepage channels
	Reported observation	Seepage
	Preventive or corrective actions to take	Monitor minor channels to assess any change of seepage rate with time
	Priority level	**P-2:** If not corrected, could likely result in structure safety issues leading to injury, environmental impact, or significant regulatory enforcement; or a repetitive deficiency that demonstrates a systematic breakdown of procedures.
	Observation date	2019-07-16

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 22**	
 Internal ID: 190716-195856-DURAM16	**Location and component**	**Whale Tail Dike** Seepage channels
	Reported observation	Seepage
	Preventive or corrective actions to take	Monitor seepage rates using a V-notch weir to assess if there are any changes with time
	Priority level	**P-2:** If not corrected, could likely result in structure safety issues leading to injury, environmental impact, or significant regulatory enforcement; or a repetitive deficiency that demonstrates a systematic breakdown of procedures.
	Observation date	2019-07-16

Observation 22



SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 22**	
 Internal ID: 190716-195349-DURAM16	**Location and component**	**Whale Tail Dike** Seepage channels
	Reported observation	Seepage
	Preventive or corrective actions to take	Install V-notch weirs at the principal channels to monitor seepage rate
	Priority level	**P-2:** If not corrected, could likely result in structure safety issues leading to injury, environmental impact, or significant regulatory enforcement; or a repetitive deficiency that demonstrates a systematic breakdown of procedures.
	Observation date	2019-07-16

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 22**

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 23**	
 Internal ID: 190718-070039-DURAM16	**Location and component**	**North East Dike** Upstream platform
	Reported observation	Cracking
	Preventive or corrective actions to take	Monitor any cracking evolution, reprofile if required
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-18

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 23**	
 Internal ID: 190718-065850-DURAM16	**Location and component**	**North East Dike** Upstream platform
	Reported observation	Cracking
	Preventive or corrective actions to take	Monitor any cracking evolution, reprofile if required
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-18

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 23**	
 Internal ID: 190718-065235-DURAM16	**Location and component**	**North East Dike** Upstream platform
	Reported observation	Cracking
	Preventive or corrective actions to take	Monitor any cracking evolution, reprofile if required
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-18

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 23**	
 Internal ID: 190717-164222-DURAM16	**Location and component**	**North East Dike** Upstream platform
	Reported observation	Cracking
	Preventive or corrective actions to take	Monitor any cracking evolution, reprofile if required
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-17

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 24**	
 Internal ID: 190717-162754-DURAM16	**Location and component**	**North East Dike** Upstream platform
	Reported observation	Sink holes
	Preventive or corrective actions to take	Add rockfill material to fill the holes and continue monitoring at that location
	Priority level	**P-3:** Single occurrences of deficiencies or non-conformance that alone would not be expected to result in structure safety issues.
	Observation date	2019-07-17

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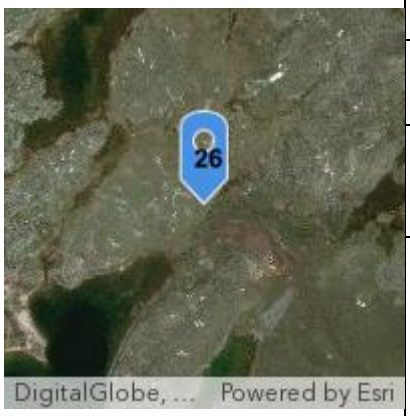
Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations

Observation 24

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 25**	
 Internal ID: 190718-074528-DURAM16	**Location and component**	**North East Dike** Crest
	Reported observation	Potholes
	Preventive or corrective actions to take	Monitor potholes, reprofile the crest if required
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-18

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 25**	
 Internal ID: 190718-065026-DURAM16	**Location and component**	**North East Dike** Upstream platform
	Reported observation	Potholes
	Preventive or corrective actions to take	Monitor potholes, reprofile the crest if required
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-18

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 26**	
 Internal ID: 190718-074820-DURAM16	**Location and component**	**North East Dike** Crest
	Reported observation	Settlement close to the upstream safety berm
	Preventive or corrective actions to take	Review as-built survey and confirm that little or no deformations occur in the area the geomembrane is installed
	Priority level	**P-3:** Single occurrences of deficiencies or non-conformance that alone would not be expected to result in structure safety issues.
	Observation date	2019-07-18

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 26**	
 Internal ID: 190717-171628-DURAM16	**Location and component**	**North East Dike** Crest
	Reported observation	Settlement close to the upstream safety berm
	Preventive or corrective actions to take	Review as-built survey and confirm that little or no deformations occur in the area the geomembrane is installed
	Priority level	**P-3:** Single occurrences of deficiencies or non-conformance that alone would not be expected to result in structure safety issues.
	Observation date	2019-07-17

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 27**	
 Internal ID: 190718-074158-DURAM16	**Location and component**	**North East Dike** Crest
	Reported observation	Minor differential settlement toward the downstream slope
	Preventive or corrective actions to take	Monitor for any evolution of the settlement and reprofile if required
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-18

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 28**	
 Internal ID: 190718-073420-DURAM16	**Location and component**	**North East Dike** Crest
	Reported observation	Circular network of cracks located where water is ponding at the downstream toe
	Preventive or corrective actions to take	Cracking observed on a pattern of approximately 17 m x 7 m; promote drainage at the toe area, monitor for any evolution of the settlement and reprofile if required
	Priority level	**P-3:** Single occurrences of deficiencies or non-conformance that alone would not be expected to result in structure safety issues.
	Observation date	2019-07-18

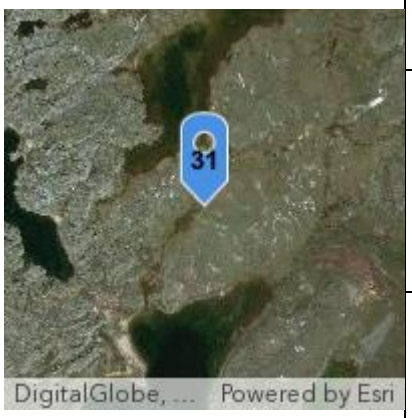
SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 29**	
 Internal ID: 190718-071252-DURAM16	**Location and component**	**North East Dike** Downstream slope
	Reported observation	Settlement
	Preventive or corrective actions to take	Monitor for any evolution of the settlement and reprofile if required
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-18

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 29**

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 30**	
 Internal ID: 190718-070952-DURAM16	**Location and component**	**North East Dike** Downstream toe
	Reported observation	Water ponding
	Preventive or corrective actions to take	Promote drainage away from the toe and monitor for any sign of seepage
	Priority level	**P-3:** Single occurrences of deficiencies or non-conformance that alone would not be expected to result in structure safety issues.
	Observation date	2019-07-18

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 30**	
 Internal ID: 190718-152159-DURAM16	**Location and component**	**North East Dike** Downstream toe
	Reported observation	Water ponding
	Preventive or corrective actions to take	Promote drainage away from the toe and monitor for any sign of seepage
	Priority level	**P-3:** Single occurrences of deficiencies or non-conformance that alone would not be expected to result in structure safety issues.
	Observation date	2019-07-18

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 30**

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 31**	
 Internal ID: 190718-065637-DURAM16	**Location and component**	**North East Dike** Upstream water level
	Reported observation	Unknown water level
	Preventive or corrective actions to take	Water was pumped from the upstream to the downstream by the time of the inspection. A stake showing the operational and maximum water levels shall be installed to monitor the water level in real time
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-18

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 32**	
 Internal ID: 190717-154230-DURAM16	**Location and component**	**WRSF Dike** Crest
	Reported observation	Minor deformations
	Preventive or corrective actions to take	Monitor deformations and reprofile if required
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-17

Observation 32

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 33**	
 Internal ID: 190717-153344-DURAM16	**Location and component**	**WRSF Dike** Upstream slope
	Reported observation	Cracking
	Preventive or corrective actions to take	Monitor cracking around the instrumentation shelter and reprofile if required
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-17

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 34**	
 Internal ID: 190717-153025-DURAM16	**Location and component**	**WRSF Dike** Instrumentation shelter
	Reported observation	Missing a handle
	Preventive or corrective actions to take	Add a handle to properly secure the door
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-17

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 35**	
 Internal ID: 190717-155431-DURAM16	**Location and component**	**WRSF Dike** Upstream platform
	Reported observation	Cracking
	Preventive or corrective actions to take	Monitor cracking along the pipe and reprofile if required
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-17

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 36**	
 Internal ID: 190717-153711-DURAM16	**Location and component**	**WRSF Dike** Thermistor
	Reported observation	Exposed thermistor cable
	Preventive or corrective actions to take	Protect the cable from weather and animals
	Priority level	**P-3:** Single occurrences of deficiencies or non-conformance that alone would not be expected to result in structure safety issues.
	Observation date	2019-07-17

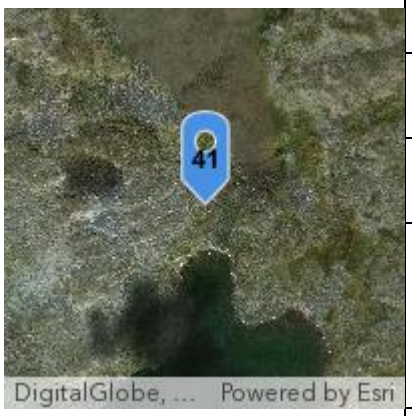
SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 37**	
 Internal ID: 190717-155112-DURAM16	**Location and component**	**WRSF Dike** Upstream platform
	Reported observation	Water ponding
	Preventive or corrective actions to take	Re-profile the platform so that the water drains in the basin
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-17

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 38**	
 Internal ID: 190717-152002-DURAM16	**Location and component**	**WRSF Dike** Downstream slope
	Reported observation	Variability in the slope angle
	Preventive or corrective actions to take	Monitor and profile the slope if any unstability
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-17

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 39**	
 Internal ID: 190717-151234-DURAM16	**Location and component**	**WRSF Dike** Downstream toe
	Reported observation	No evidence of any seepage in the water ponding downstream
	Preventive or corrective actions to take	Monitor water ponding for any signs of seepage water
	Priority level	**P-3:** Single occurrences of deficiencies or non-conformance that alone would not be expected to result in structure safety issues.
	Observation date	2019-07-17

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 39**	
 Internal ID: 190717-151057-DURAM16	**Location and component**	**WRSF Dike** Downstream toe
	Reported observation	Water ponding
	Preventive or corrective actions to take	Promote drainage away from the toe and monitor for any sign of seepage
	Priority level	**P-3:** Single occurrences of deficiencies or non-conformance that alone would not be expected to result in structure safety issues.
	Observation date	2019-07-17

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 40**	
 Internal ID: 190717-143741-DURAM16	**Location and component**	**WRSF Dike** Upstream water level
	Reported observation	Water elevation is above its operational level
	Preventive or corrective actions to take	Continue monitoring on a daily basis until the water level decreases to its operational level
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-17

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 41**	
 Internal ID: 190717-152621-DURAM16	**Location and component**	**WRSF Dike** Upstream water level
	Reported observation	Lack of operating stake
	Preventive or corrective actions to take	Install a stake showing operating and maximum water levels
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-17

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 42**	
 Internal ID: 190717-145024-DURAM16	**Location and component**	**Mammoth Dike** Crest
	Reported observation	Cracking
	Preventive or corrective actions to take	Monitor any cracking evolution, reprofile if required
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-17

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 42**	
 Internal ID: 190717-142337-DURAM16	**Location and component**	**Mammoth Dike** Crest
	Reported observation	Cracking
	Preventive or corrective actions to take	Monitor any cracking evolution, reprofile if required
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-17

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 43**	
 Internal ID: 190717-142105-DURAM16	**Location and component**	**Mammoth Dike** Crest
	Reported observation	Slightly uneven surface
	Preventive or corrective actions to take	As the crest is not used as a road, continue monitoring deformations of the crest periodically and reprofile if required
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-17

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 44**	
 Internal ID: 190717-141255-DURAM16	**Location and component**	**Mammoth Dike** Crest
	Reported observation	Potholes
	Preventive or corrective actions to take	Monitor potholes, reprofile the crest if required
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-17

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 44**

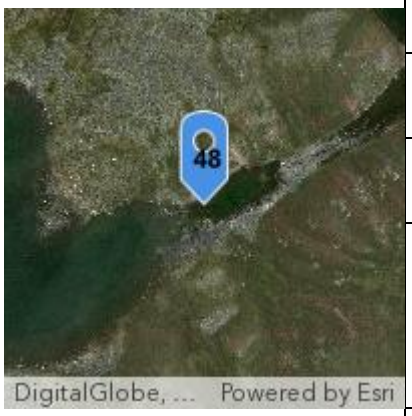
SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 45**	
 Internal ID: 190717-140854-DURAM16	**Location and component**	**Mammoth Dike** Downstream slope
	Reported observation	No deformation observed
	Preventive or corrective actions to take	Monitor for any deformation in the downstream pond area
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-17

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 46**	
 Internal ID: 190717-141038-DURAM16	**Location and component**	**Mammoth Dike** Downstream toe
	Reported observation	Water ponding
	Preventive or corrective actions to take	Dry the downstream area of Mammoth Dike by pumping the water out
	Priority level	**P-3:** Single occurrences of deficiencies or non-conformance that alone would not be expected to result in structure safety issues.
	Observation date	2019-07-17

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 46**

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 47**	
 Internal ID: 190717-135527-DURAM16	**Location and component**	**Mammoth Dike** Thermistor
	Reported observation	Instrumentation facility installed properly
	Preventive or corrective actions to take	
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-17

Observation 47

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 48**	
 Internal ID: 190717-135627-DURAM16	**Location and component**	**Mammoth Dike** Instrumentation shelter
	Reported observation	Missing a handle
	Preventive or corrective actions to take	Add a handle to properly secure the door
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-17

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 49**	
 Internal ID: 190717-140342-DURAM16	**Location and component**	**Mammoth Dike** Upstream water level
	Reported observation	Unknown water level
	Preventive or corrective actions to take	Install a stake showing operating and maximum water levels
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-17

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 50**	
 Internal ID: 190718-121027-DURAM16	**Location and component**	**Main dewatering ramp** Slope
	Reported observation	Potentially constructed on ice or fill material may contain massive ice sheets
	Preventive or corrective actions to take	Monitor closely the stability of the slope as the water level decreases in Whale Tail North basin
	Priority level	**P-2:** If not corrected, could likely result in structure safety issues leading to injury, environmental impact, or significant regulatory enforcement; or a repetitive deficiency that demonstrates a systematic breakdown of procedures.
	Observation date	2019-07-18

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 51**	
 Internal ID: 190718-120817-DURAM16	**Location and component**	**Main dewatering ramp** Slope (end)
	Reported observation	Probable instability of the ten-metre-high embankment during dewatering
	Preventive or corrective actions to take	Review the design and reroute the ramp if instability conditions are confirmed
	Priority level	**P-2:** If not corrected, could likely result in structure safety issues leading to injury, environmental impact, or significant regulatory enforcement; or a repetitive deficiency that demonstrates a systematic breakdown of procedures.
	Observation date	2019-07-18

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 52**	
 Internal ID: 190718-115631-DURAM16	**Location and component**	**Main dewatering ramp** Access road
	Reported observation	Ice trapped under the access ramp
	Preventive or corrective actions to take	Ramp was closed by AEM, other ramp located north built right beside. Continue monitoring for any sign of instability as the water level decreases in Whale Tail North basin
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-18

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 53**	
 Internal ID: 190718-133948-DURAM16	**Location and component**	**Saline protection ditch** Crest
	Reported observation	Cracking
	Preventive or corrective actions to take	Monitor any cracking evolution, reprofile if required
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-18

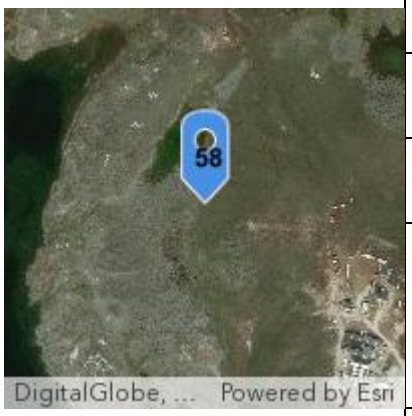
SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 53**	
 Internal ID: 190718-133717-DURAM16	**Location and component**	**Saline protection ditch** Slope
	Reported observation	Cracking
	Preventive or corrective actions to take	Monitor any cracking evolution, reprofile if required
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-18

Observation 53

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 54**	
 Internal ID: 190718-134851-DURAM16	**Location and component**	**Saline protection ditch** Crest
	Reported observation	Hole in the 0-20 mm material
	Preventive or corrective actions to take	Fill the hole with 0-20 mm material and monitor any subsequent settlement
	Priority level	**P-3:** Single occurrences of deficiencies or non-conformance that alone would not be expected to result in structure safety issues.
	Observation date	2019-07-18

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 55**	
 Internal ID: 190718-134528-DURAM16	**Location and component**	**Saline protection ditch** Crest
	Reported observation	Exposed geomembrane
	Preventive or corrective actions to take	Review the anchor design of the liner and cover the geomembrane with 0-20 mm material accordingly
	Priority level	**P-2:** If not corrected, could likely result in structure safety issues leading to injury, environmental impact, or significant regulatory enforcement; or a repetitive deficiency that demonstrates a systematic breakdown of procedures.
	Observation date	2019-07-18

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 56**	
 Internal ID: 190718-135423-DURAM16	**Location and component**	**Saline protection ditch** General view
	Reported observation	Cobbles falling in the ditch on the liner
	Preventive or corrective actions to take	AEM requested the construction of a berm to the right to prevent snow/road material falling into the ditch
	Priority level	**P-3:** Single occurrences of deficiencies or non-conformance that alone would not be expected to result in structure safety issues.
	Observation date	2019-07-18

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 57**	
 Internal ID: 190718-132936-DURAM16	**Location and component**	**Saline protection ditch** Water outlet
	Reported observation	Water ponding
	Preventive or corrective actions to take	Unblock the culvert to allow water flowing toward AP5
	Priority level	**P-3:** Single occurrences of deficiencies or non-conformance that alone would not be expected to result in structure safety issues.
	Observation date	2019-07-18

SNC·LAVALIN

Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations

Observation 58

Internal ID: 190718-132555-DURAM16

Location and component	**Site haulage road** Culvert
Reported observation	Blocked culvert
Preventive or corrective actions to take	Remove materials to free the flow of water
Priority level	**P-3:** Single occurrences of deficiencies or non-conformance that alone would not be expected to result in structure safety issues.
Observation date	2019-07-18

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 58**

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 58**	
 Internal ID: 190718-095435-DURAM16	**Location and component**	**Site haulage road** Culvert
	Reported observation	Blocked culvert
	Preventive or corrective actions to take	Remove materials to free the flow of water
	Priority level	**P-3:** Single occurrences of deficiencies or non-conformance that alone would not be expected to result in structure safety issues.
	Observation date	2019-07-18

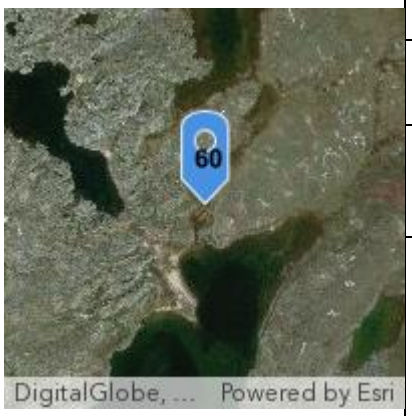
SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 59**	
 Internal ID: 190718-095211-DURAM16	**Location and component**	**Site haulage road** Culvert
	Reported observation	Deformartions of the corrugated steel pipe
	Preventive or corrective actions to take	Water is still flowing through the culvert. Monitor for any excess deformation
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-18

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 59**

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 59**	
 Internal ID: 190718-094718-DURAM16	**Location and component**	**Site haulage road** Culvert
	Reported observation	Deformartions of the corrugated steel pipe
	Preventive or corrective actions to take	Water is still flowing through the culvert. Monitor for any excess deformation
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-18

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 59**

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 59**	
 Internal ID: 190718-152840-DURAM16	**Location and component**	**Site haulage road** Culvert
	Reported observation	Culverts are too high from ground and slightly distorted
	Preventive or corrective actions to take	Water is still flowing through the culvert. Monitor for any excess deformation
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-18

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 60**	
 Internal ID: 190718-153703-DURAM16	**Location and component**	**Site haulage road** Culvert
	Reported observation	Culverts buried following the widening of the road
	Preventive or corrective actions to take	Consider other solutions to ensure proper drainage in that area. Review water management plan for the sector
	Priority level	**P-3:** Single occurrences of deficiencies or non-conformance that alone would not be expected to result in structure safety issues.
	Observation date	2019-07-18

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 60**

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 61**	
 Internal ID: 190718-145124-DURAM16	**Location and component**	**Site haulage road** Culvert
	Reported observation	Culvert is too short/slope is too steep
	Preventive or corrective actions to take	Consider reprofiling the road with rockfill material around the culvert for a more stable structure
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-18

Observation 61

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 62**	
 Internal ID: 190718-152340-DURAM16	**Location and component**	**Site haulage road** Road
	Reported observation	Sink holes located on the edge of the road
	Preventive or corrective actions to take	Reprofile by adding and compacting material on top of the sinkholes; continue monitoring for further deformations
	Priority level	**P-3:** Single occurrences of deficiencies or non-conformance that alone would not be expected to result in structure safety issues.
	Observation date	2019-07-18

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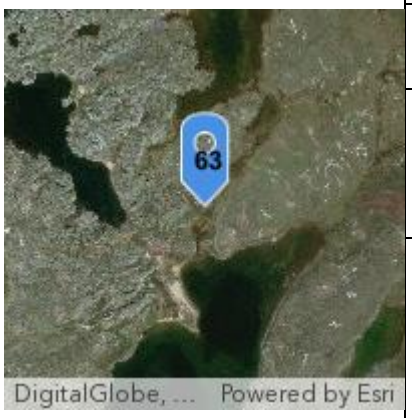
Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations

Observation 62

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 63**	
 Internal ID: 190718-154221-DURAM16	**Location and component**	**Site haulage road** Access road
	Reported observation	Significant subsidence on the edge of the road
	Preventive or corrective actions to take	Potential safety hazard; re-profile that area and monitor any subsequent settlement. Review water management plan for that section
	Priority level	**P-1:** A high priority or actual structure safety issue considered immediately dangerous to life, health, or the environment; or a significant risk of regulatory enforcement.
	Observation date	2019-07-18

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 63**

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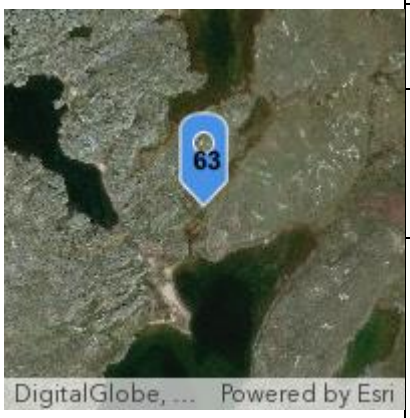
Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations

Observation 63

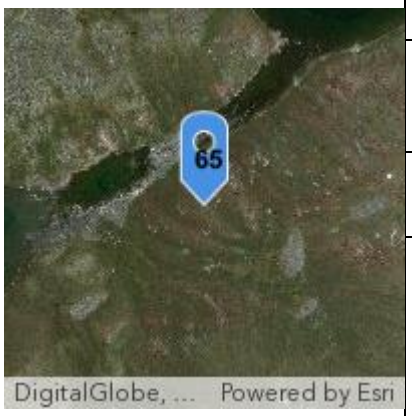


Internal ID: 190718-154014-DURAM16

Location and component	**Site haulage road** Access road
Reported observation	Significant subsidence on the edge of the road
Preventive or corrective actions to take	Potential safety hazard; re-profile that area and monitor any subsequent settlement. Review water management plan for that section
Priority level	**P-1:** A high priority or actual structure safety issue considered immediately dangerous to life, health, or the environment; or a significant risk of regulatory enforcement.
Observation date	2019-07-18

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 63**

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 64**	
 Internal ID: 190718-161112-DURAM16	**Location and component**	**Site haulage road** Access road
	Reported observation	Water collected in a pond on the west side of the road
	Preventive or corrective actions to take	Small pond used as a contingency basin (last catch basin before entering the open pit). Water to be transferred at an adequate location
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-18

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 65**	
 Internal ID: 190718-162131-DURAM16	**Location and component**	**Site haulage road** General view
	Reported observation	As per AEM, the watershed shown on the photograph is flooding the downstream area of Mammoth Dike
	Preventive or corrective actions to take	Add culverts to promote drainage and reduce permafrost degradation
	Priority level	**P-3:** Single occurrences of deficiencies or non-conformance that alone would not be expected to result in structure safety issues.
	Observation date	2019-07-18

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 66**	
 Internal ID: 190718-090354-DURAM16	**Location and component**	**Amaruq bulk fuel storage facility** Downstream slope
	Reported observation	Cracking
	Preventive or corrective actions to take	Monitor any cracking evolution, reprofile if required
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-18

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 66**

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 66**	
 Internal ID: 190718-090024-DURAM16	**Location and component**	**Amaruq bulk fuel storage facility** Crest
	Reported observation	Cracking
	Preventive or corrective actions to take	Monitor any cracking evolution, reprofile if required
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-18

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 66**	
 Internal ID: 190718-085548-DURAM16	**Location and component**	**Amaruq bulk fuel storage facility** Downstream slope
	Reported observation	Cracking
	Preventive or corrective actions to take	Monitor any cracking evolution, reprofile if required
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-18

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 66**

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 67**	
 Internal ID: 190718-091013-DURAM16	**Location and component**	**Amaruq bulk fuel storage facility** Crest
	Reported observation	Tensile and circular cracking
	Preventive or corrective actions to take	Review the design for the downstream slope requirements. Some steep sections should be more gentle. Monitor any cracking evolution, reprofile if required
	Priority level	**P-2:** If not corrected, could likely result in structure safety issues leading to injury, environmental impact, or significant regulatory enforcement; or a repetitive deficiency that demonstrates a systematic breakdown of procedures.
	Observation date	2019-07-18

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 67**

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 68**	
 Internal ID: 190718-085851-DURAM16	**Location and component**	**Amaruq bulk fuel storage facility** Crest
	Reported observation	Settlement and cracks on the 0-20 mm material
	Preventive or corrective actions to take	Add 0-20 mm material on the crest and compact it
	Priority level	**P-3:** Single occurrences of deficiencies or non-conformance that alone would not be expected to result in structure safety issues.
	Observation date	2019-07-18

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 68**

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 69**	
 Internal ID: 190718-091700-DURAM16	**Location and component**	**Amaruq bulk fuel storage facility** Downstream slope
	Reported observation	Cracking and instability
	Preventive or corrective actions to take	Review the design. Slopes appear to be steep and instabilities are clearly visible at many locations. Densification of the 0-20 mm material may be required
	Priority level	**P-3:** Single occurrences of deficiencies or non-conformance that alone would not be expected to result in structure safety issues.
	Observation date	2019-07-18

Observation 69

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 70**	
 Internal ID: 190718-085130-DURAM16	**Location and component**	**Amaruq bulk fuel storage facility** Ditch
	Reported observation	Instability
	Preventive or corrective actions to take	Reprofile with gentler slope if required
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-18

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 70**

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 71**	
 Internal ID: 190718-090202-DURAM16	**Location and component**	**Amaruq bulk fuel storage facility** Downstream slope
	Reported observation	Cavities that may be associated with lack of compaction
	Preventive or corrective actions to take	Monitor any evolution of the cavities, reprofile if required
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-18

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 72**	
 Internal ID: 190718-090630-DURAM16	**Location and component**	**Amaruq bulk fuel storage facility** Crest
	Reported observation	Lack of material
	Preventive or corrective actions to take	Review design for the anchor requirements. If required, add 0-20 mm material on top of the liner and compact it
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-18

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 72**	
 Internal ID: 190718-085742-DURAM16	**Location and component**	**Amaruq bulk fuel storage facility** Crest
	Reported observation	Lack of material
	Preventive or corrective actions to take	Review design for the anchor requirements. If required, add 0-20 mm material on top of the liner and compact it
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-18

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 73**	
 Internal ID: 190718-093220-DURAM16	**Location and component**	**Amaruq bulk fuel storage facility** Liner
	Reported observation	No material on top of the geomembrane and tensions were observed in the liner at some locations
	Preventive or corrective actions to take	Review the design to validate if the geomembrane is intended to be left exposed. Monitor any tension cracking of the liner
	Priority level	**P-3:** Single occurrences of deficiencies or non-conformance that alone would not be expected to result in structure safety issues.
	Observation date	2019-07-18

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 73**	
 Internal ID: 190718-084920-DURAM16	**Location and component**	**Amaruq bulk fuel storage facility** Liner
	Reported observation	Exposed liner
	Preventive or corrective actions to take	Review the design requirements and add material on top if needed
	Priority level	**P-3:** Single occurrences of deficiencies or non-conformance that alone would not be expected to result in structure safety issues.
	Observation date	2019-07-18

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 74**	
 Internal ID: 190718-092910-DURAM16	**Location and component**	**Amaruq bulk fuel storage facility** Downstream toe
	Reported observation	Water ponding
	Preventive or corrective actions to take	Drain the water further away from the embankment
	Priority level	**P-3:** Single occurrences of deficiencies or non-conformance that alone would not be expected to result in structure safety issues.
	Observation date	2019-07-18

SNC·LAVALIN

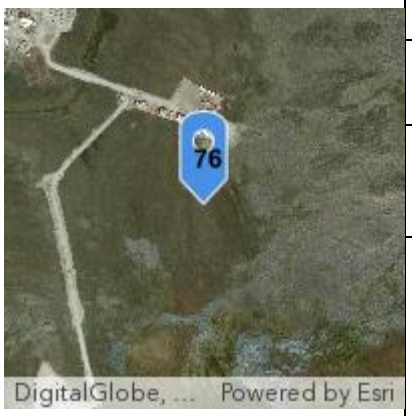
Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations

Observation 75

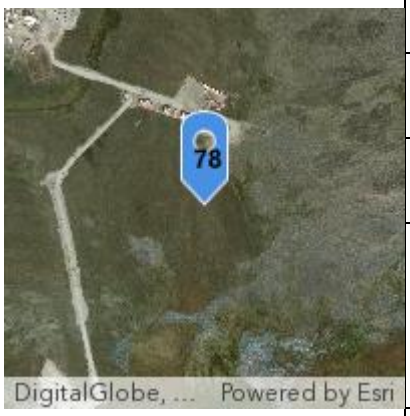
Internal ID: 190729-102542-DURAM16

Location and component	**Amaruq bulk fuel storage facility** Downstream slope
Reported observation	Discharge point of the pump is located within the slope
Preventive or corrective actions to take	Discharge point should be moved further of the toe to minimize risks of permafrost degradation under the embankment which could lead to instability
Priority level	**P-2:** If not corrected, could likely result in structure safety issues leading to injury, environmental impact, or significant regulatory enforcement; or a repetitive deficiency that demonstrates a systematic breakdown of procedures.
Observation date	2019-07-18

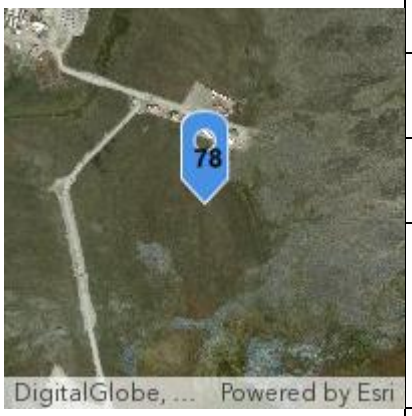
SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 75**

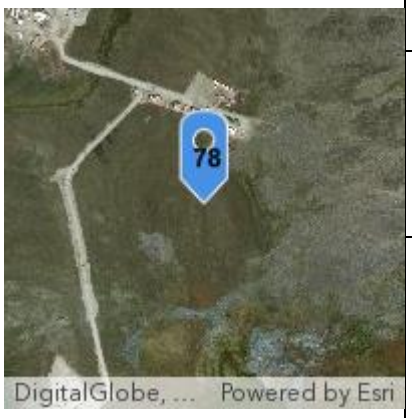
SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 76**	
 Internal ID: 190718-171537-DURAM16	**Location and component**	**Fuel Storage Facility #2** Liner
	Reported observation	Membrane panels welded all in the same direction (east-west)
	Preventive or corrective actions to take	Monitor the structure for any deformation that may affect the seams of the geosynthetic
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-18

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 76**	
 Internal ID: 190718-171033-DURAM16	**Location and component**	**Fuel Storage Facility #2** Downstream slope
	Reported observation	Horizontal seam, should have been welded perpendicular to the slope
	Preventive or corrective actions to take	Monitor the structure for any deformation that may affect the seams of the geosynthetic
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-18

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 77**	
 Internal ID: 190718-171431-DURAM16	**Location and component**	**Fuel Storage Facility #2** Upstream slope
	Reported observation	Holes in liner
	Preventive or corrective actions to take	Patch the holes using the same type of liner
	Priority level	**P-3:** Single occurrences of deficiencies or non-conformance that alone would not be expected to result in structure safety issues.
	Observation date	2019-07-18

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 77**

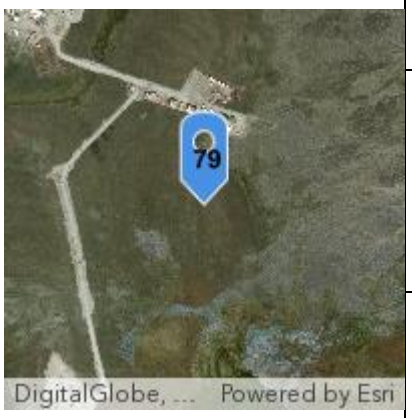
SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 77**	
 Internal ID: 190718-170539-DURAM16	**Location and component**	**Fuel Storage Facility #2** Crest
	Reported observation	Teared liner
	Preventive or corrective actions to take	Patch the damaged area using the same type of liner
	Priority level	**P-3:** Single occurrences of deficiencies or non-conformance that alone would not be expected to result in structure safety issues.
	Observation date	2019-07-18

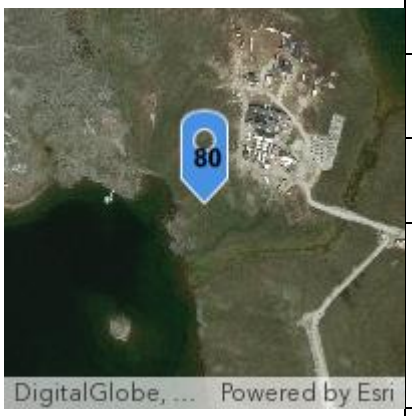
SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 78**	
 Internal ID: 190718-170656-DURAM16	**Location and component**	**Fuel Storage Facility #2** Upstream slope
	Reported observation	Material on liner
	Preventive or corrective actions to take	Review the design to validate that the liner can stay exposed and unprotected. Remove any object in contact with the liner which could damage and perforate the membrane
	Priority level	**P-2:** If not corrected, could likely result in structure safety issues leading to injury, environmental impact, or significant regulatory enforcement; or a repetitive deficiency that demonstrates a systematic breakdown of procedures.
	Observation date	2019-07-18

SNC·LAVALIN

Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations

Observation 78

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 79**	
 Internal ID: 190718-170811-DURAM16	**Location and component**	**Fuel Storage Facility #2** Water elevation
	Reported observation	Very little freeboard observed
	Preventive or corrective actions to take	Review the design for the operating water level and its minimum freeboard requirement. Monitor the water level ponding at the southwest corner of the structure and pump the water out if required
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-18

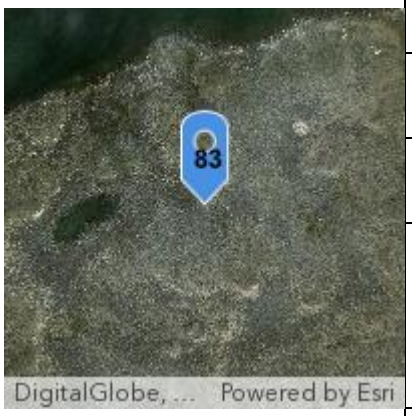
SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 80**	
 Internal ID: 190718-105933-DURAM16	**Location and component**	**WTP pad** Crest
	Reported observation	Cracking
	Preventive or corrective actions to take	Monitor any cracking evolution, reprofile if required
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-18

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 81**	
 Internal ID: 190718-110103-DURAM16	**Location and component**	**WTP pad** Slope
	Reported observation	Raveling
	Preventive or corrective actions to take	Soften the slope and compact with crushed rock
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-18

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 81**

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 82**	
 Internal ID: 190718-110520-DURAM16	**Location and component**	**WTP pad** Downstream slope
	Reported observation	Instability and puddles of water at the toe
	Preventive or corrective actions to take	Gentle the slope using esker material (rounded cobbles) or use crushed rock material which is more stable. Monitor the water ponding at the toe which could also contribute to instability
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-18

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 82**

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 83**	
 Internal ID: 190718-164040-DURAM16	**Location and component**	**Emulsion plant** Pad
	Reported observation	Pad and slopes are straight, uniform and show no evidence of deformation
	Preventive or corrective actions to take	
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-18

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 83**

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 84**	
 Internal ID: 190718-150727-DURAM16	**Location and component**	**Nemo lake** Pad
	Reported observation	Pad and slopes are straight and show no sign of deformation
	Preventive or corrective actions to take	
	Priority level	**P-4:** Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.
	Observation date	2019-07-18

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 84**

SNC·LAVALIN	**Whale Tail 2019 Statutory Annual Inspection: Observations and recommendations** **Observation 85**	
 Internal ID: 190718-163158-DURAM16	**Location and component**	**Diffuser** General view
	Reported observation	As per AEM, diffuser should have stalled in the bottom of Mammoth Lake
	Preventive or corrective actions to take	As per AEM, the diffuser will be reinstalled this year
	Priority level	**P-3:** Single occurrences of deficiencies or non-conformance that alone would not be expected to result in structure safety issues.
	Observation date	2019-07-18

Observation 85

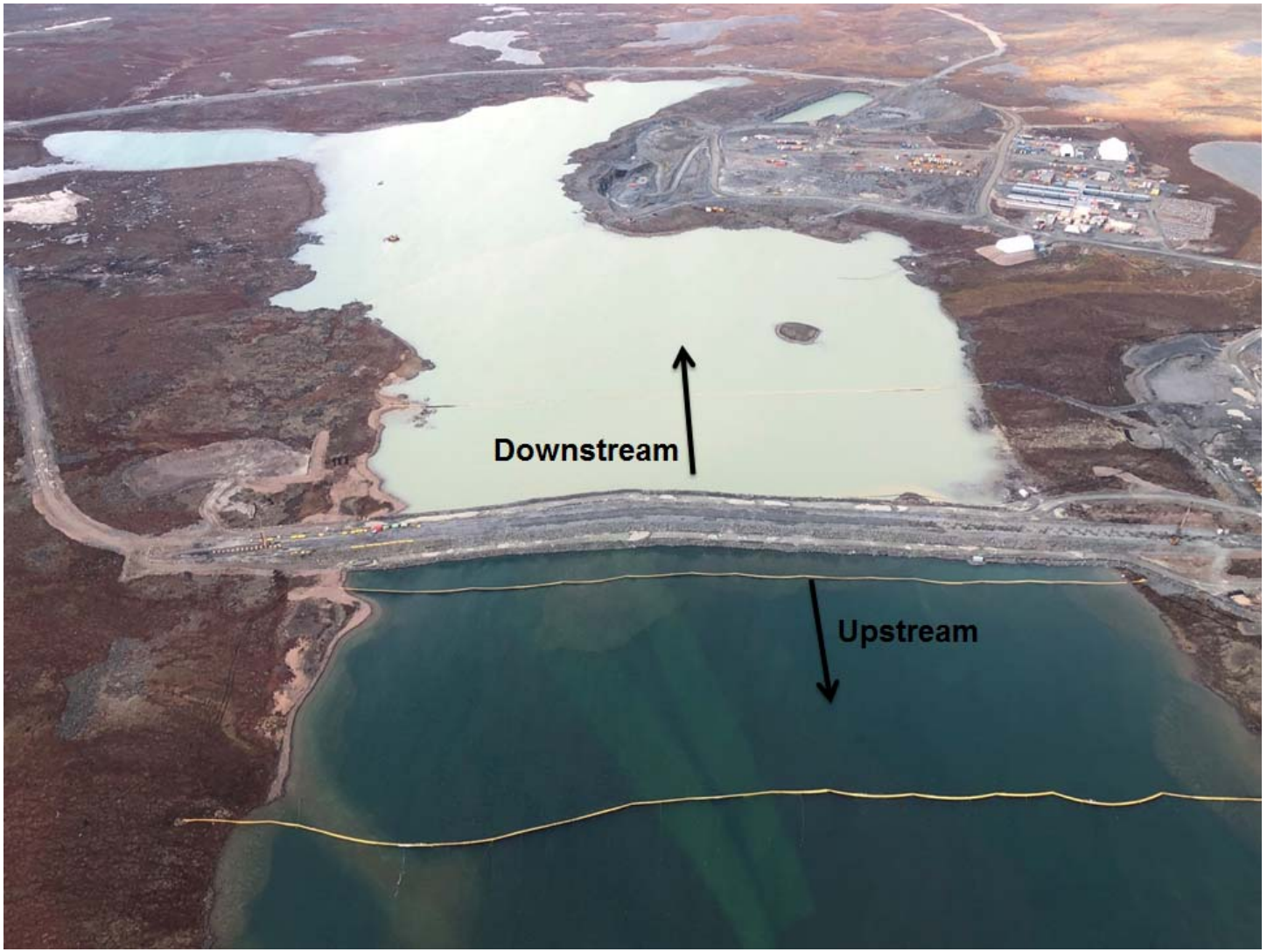
Appendix D

Instrumentation Data of Whale Tail Dike, WRSF Dike and Mammoth Dike

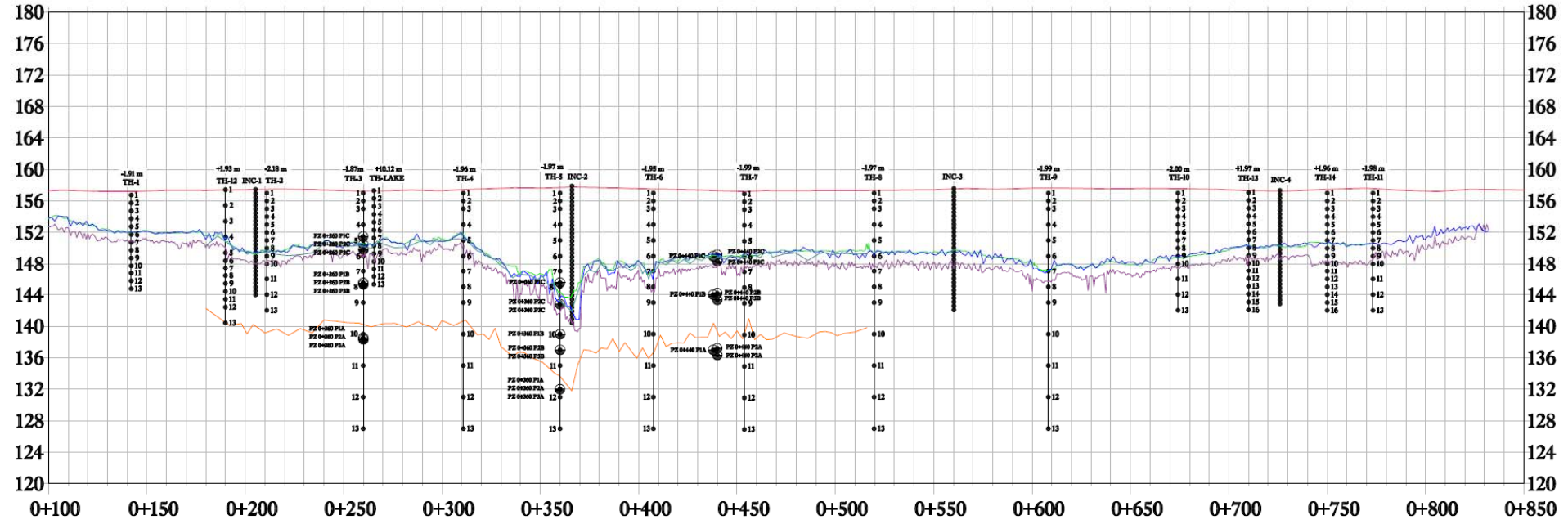
Amaruq Instrumentation Report

Date : August 21st, 2019

Whale Tail Dike Aerial View



Profile View



LEGEND :

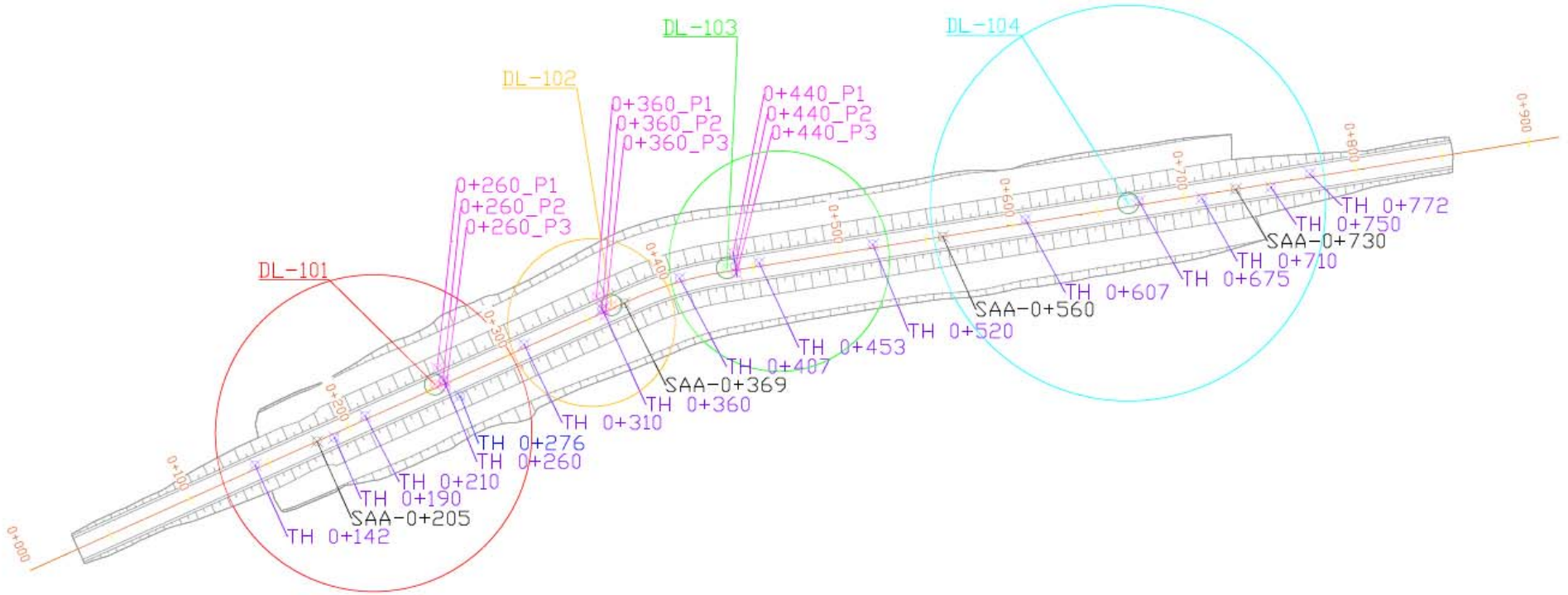
- APPROVED BEDROCK
- GROUTING EXTENT
- TOP DIKE EL. 157m
- BOTTOM SECANTS PILES
- ENCOUNTERED BEDROCK BY HENRY DRILLING
- BEDROCK ENCOUNTERED DURING INJECTION CASING INSTALLATION (0.700M UPSTREAM OFFSET CENTERLINE)

NOTE :

- THE FIGURE ABOVE THE INSTRUMENT REPRESENTS THE OFFSET OF THE INSTRUMENT IN RELATION TO CENTERLINE - IF IT IS POSITIVE THE INSTRUMENT IS UPSTREAM (SOUTH SIDE) AND IF IT IS NEGATIVE THE INSTRUMENT IS DOWNSTREAM (NORTH SIDE).

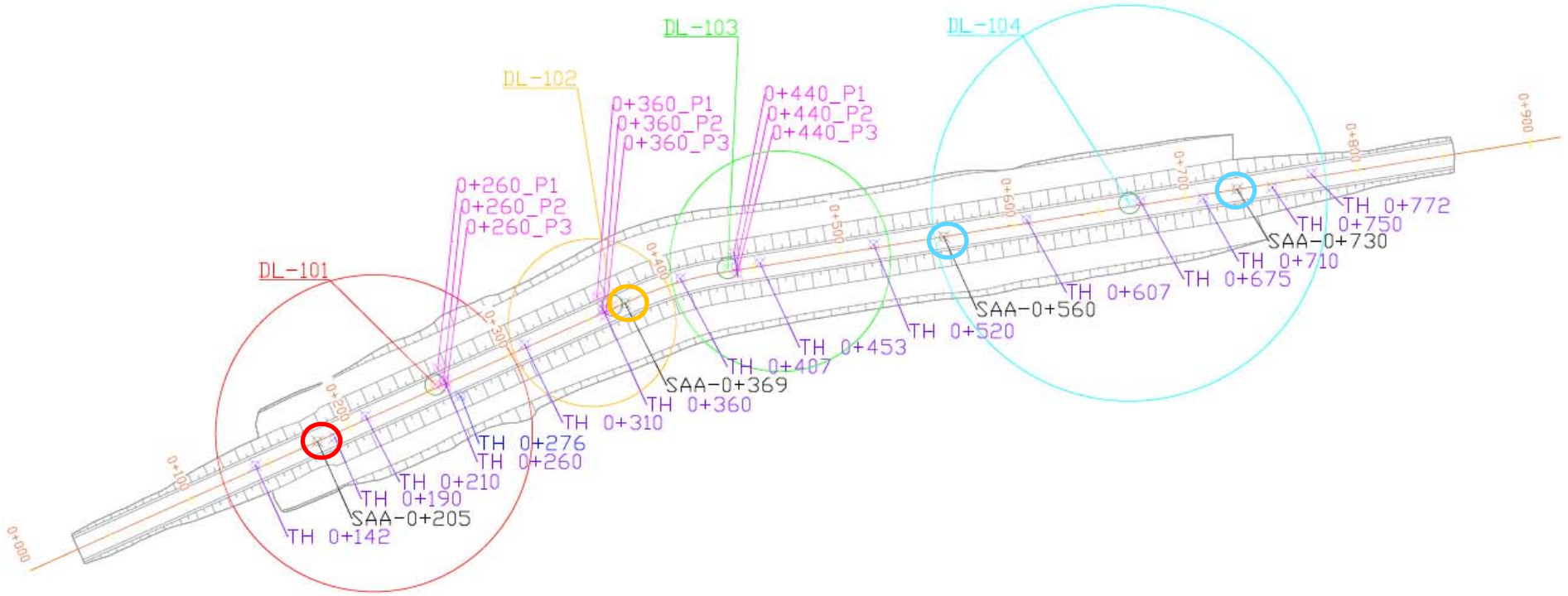
SCALE : 1:2000
VERTICAL EXAGERATION : 4

Plan View of Instruments Location



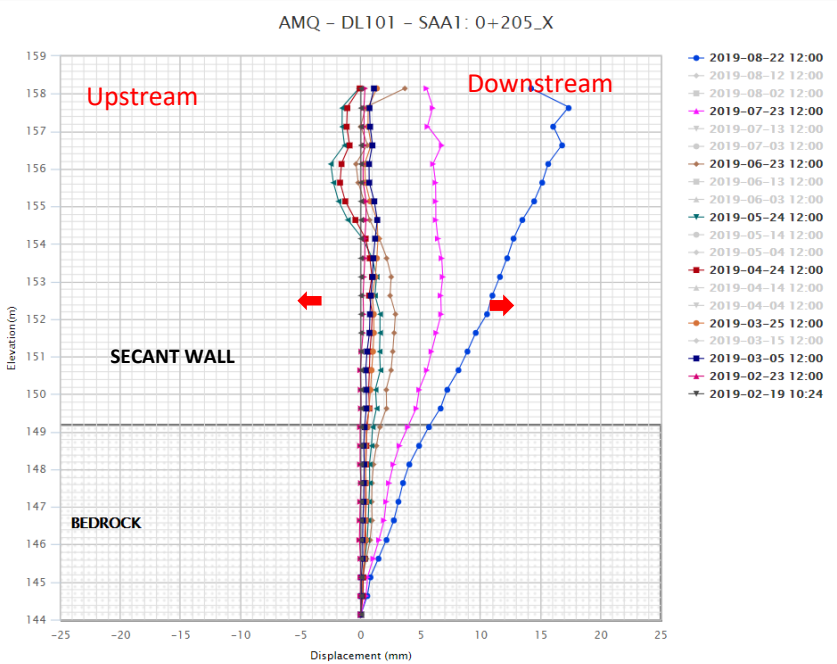
\\Cambfs01\groups\Engineering\05-Geotechnic\14- Amaruq\01 - Dewatering Dikes\1 - Whale Tale Dike\4 - Operation\1- Inspection

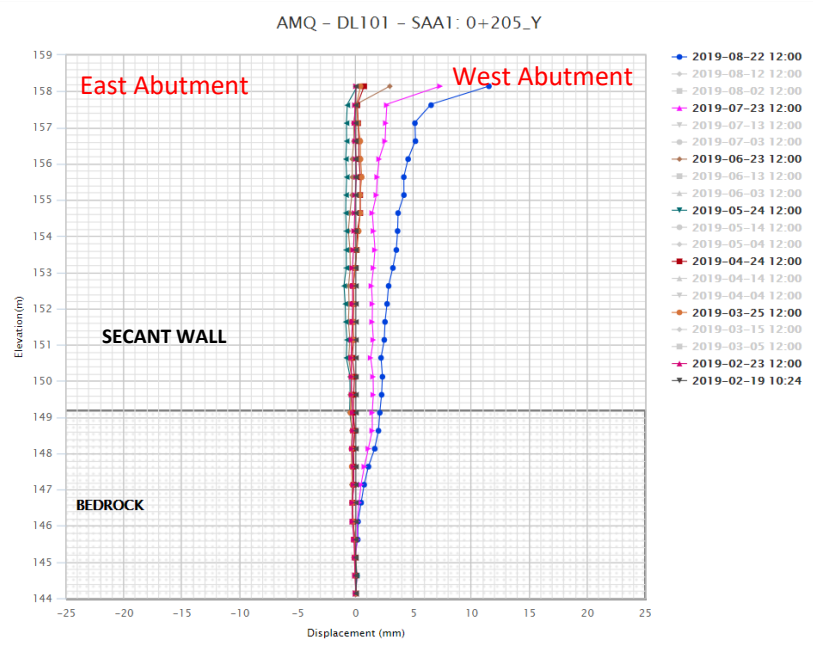
Inclinometers



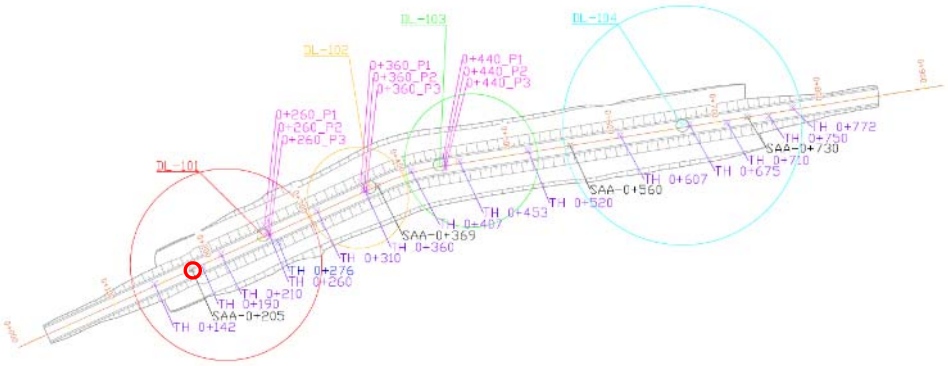
\\Cambfs01\groups\Engineering\05-Geotechnic\14- Amaruq\01 - Dewatering Dikes\1 - Whale Tale Dike\4 - Operation\1- Inspection

Inclinometer SAA-0+205 / INC-1 – Incremental Displacement

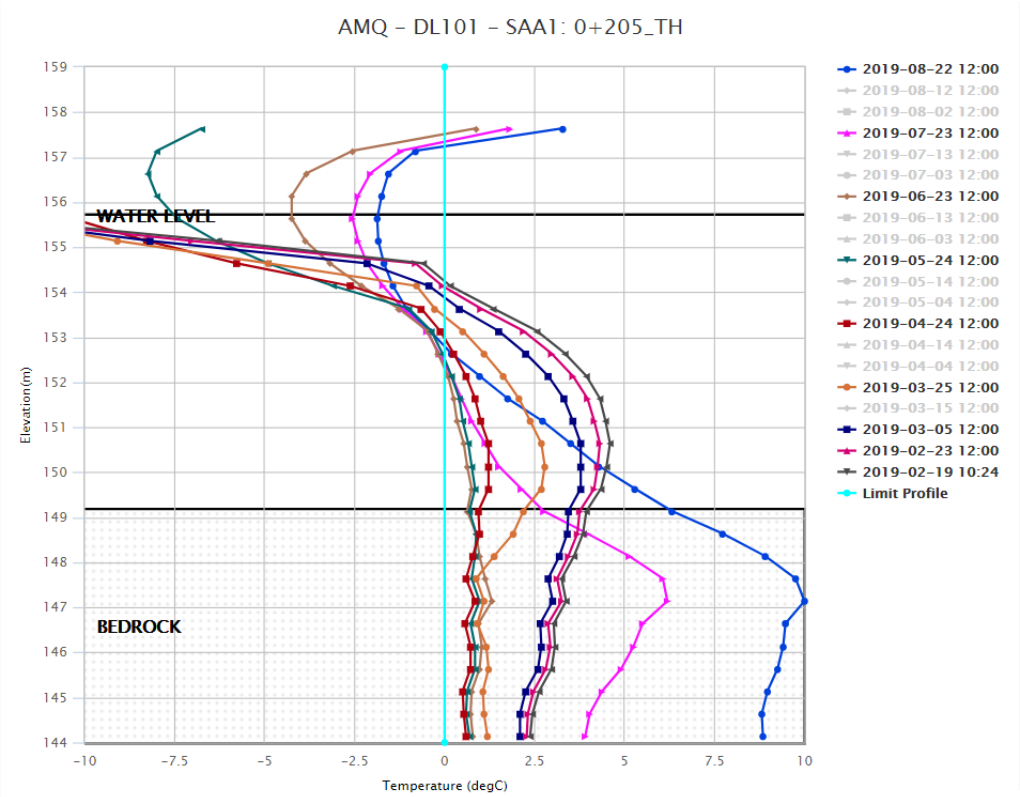




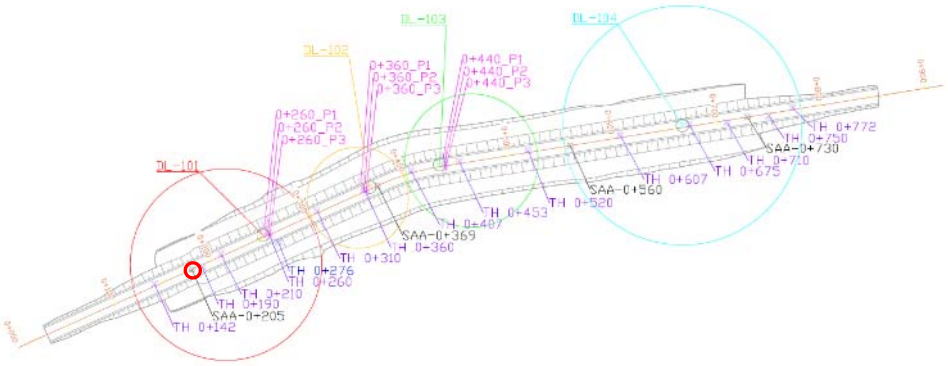
Comments:



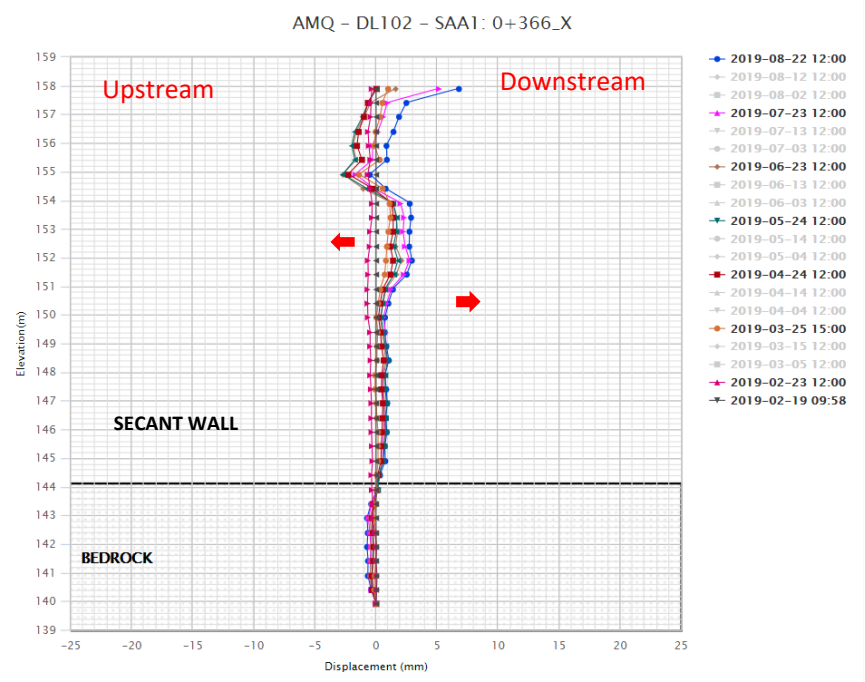
Inclinometer SAA-0+205 / INC-1 – Temperature

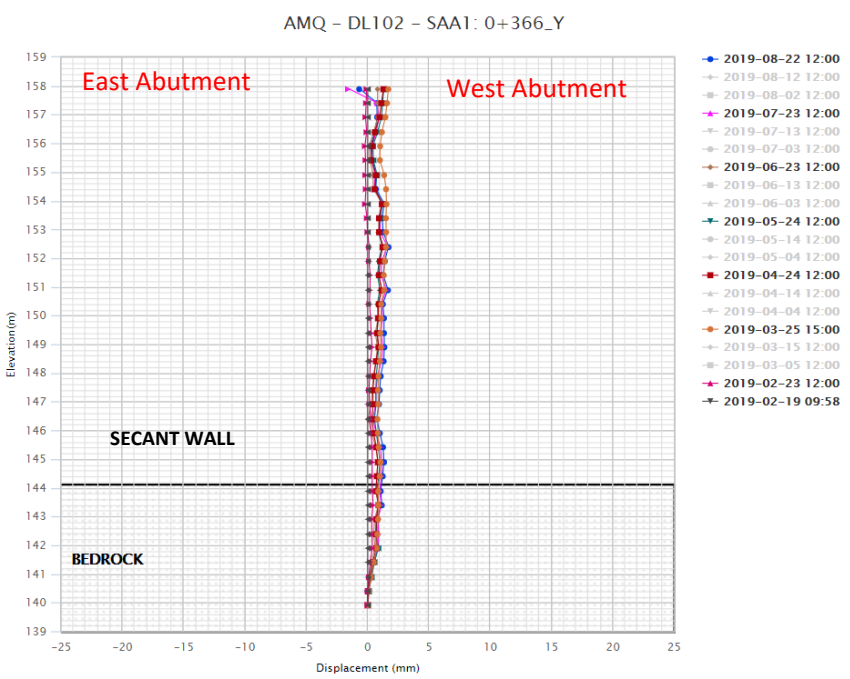


Comments:



Inclinometer SAA-0+366 / INC-2 – Incremental Displacement





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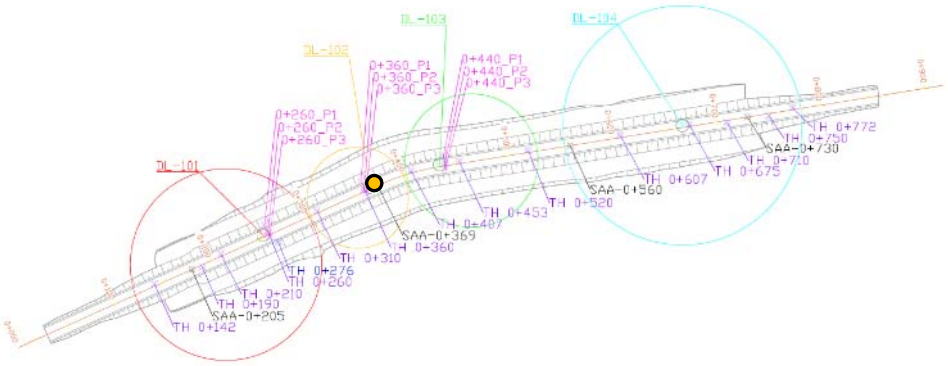
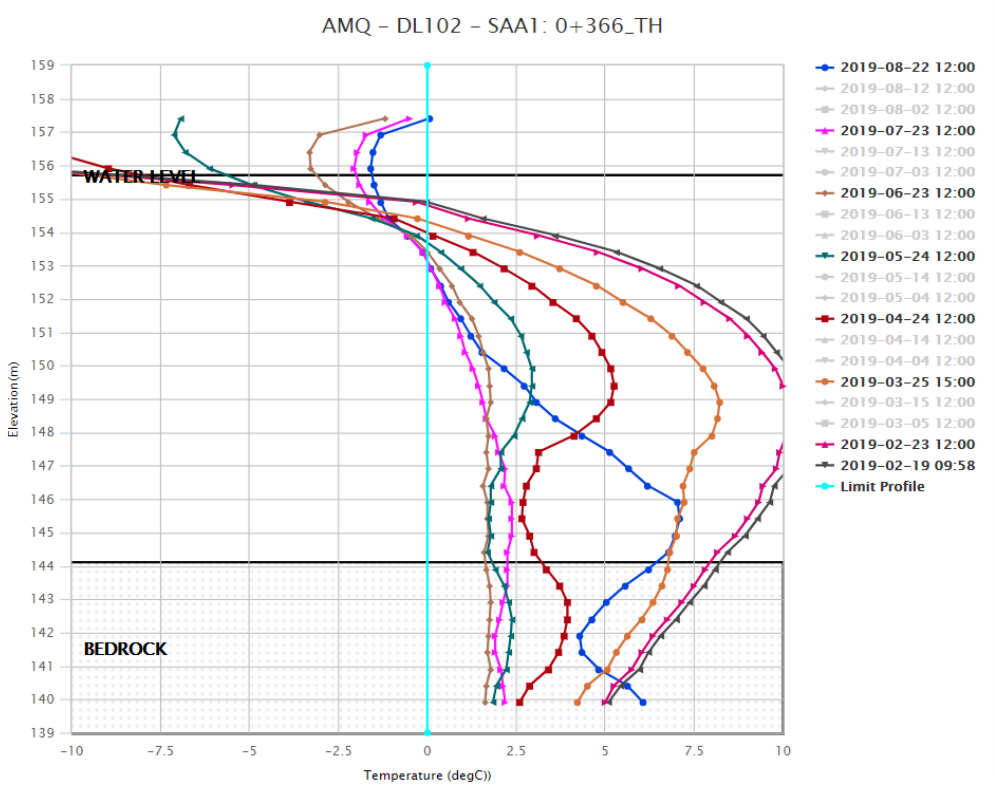
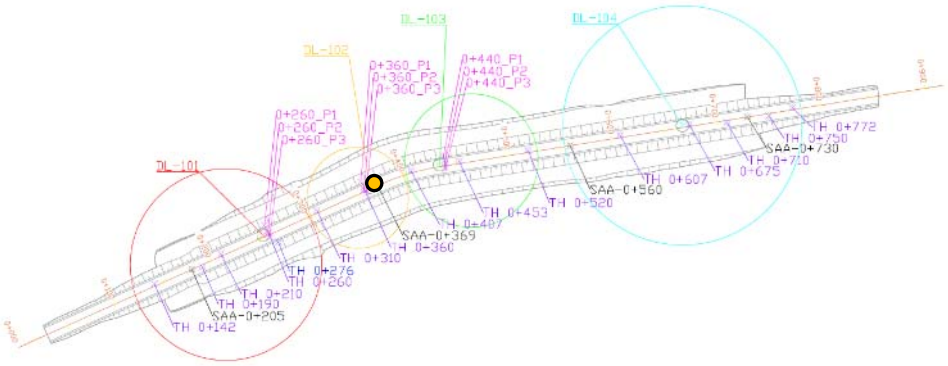


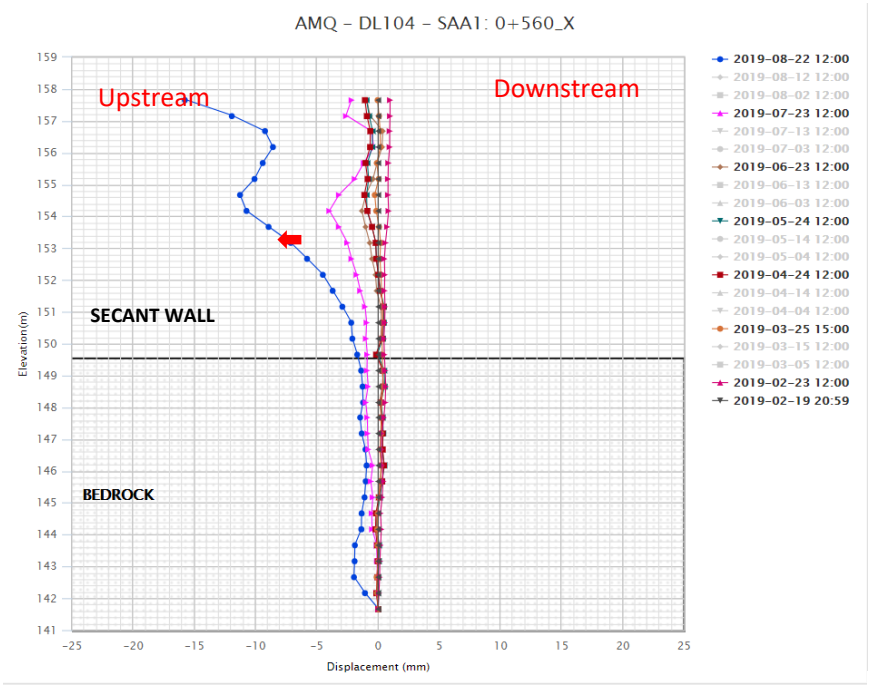
Inclinometer SAA-0+366 / INC-2 – Temperature

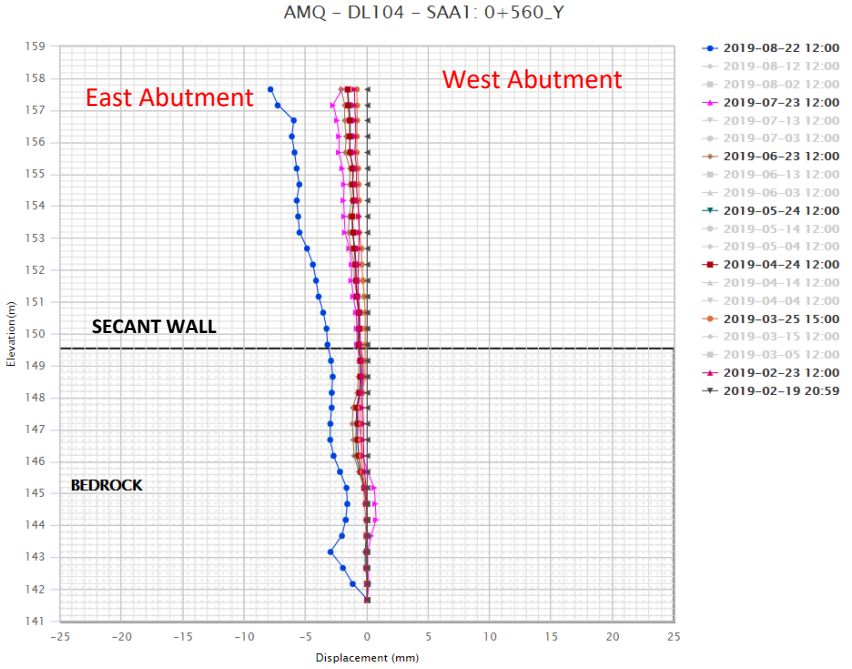


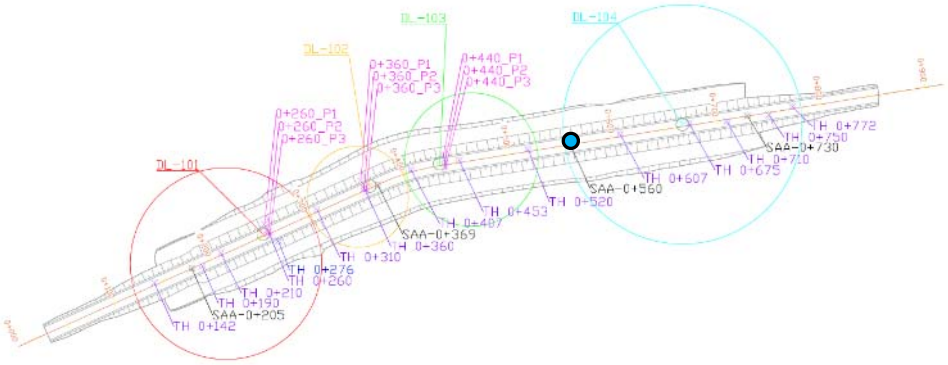


Comments:

Inclinometer SAA-0+560 / INC-3 – Incremental Displacement

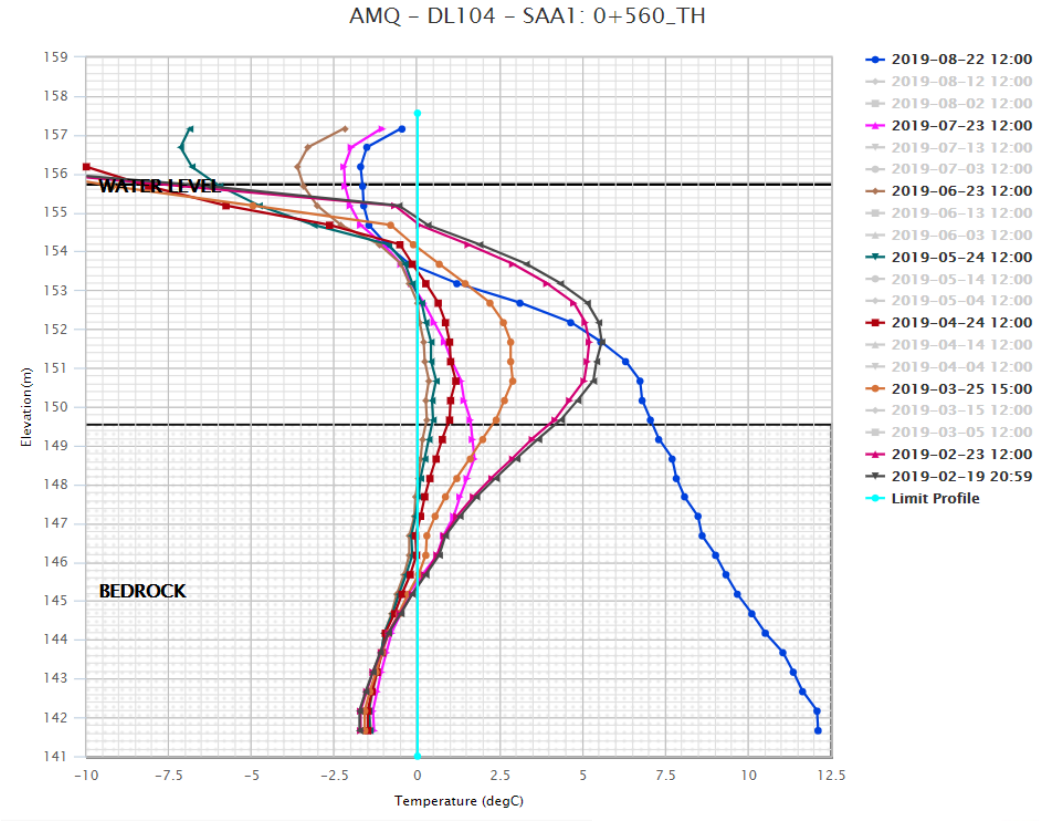


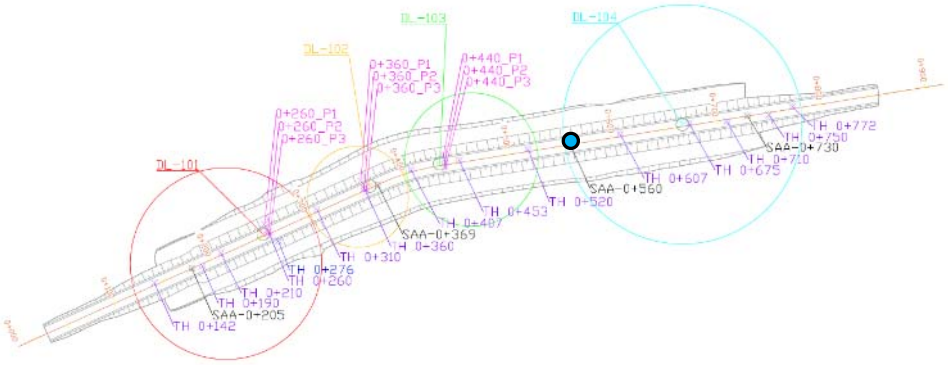




Comments:

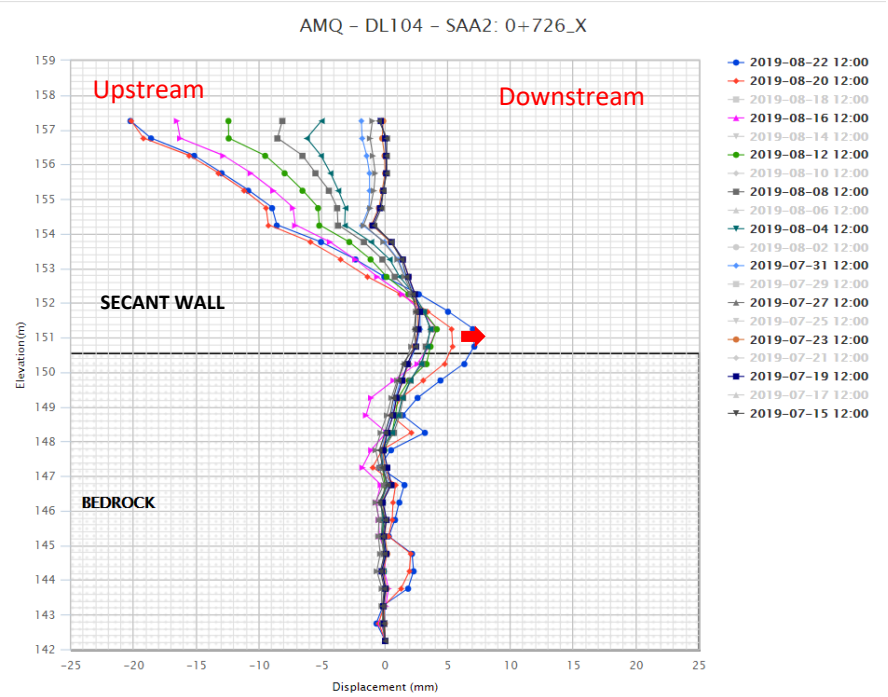
Inclinometer SAA-0+560 / INC-3 – Temperature

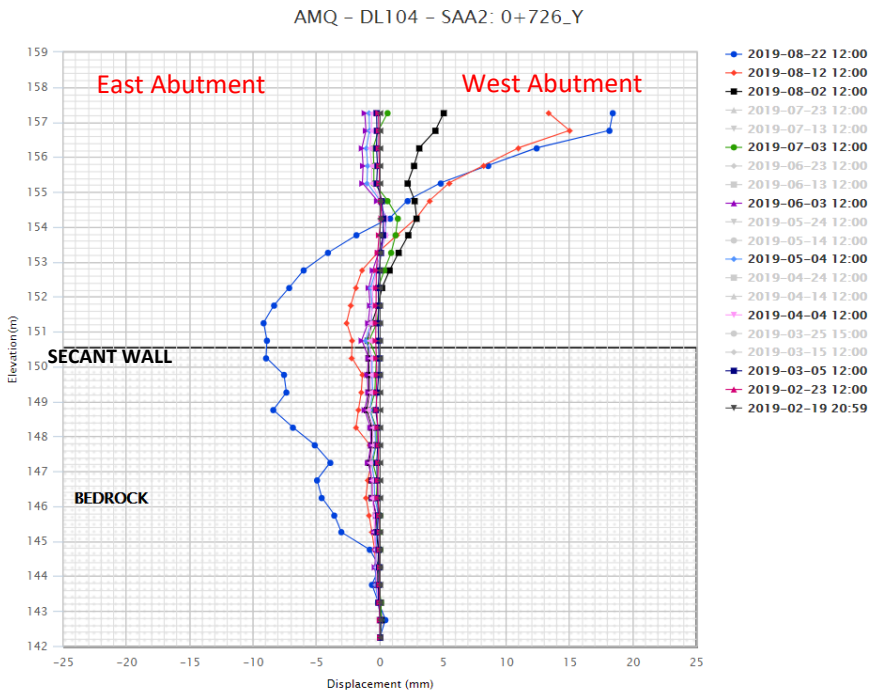




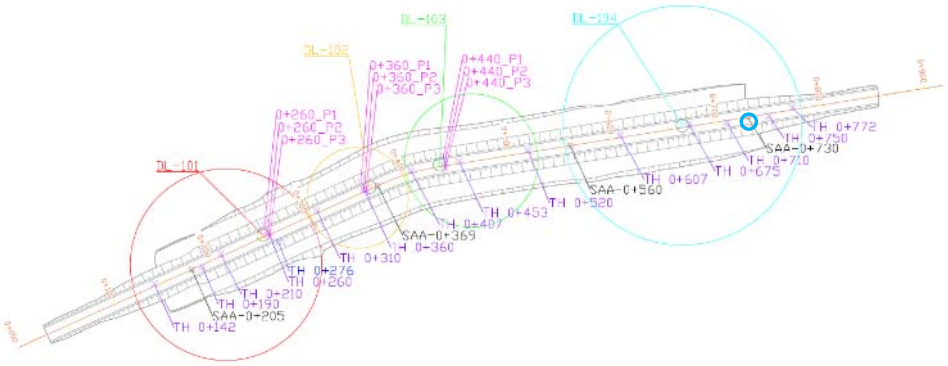
Comments:

Inclinometer SAA-0+726 / INC-4 – Incremental Displacement

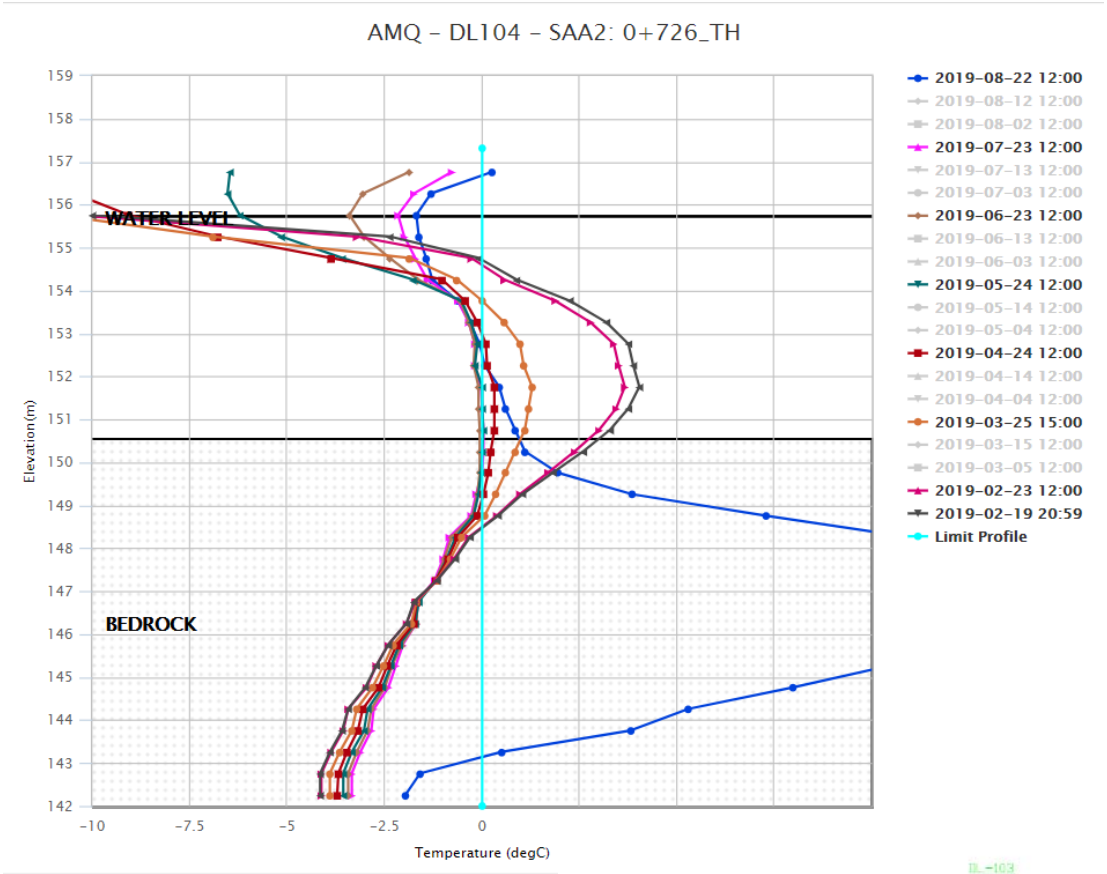


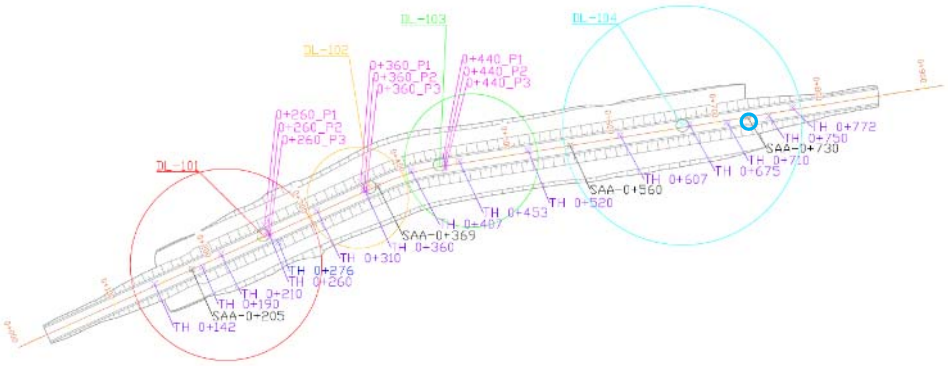


Comments:.



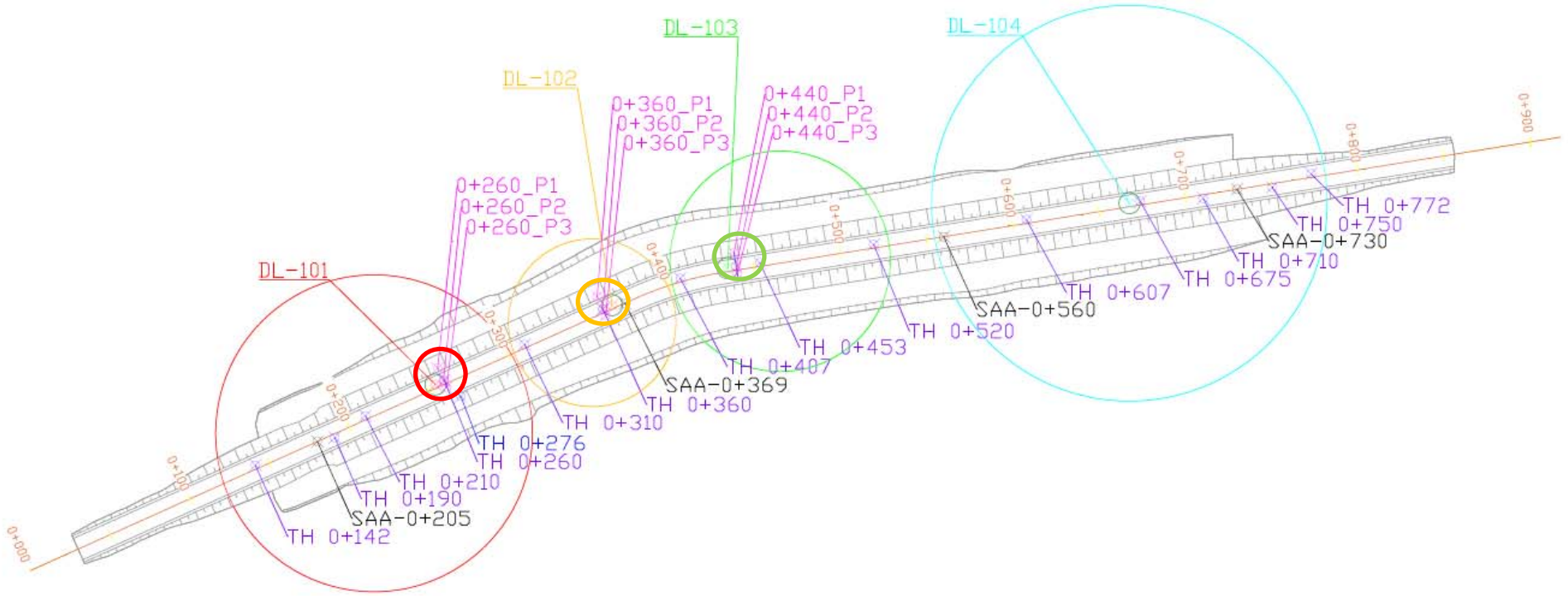
Inclinometer SAA-0+726 / INC-4 – Temperature





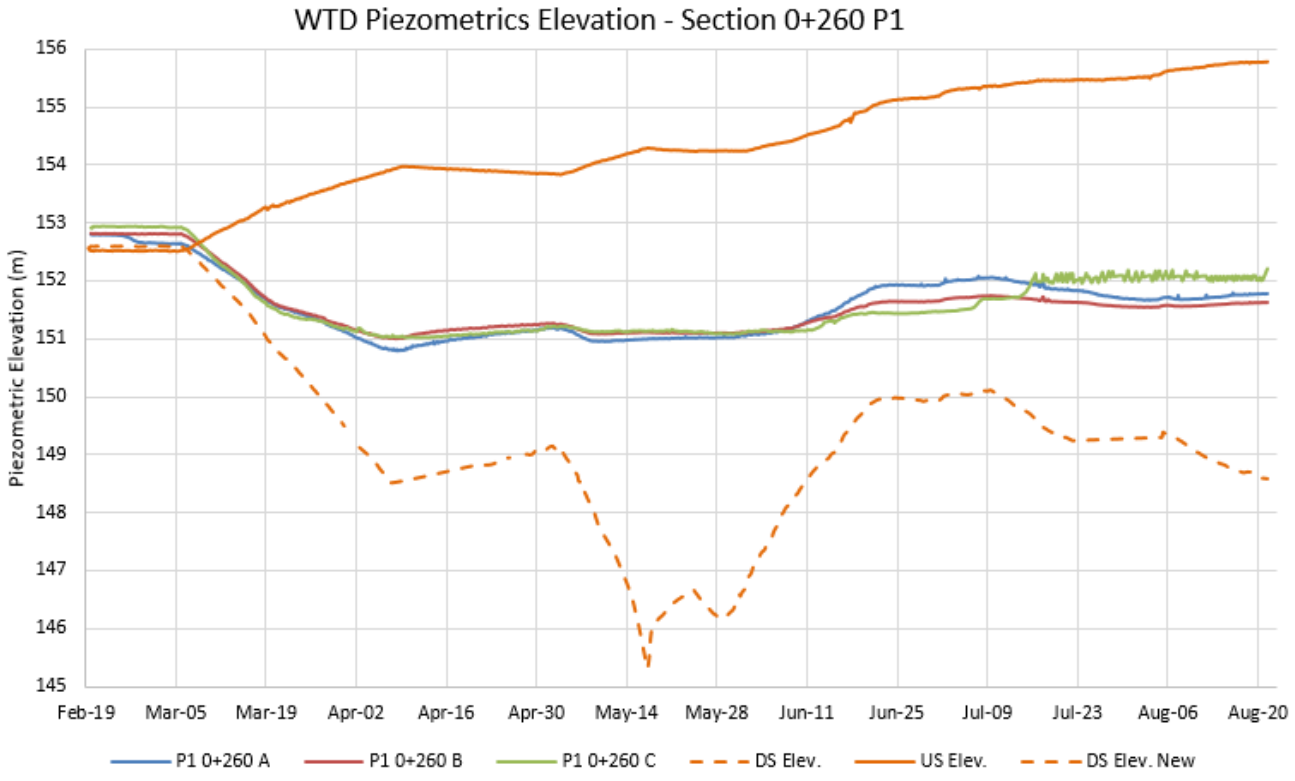
Comments:

Piezometers



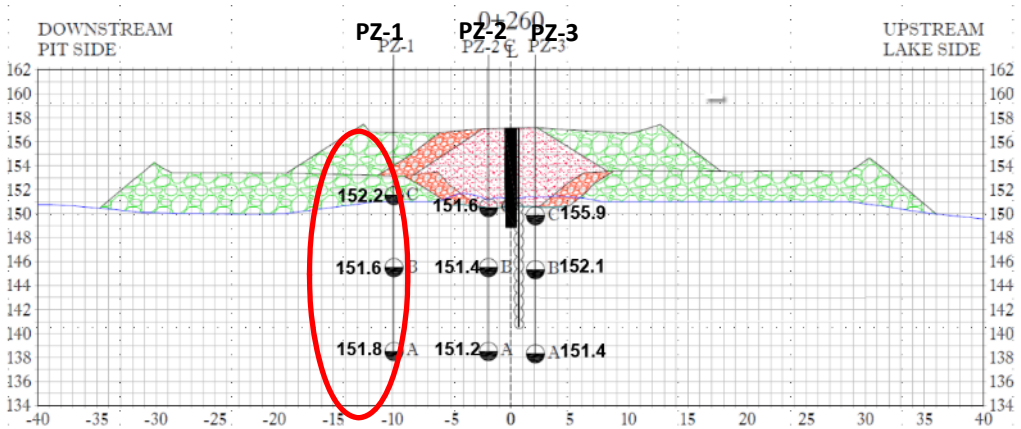
\\Cambfs01\groups\Engineering\05-Geotechnic\14- Amaruq\01 - Dewatering Dikes\1 - Whale Tale Dike\4 - Operation\1- Inspection

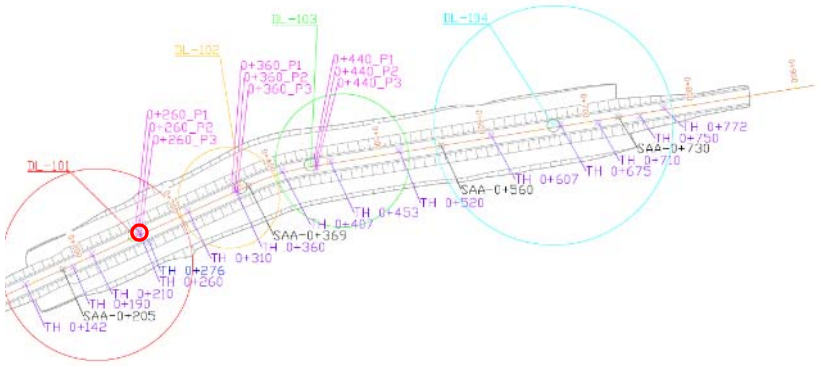
Piezometer 0+260_P1 (A-B-C)



Comments:

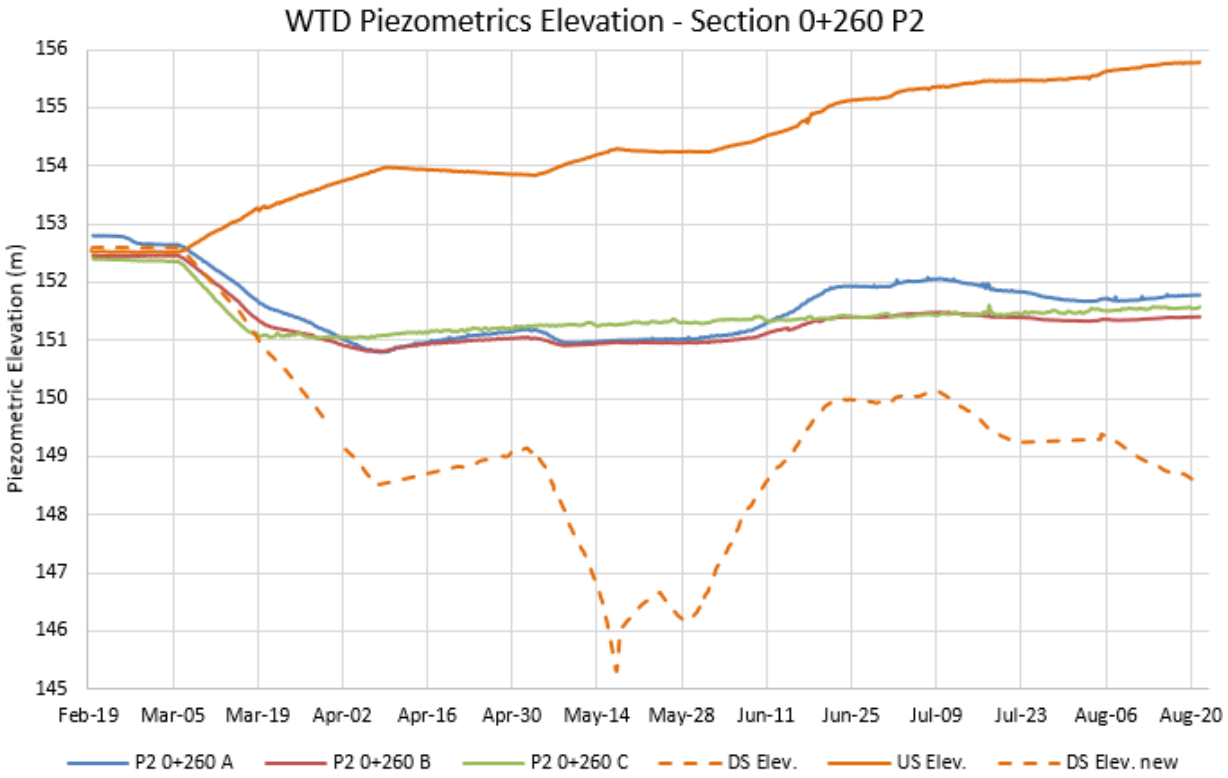
Total Head on August 21st, 2019





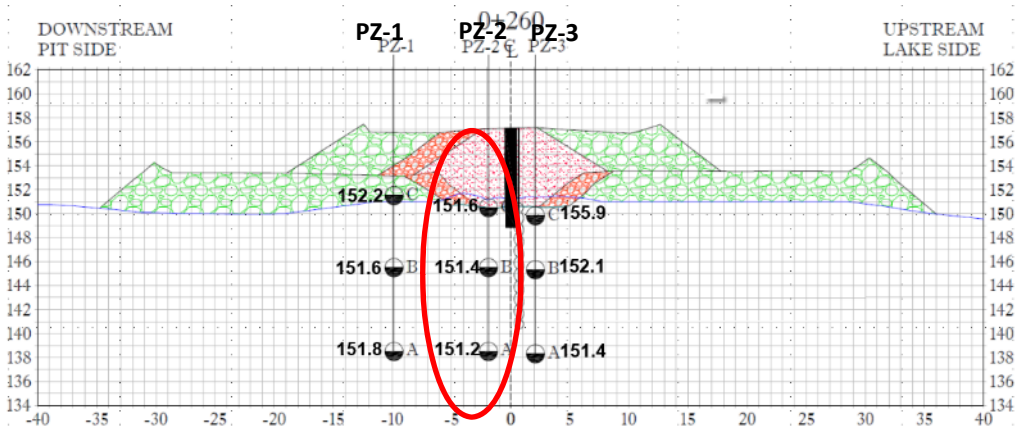
Whale Tail Dike

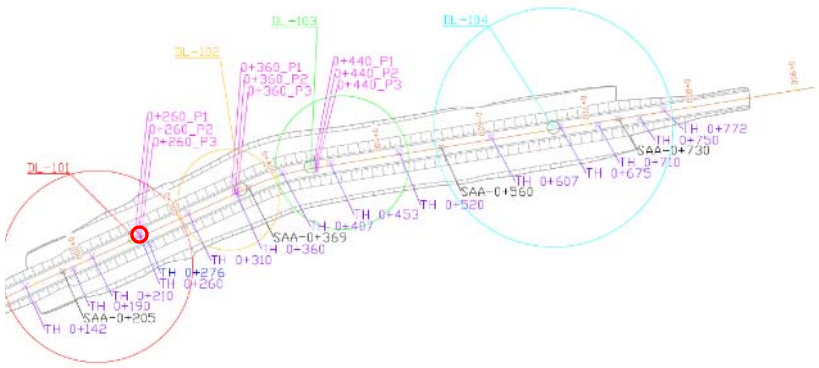
Piezometer 0+260_P2 (A-B-C)



Comments:

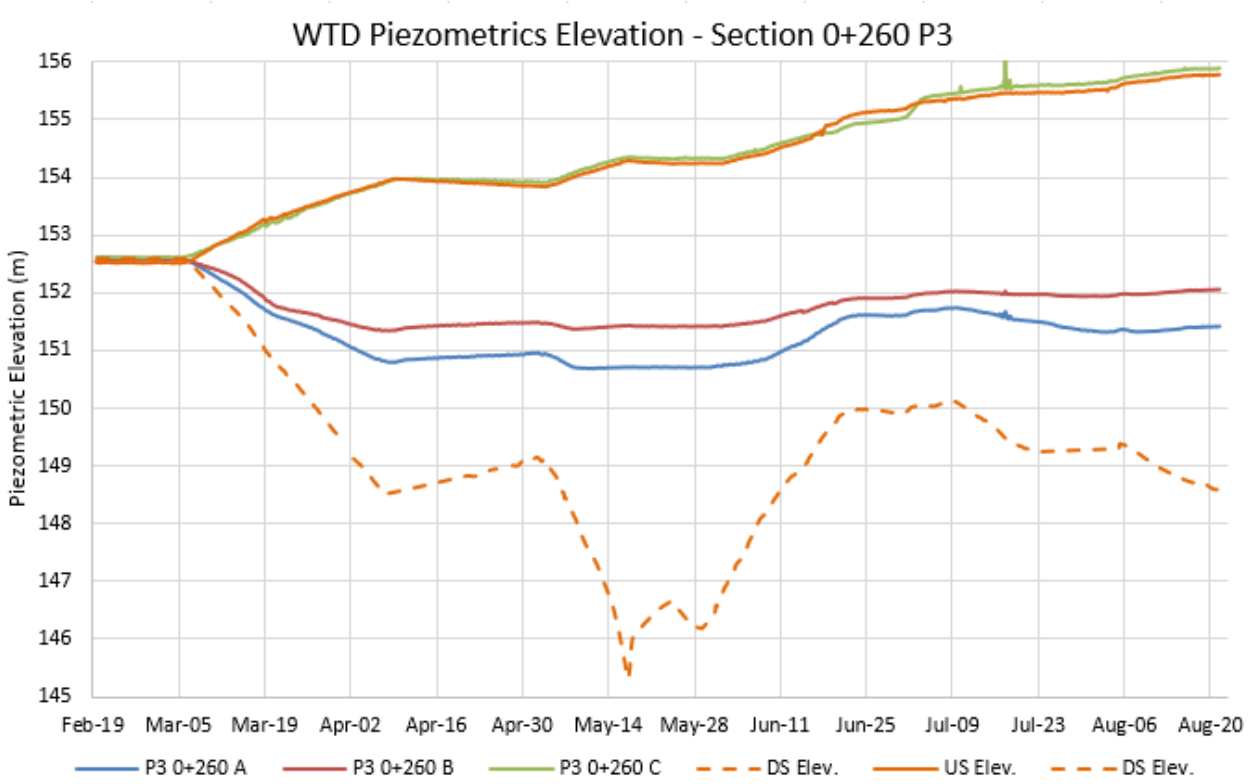
Total Head on August 21st, 2019





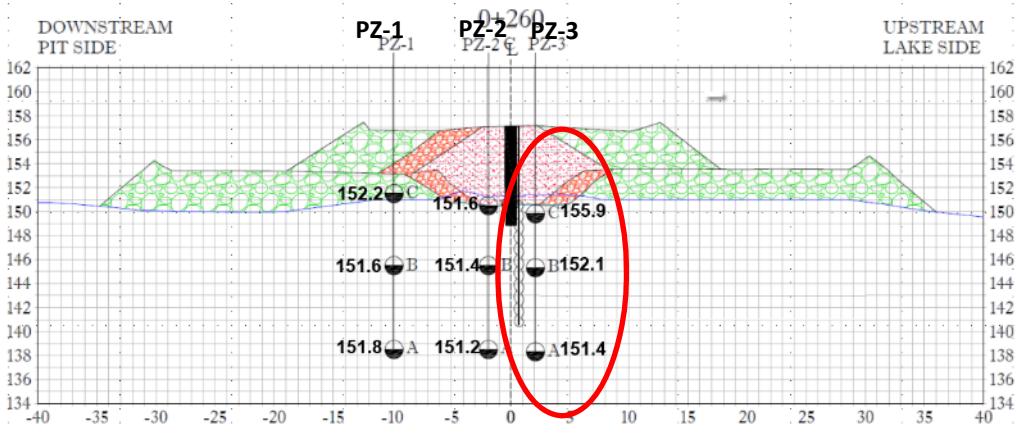
Whale Tail Dike

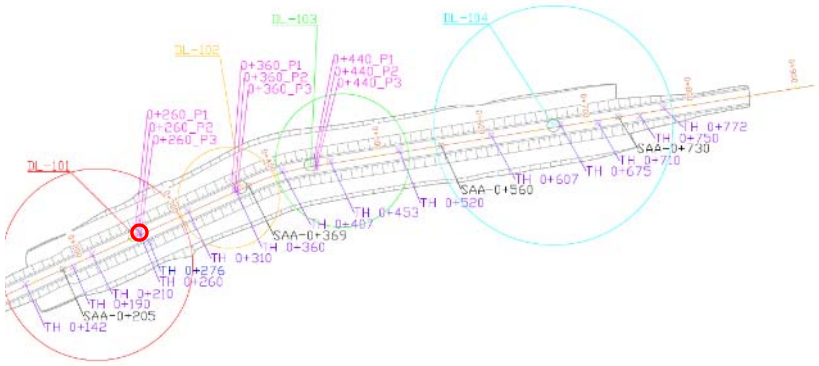
Piezometer 0+260_P3 (A-B-C)



Comments:

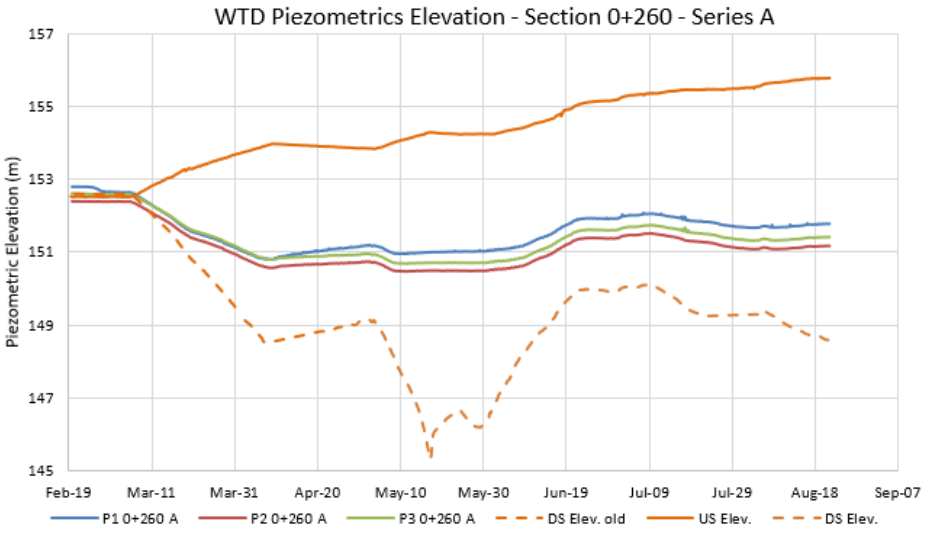
Total Head on August 21st, 2019

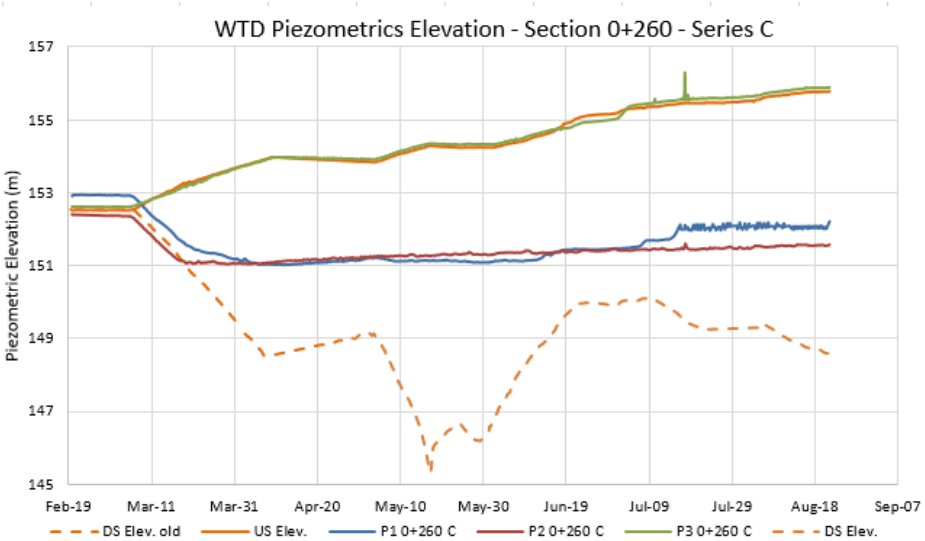


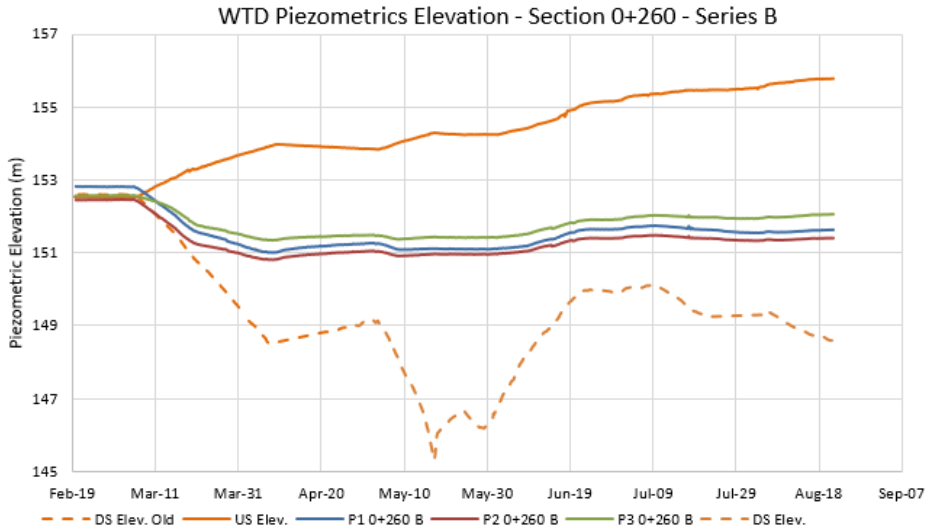


Whale Tail Dike

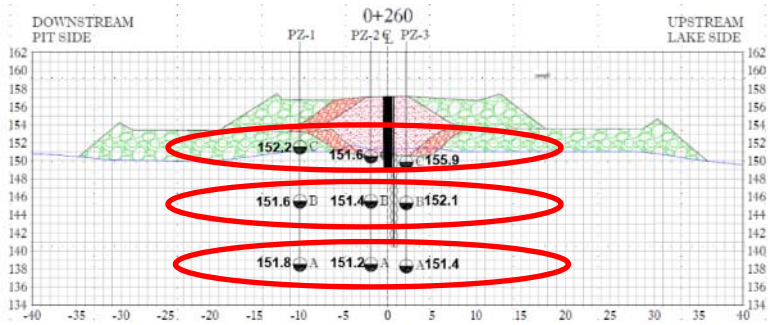
Piezometer 0+260 Graph By A, B and C series



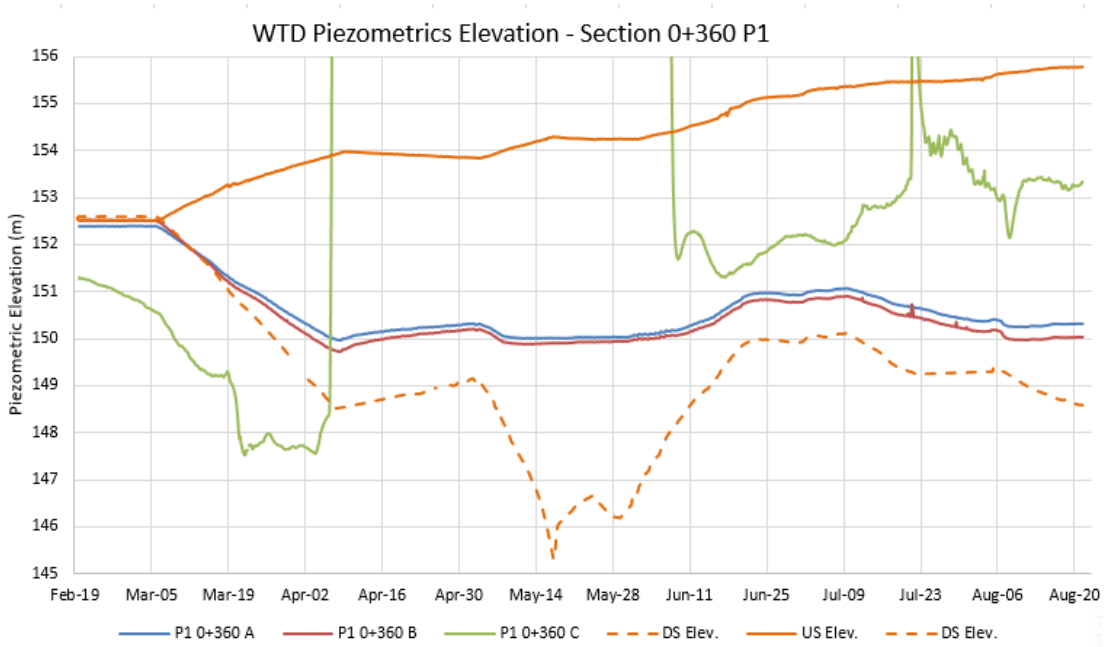




Comments: Total Head on August 21st, 2019

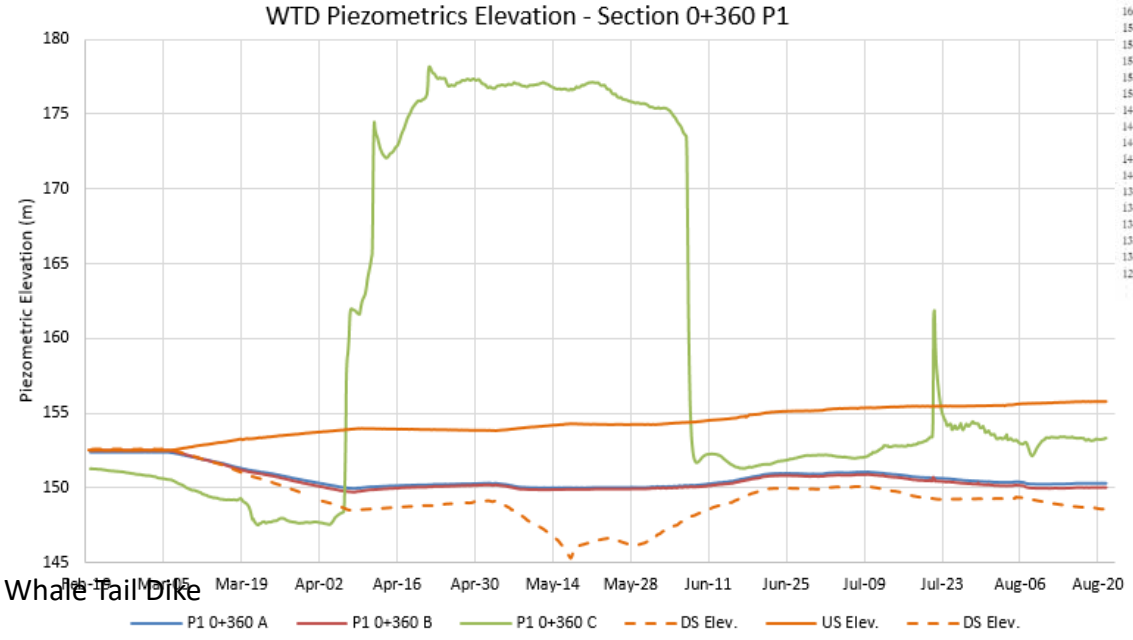


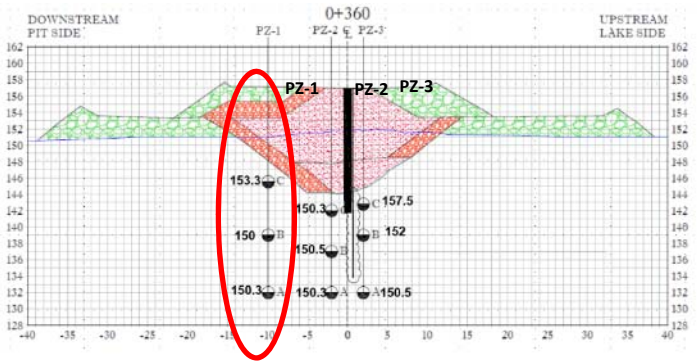
Piezometer 0+360_P1 (A-B-C)

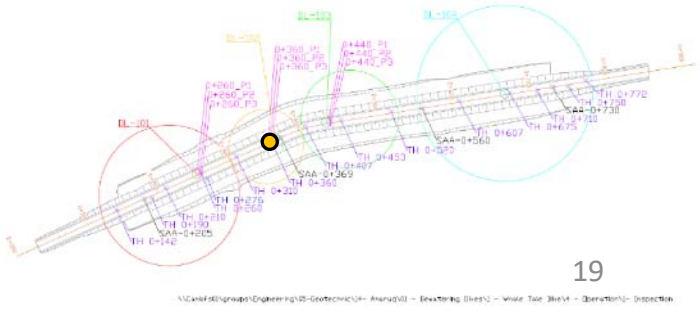


Comments:

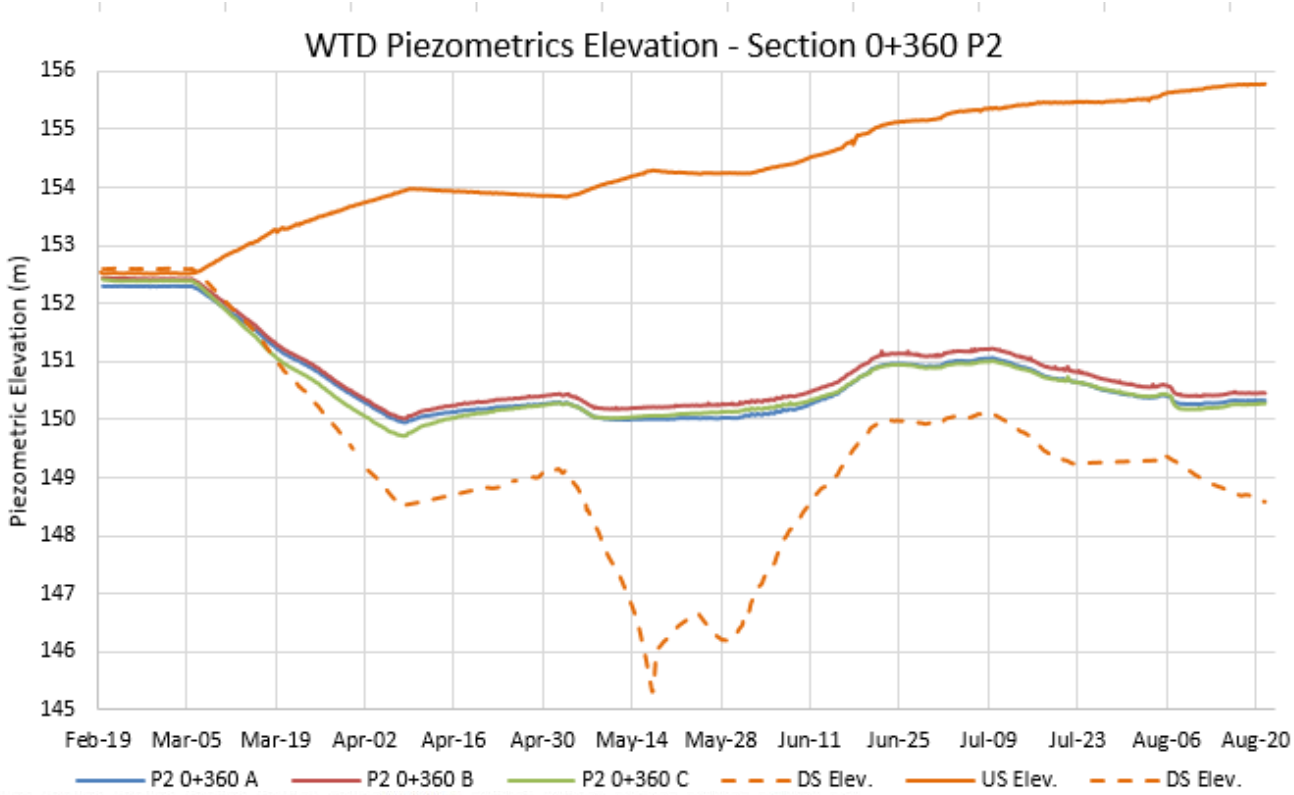
Total Head on August 21st, 2019





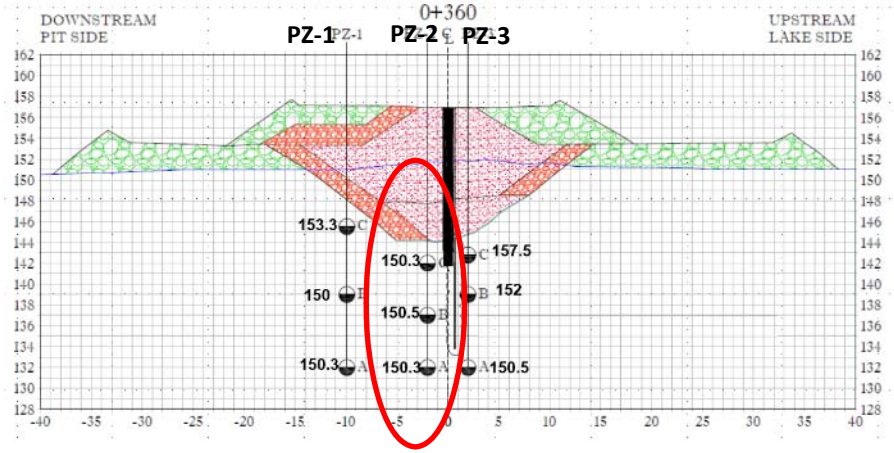


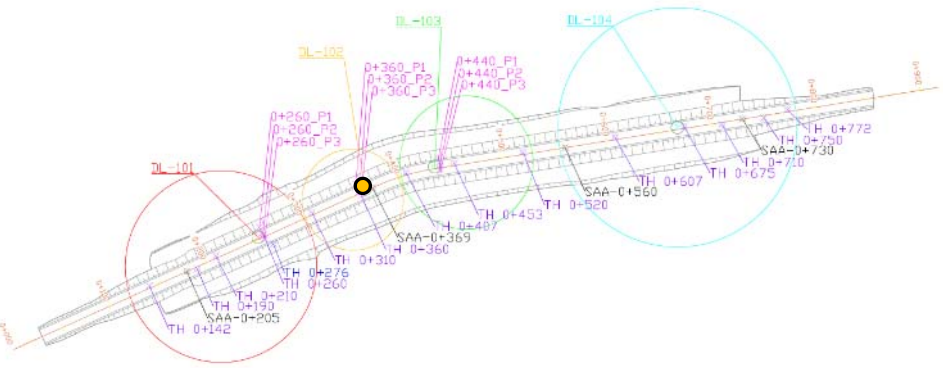
Piezometer 0+360_P2 (A-B-C)



Comments:

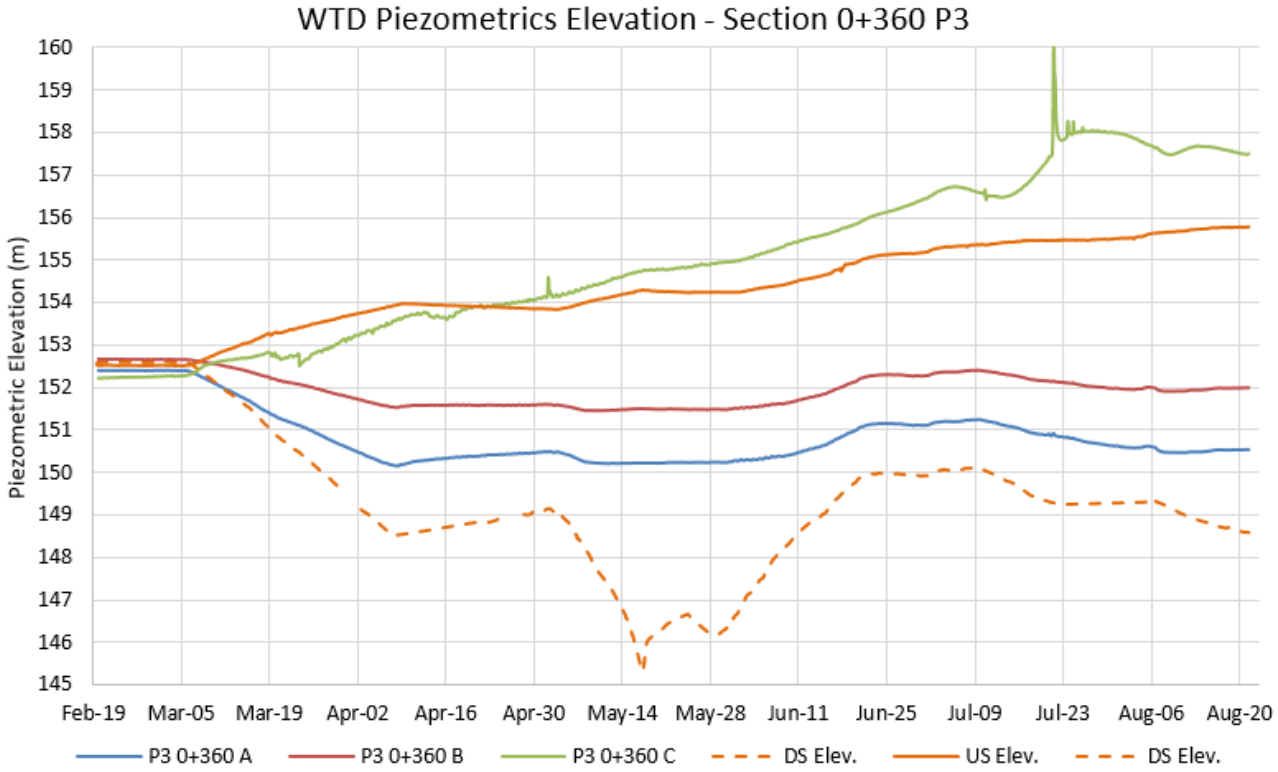
Total Head on August 21st, 2019





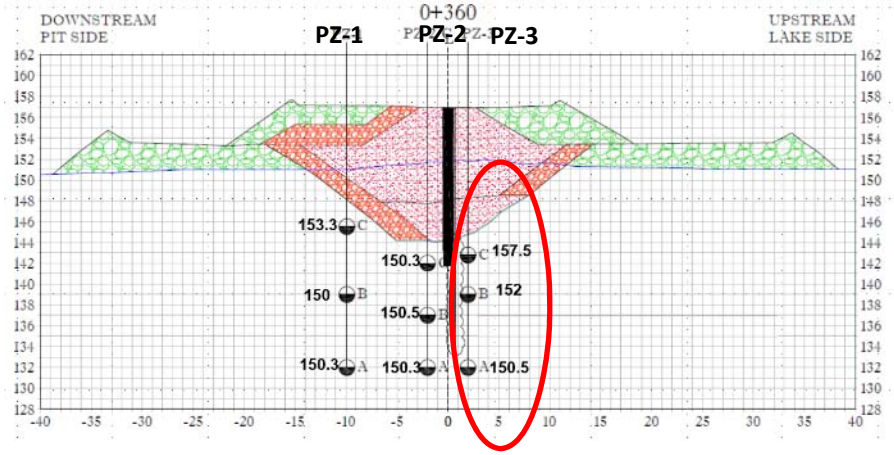
Whale Tail Dike

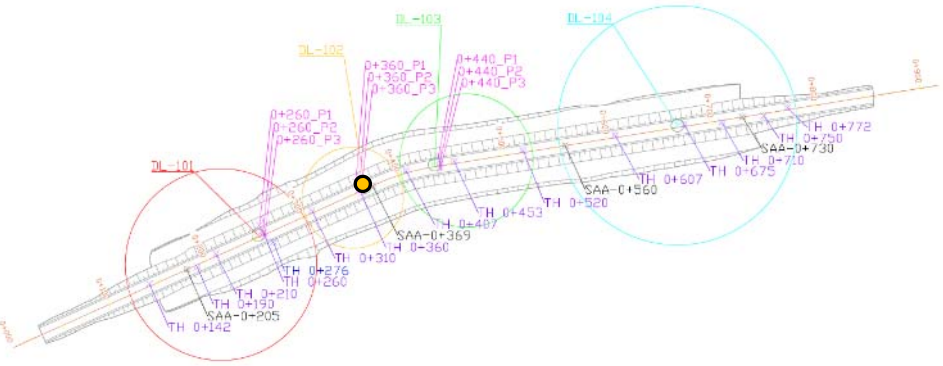
Piezometer 0+360_P3 (A-B-C)



Comments:

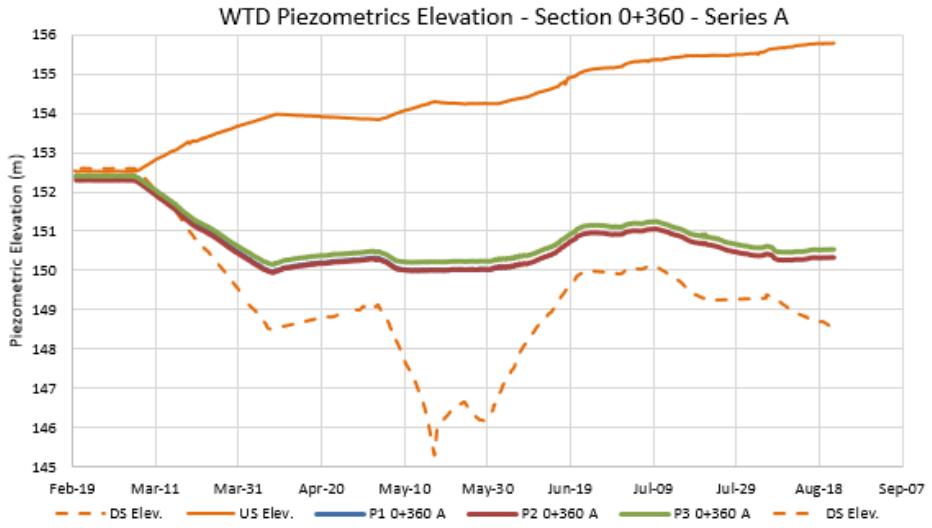
Total Head on August 21st, 2019

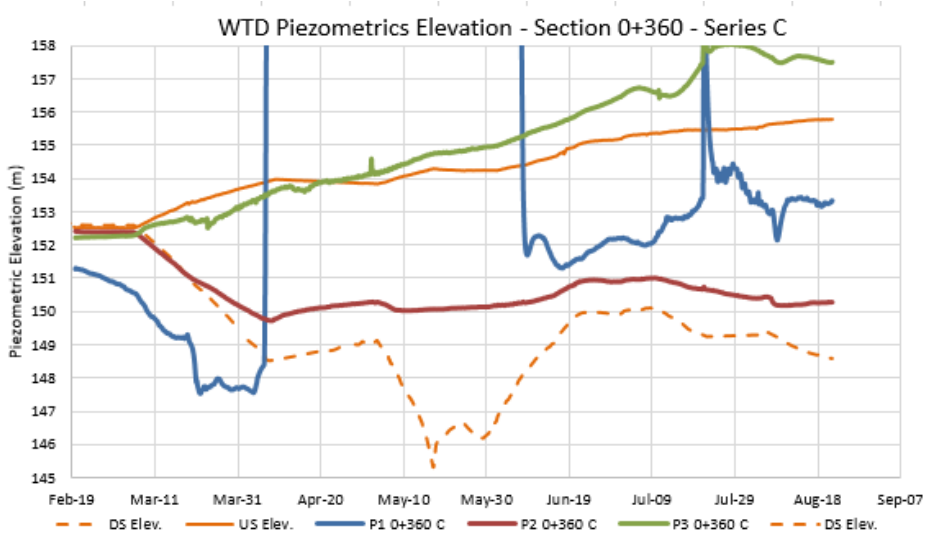


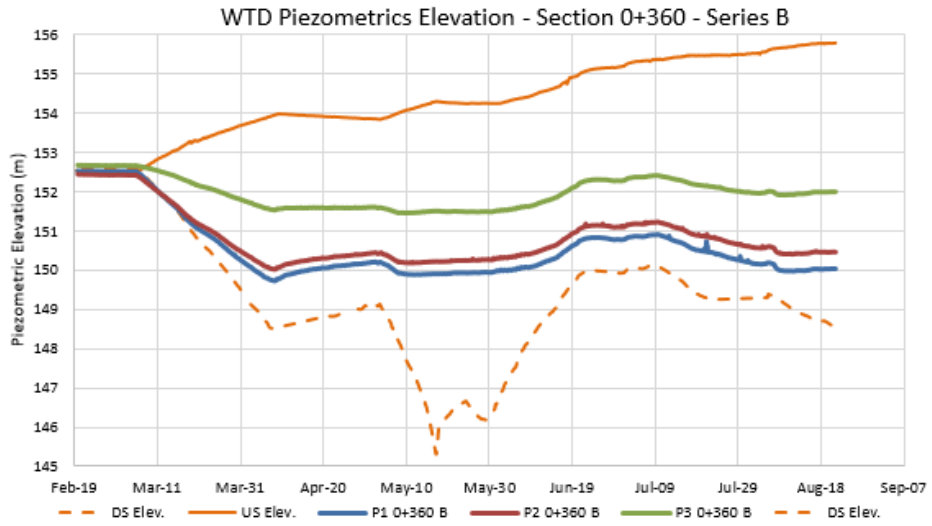


Whale Tail Dike

Piezometer 0+360 Graph By A, B and C series







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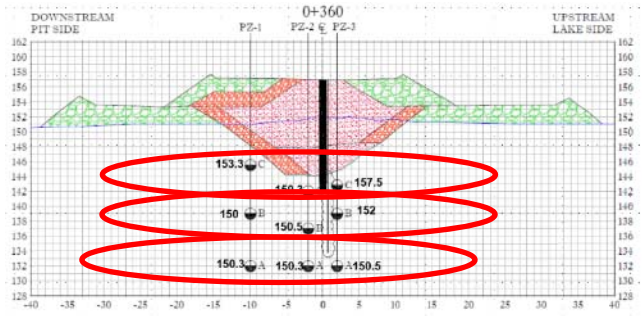
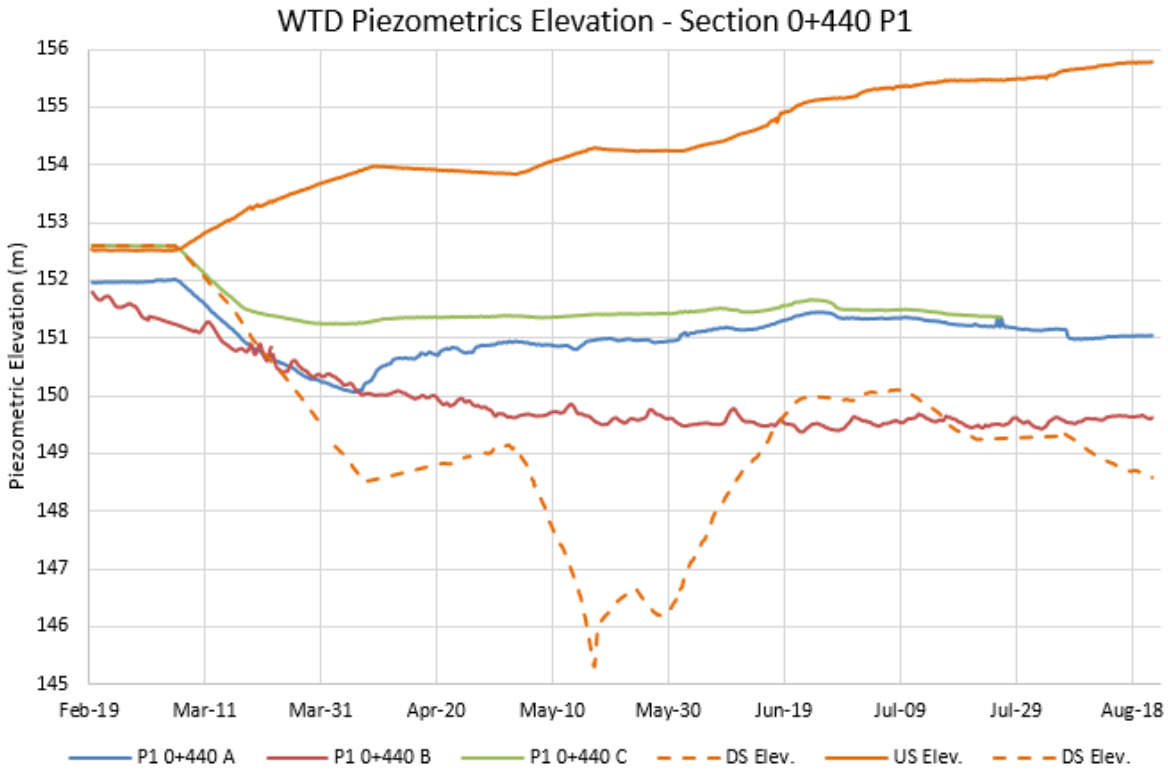
Total Head on August 21st, 2019

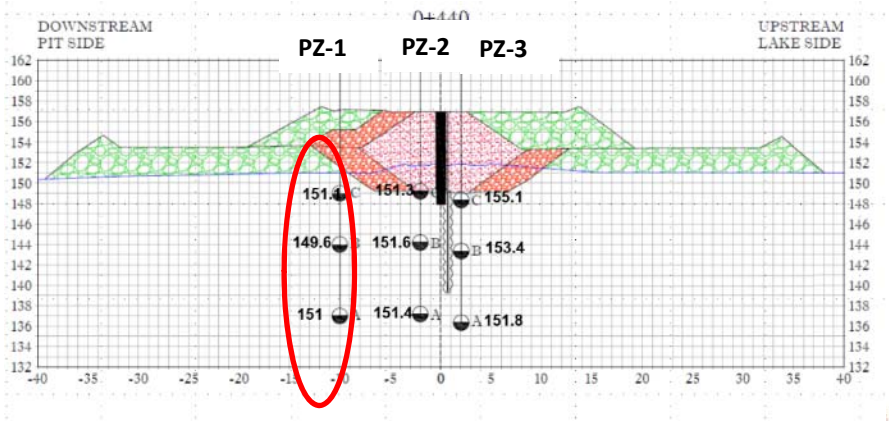


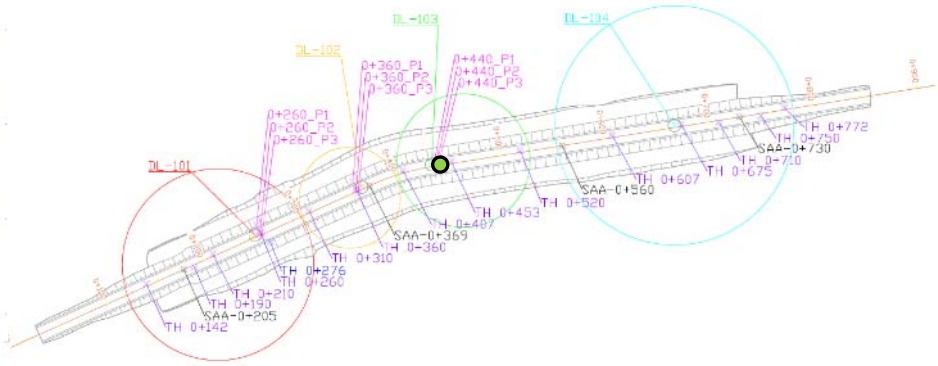
Piezometer 0+440_P1 (A-B-C)



Comments:

Total Head on August 21st, 2019





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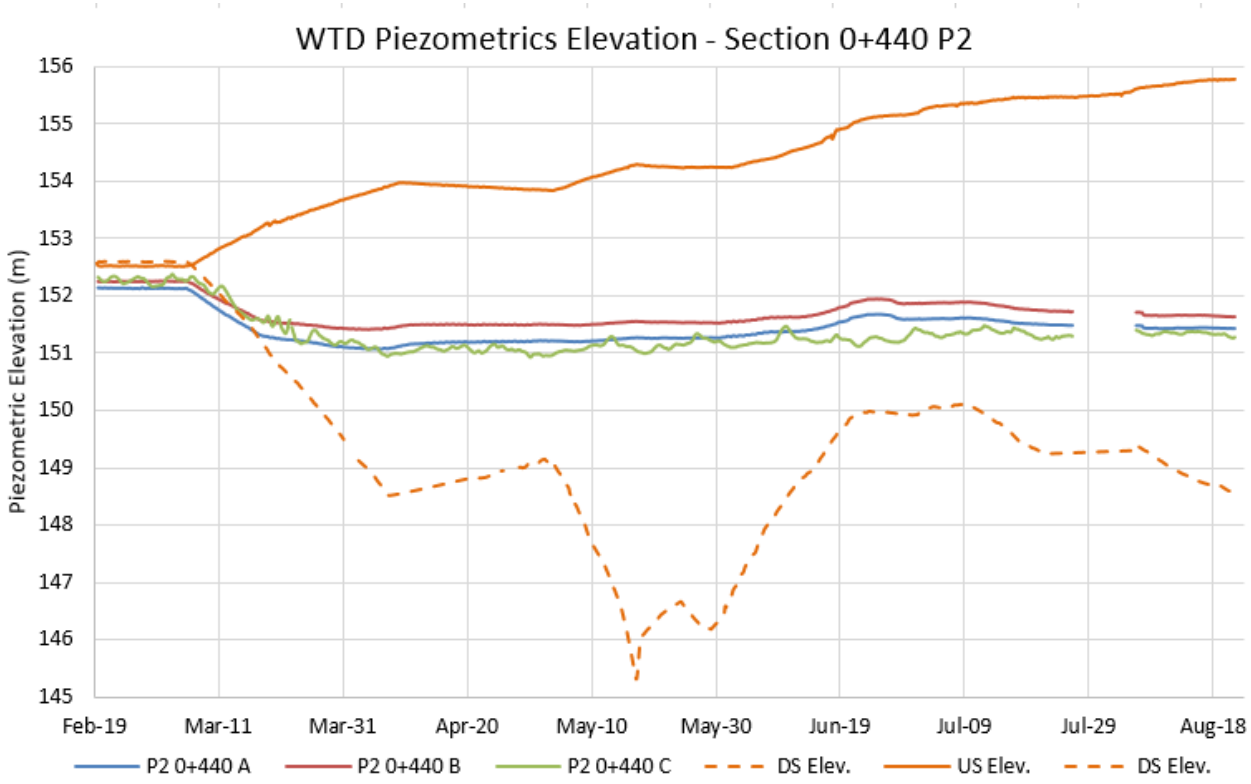
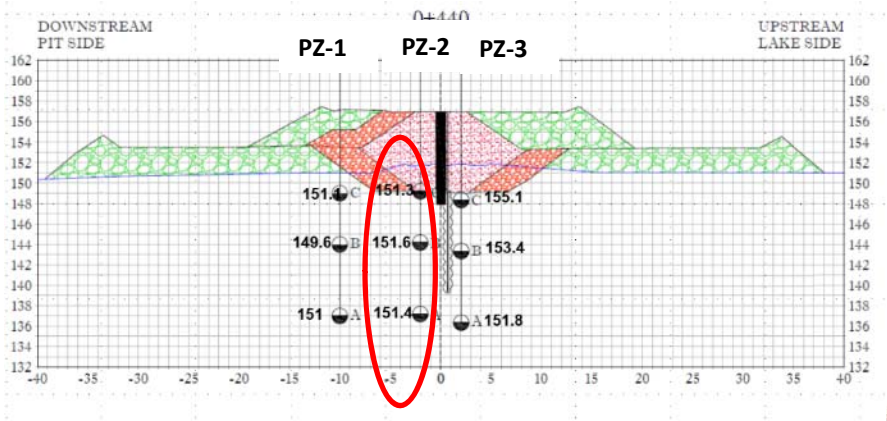
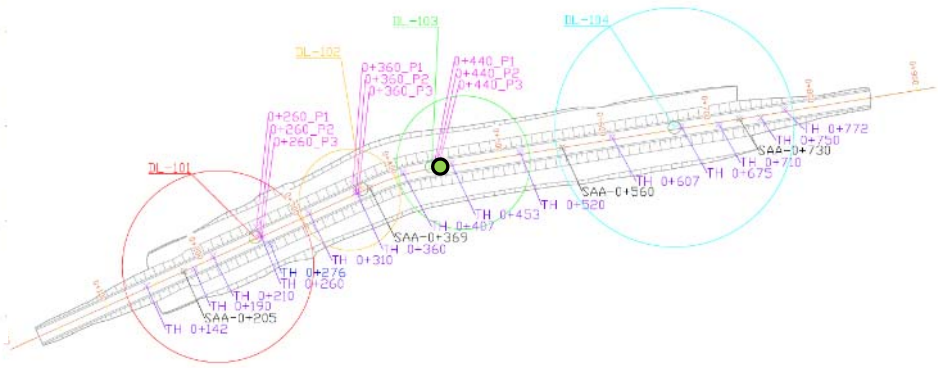
Piezometer 0+440_P2 (A-B-C)



Comments:

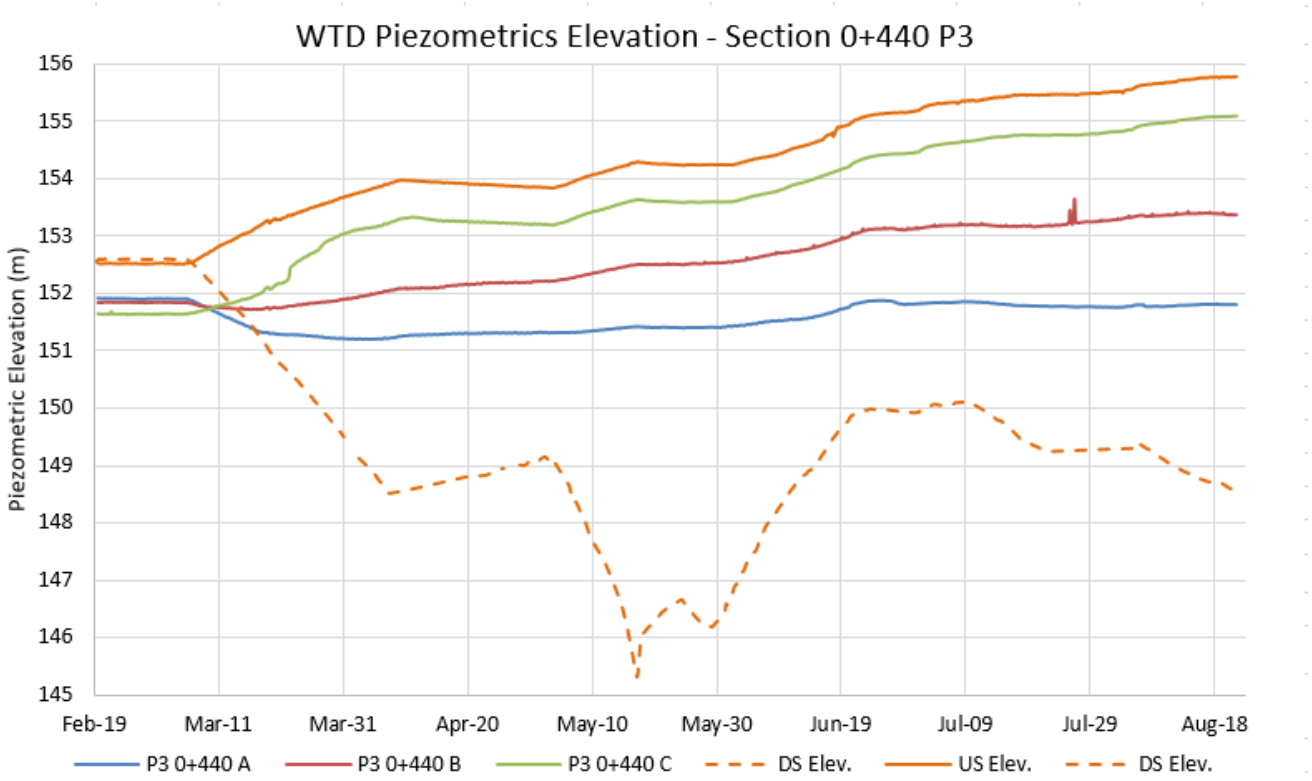
Total Head on August 21st, 2019





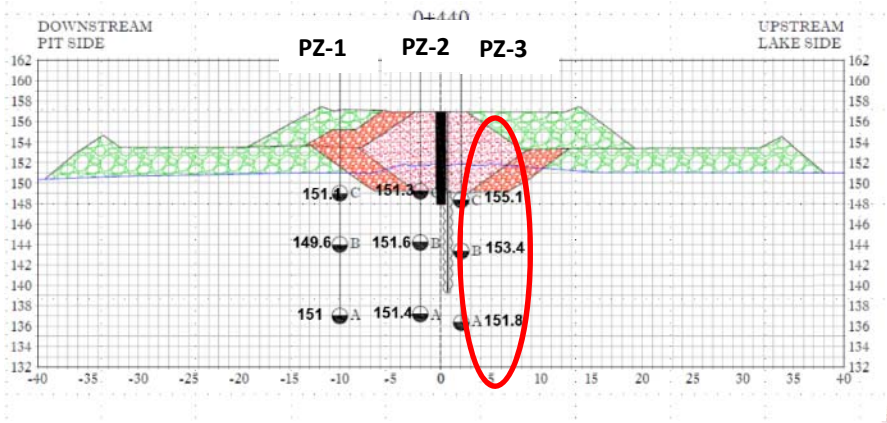
Whale Tail Dike

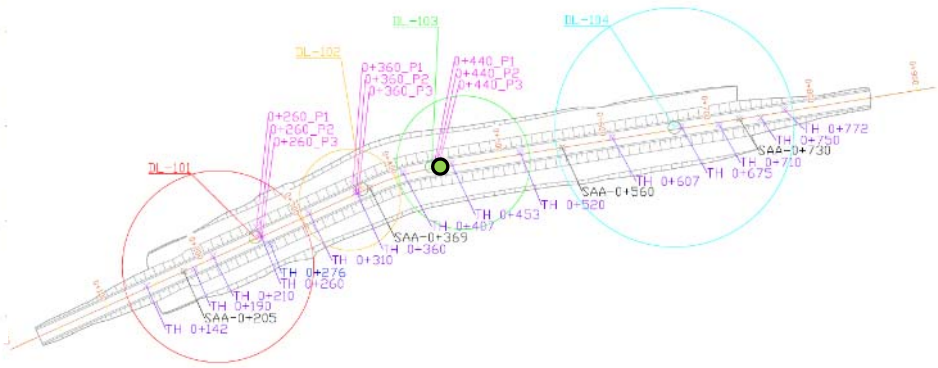
Piezometer 0+440_P3 (A-B-C)



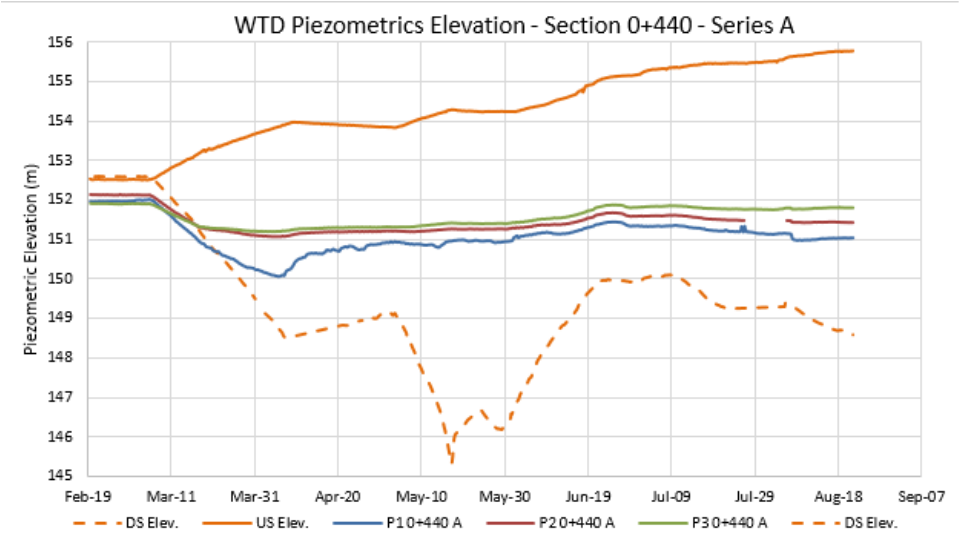
Comments:

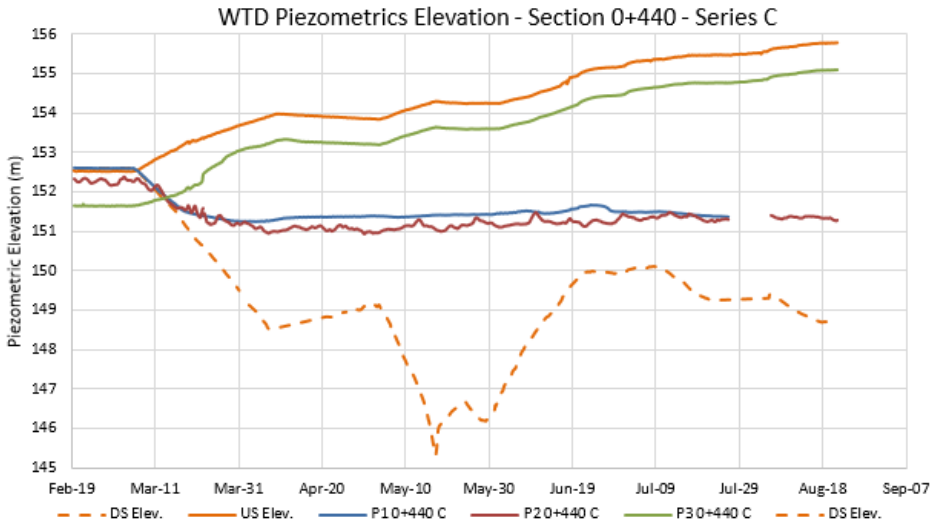
Total Head on August 21st, 2019

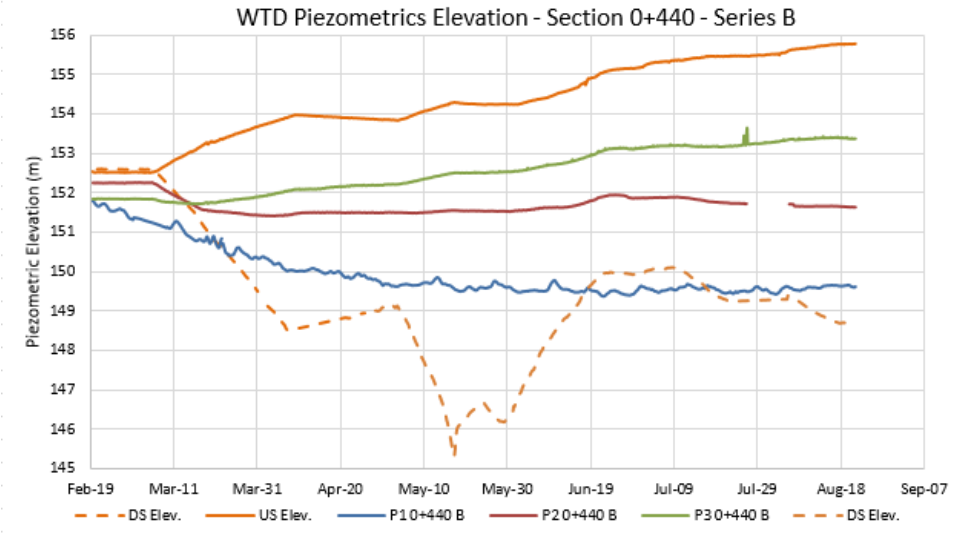




Piezometer 0+440 Graph By A, B and C series

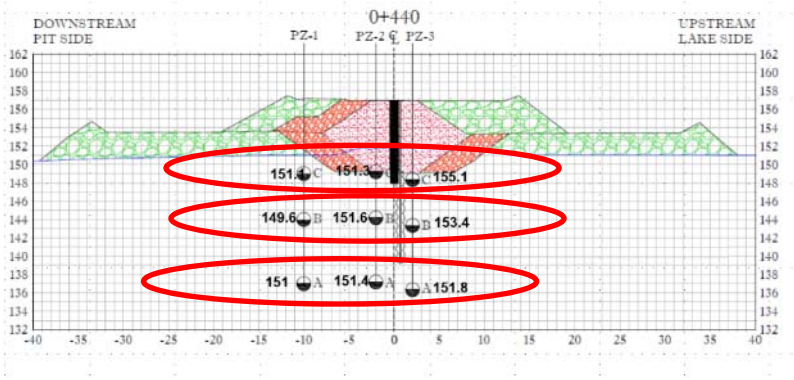




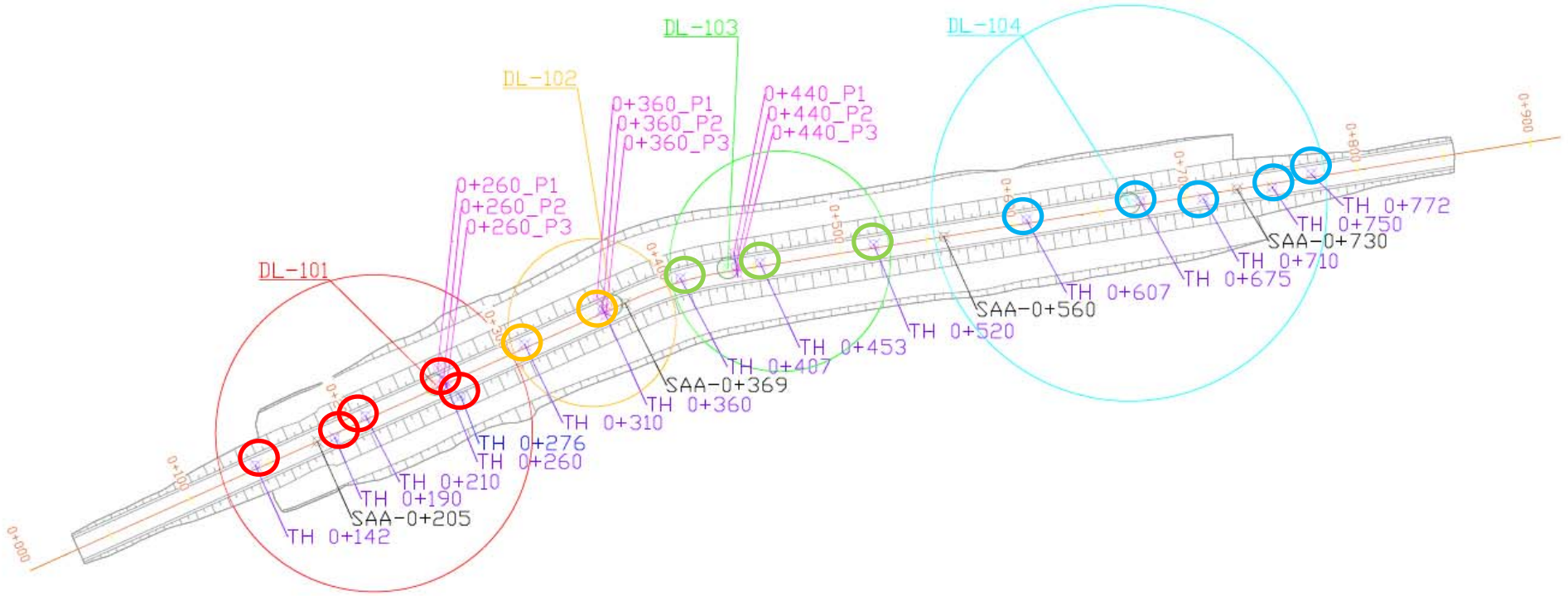


Comments:

Total Head on August 21st, 2019



Thermistors



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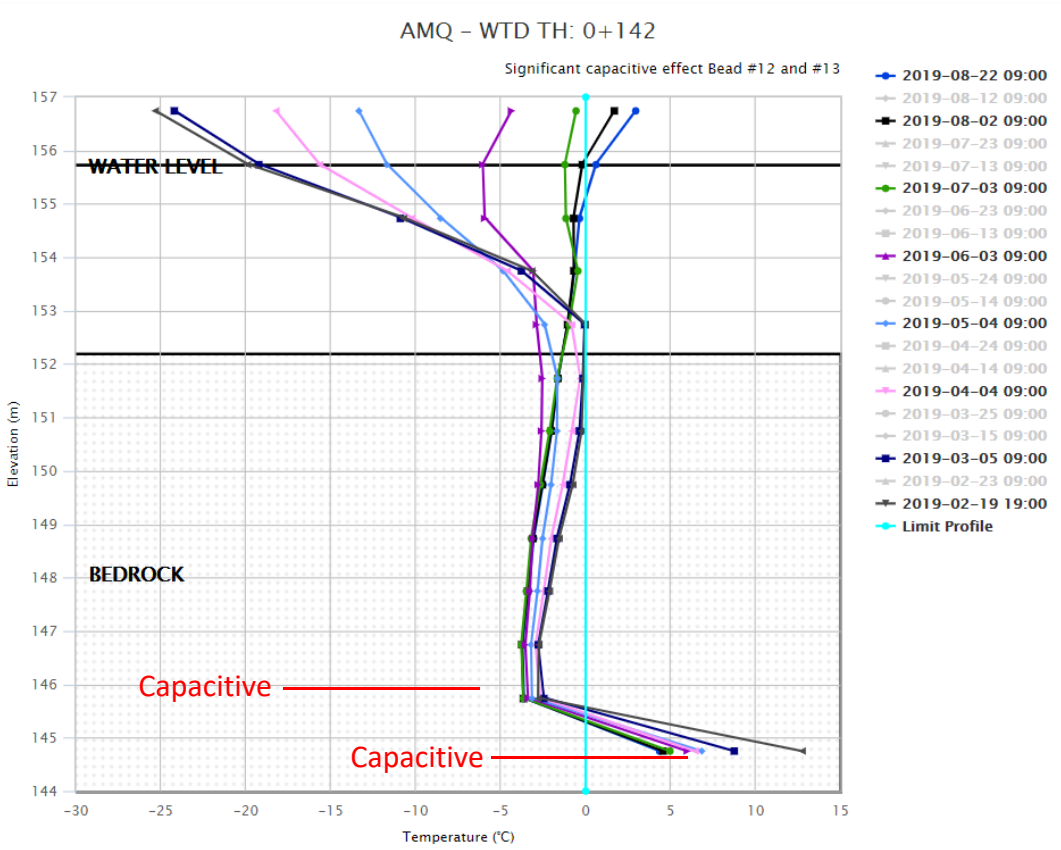
Thermistor TH 0+142 / TH-1



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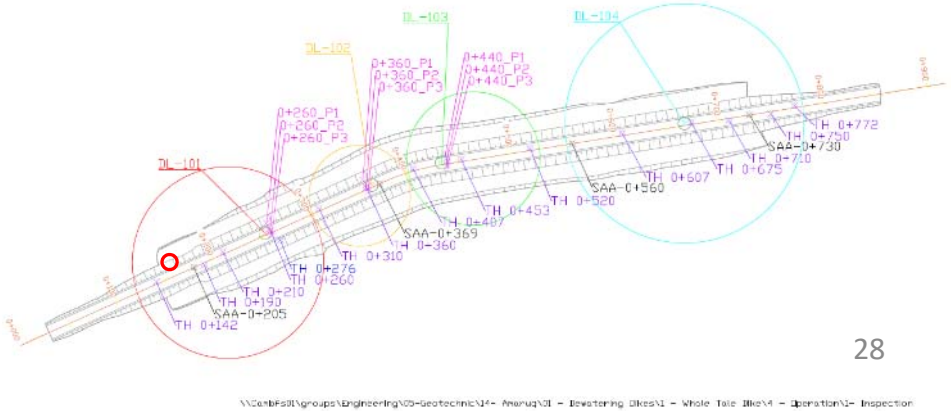
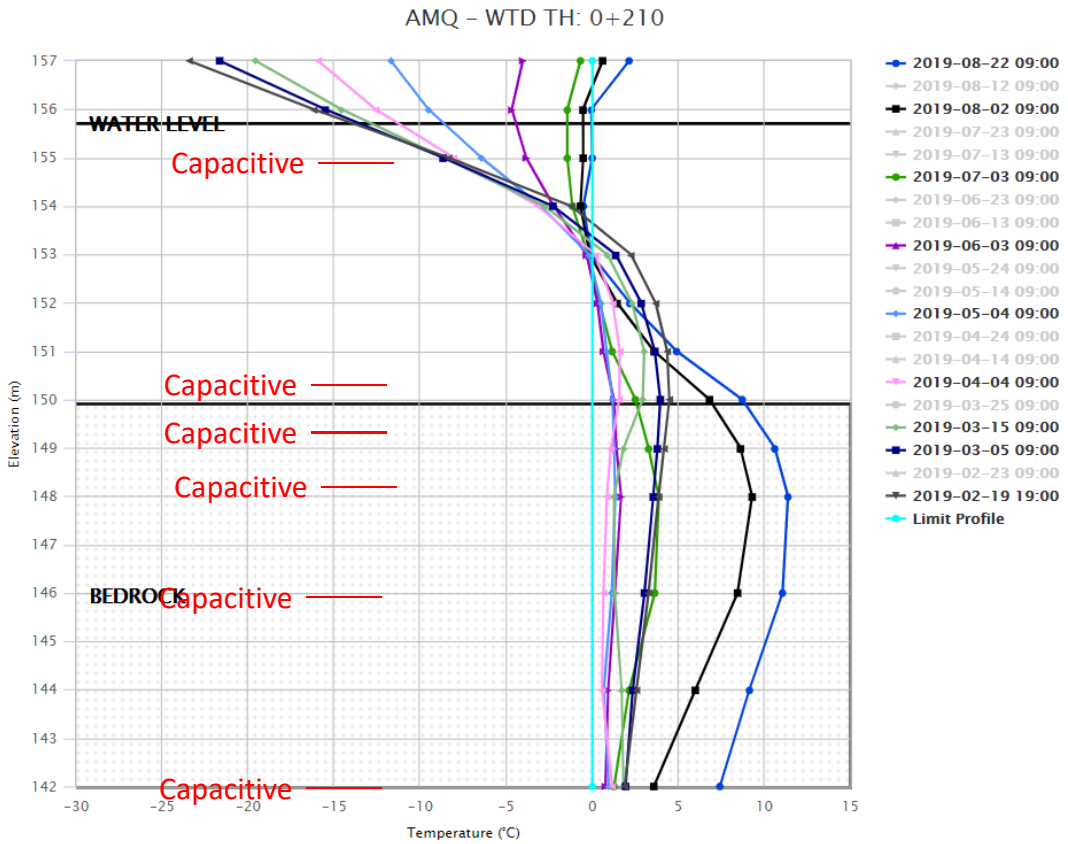


Thermistor TH 0+210 / TH-2



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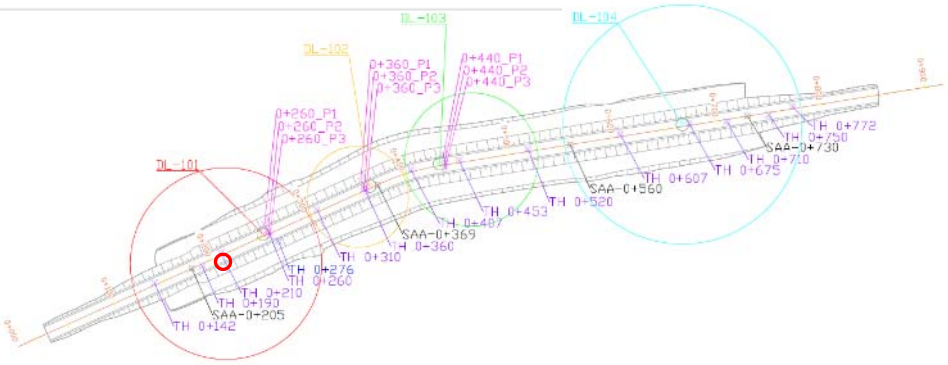
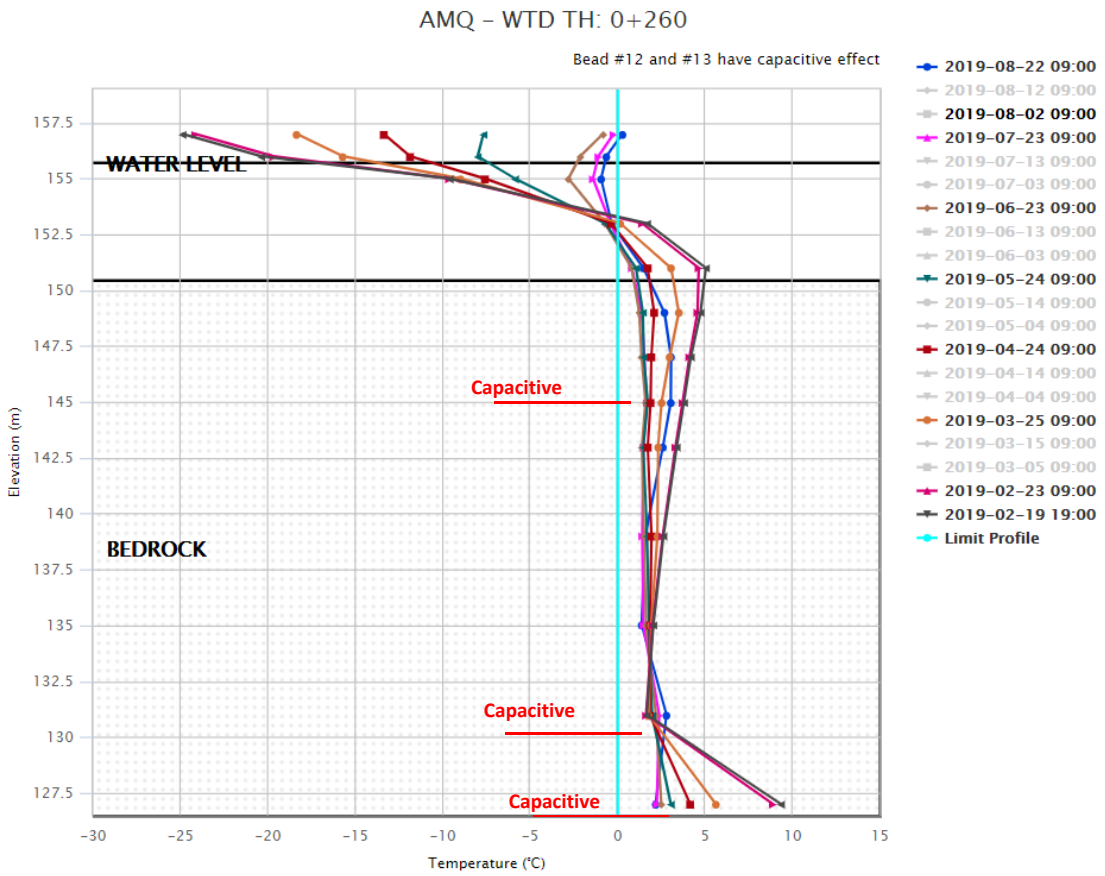


Thermistor TH 0+260 / TH-3



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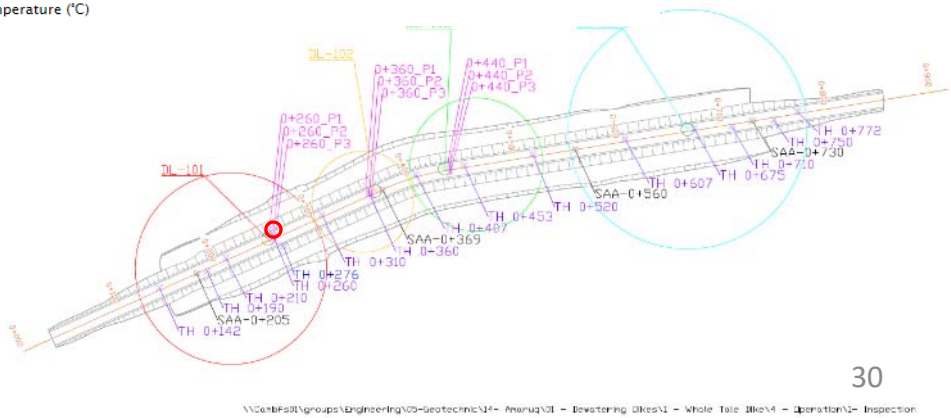
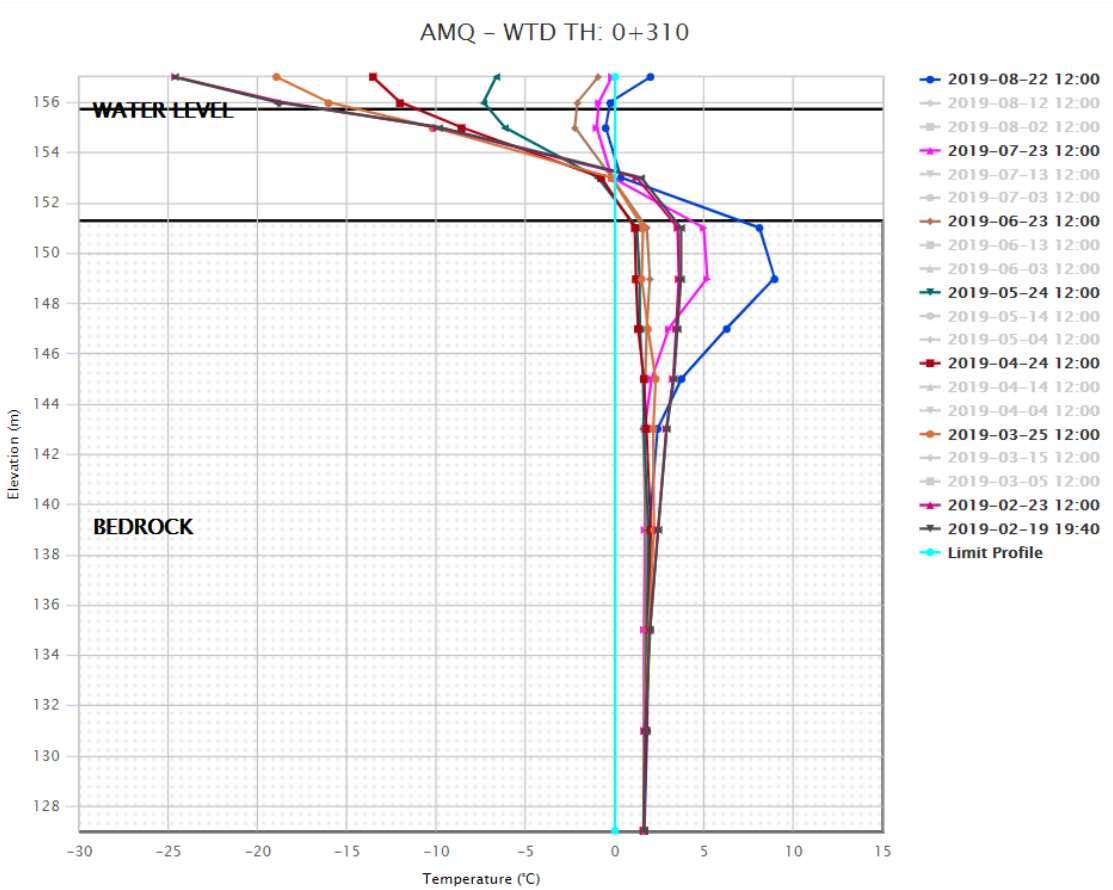


\\CanFS01\groups\Engineering\05-Geotechnic\14- Amaruq\01 - Dewatering Dikes\1 - Whale Tail Dike\4 - Operation\2- Inspection

Thermistor TH 0+310 / TH-4



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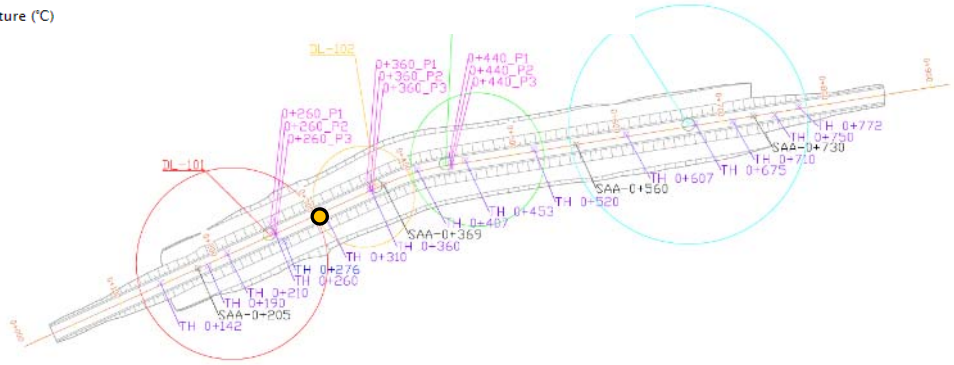
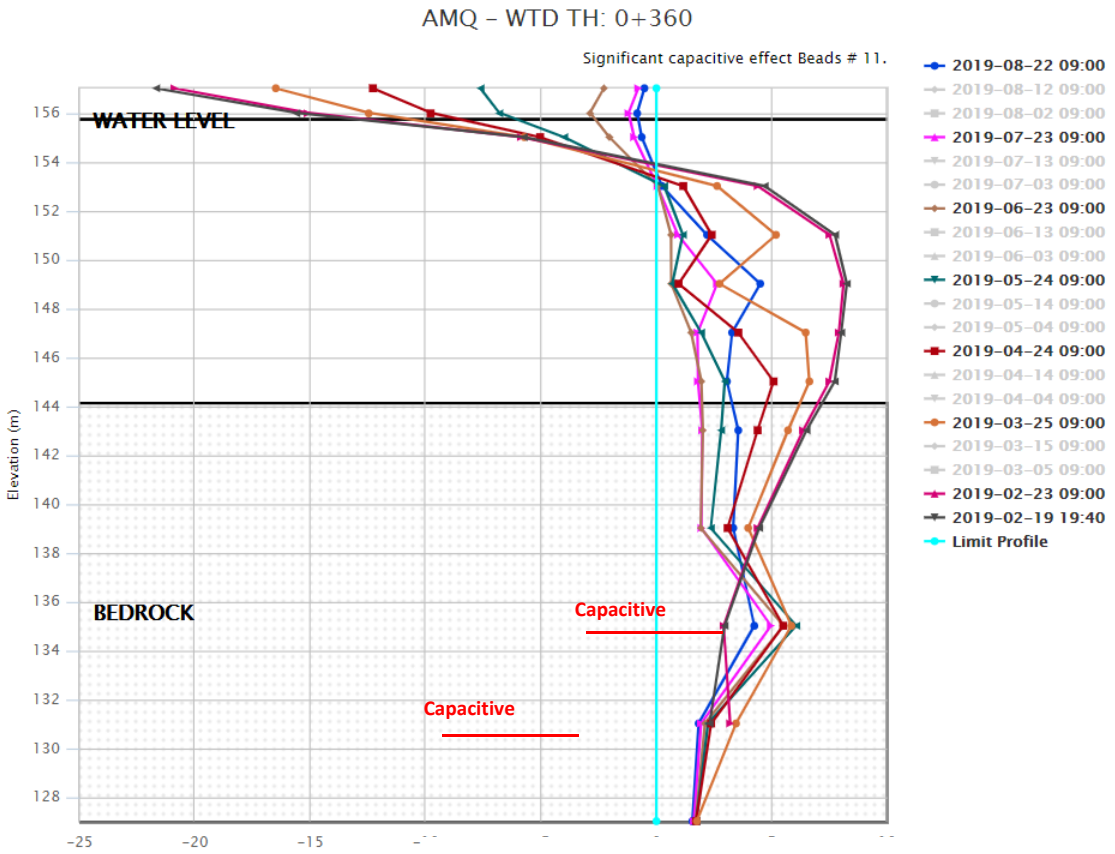


Thermistor TH 0+360 / TH-5



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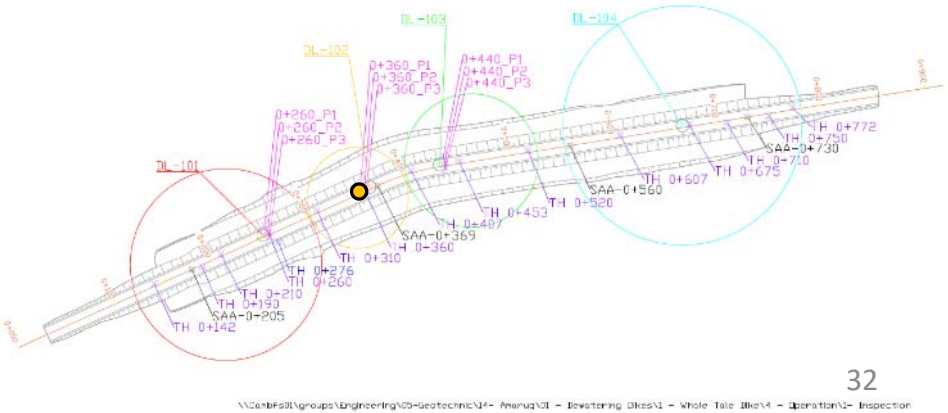
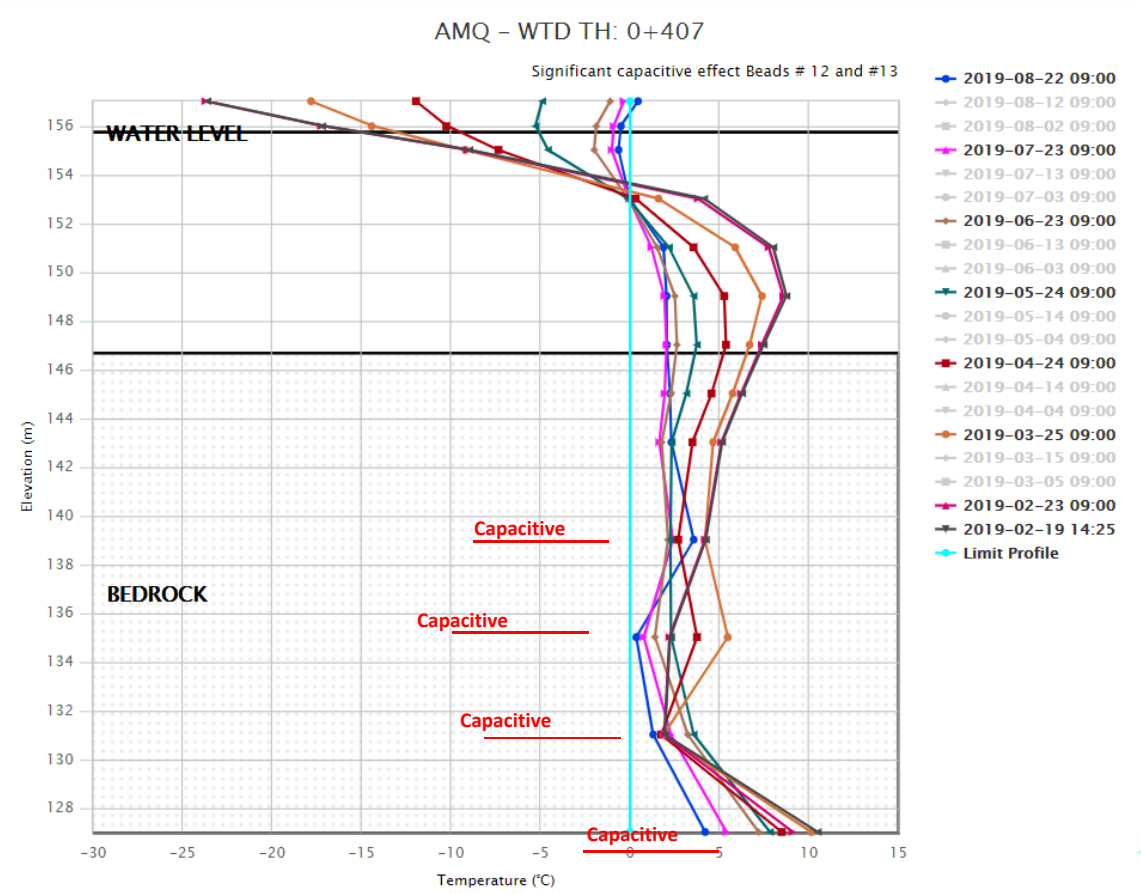


Thermistor TH 0+407 / TH-6



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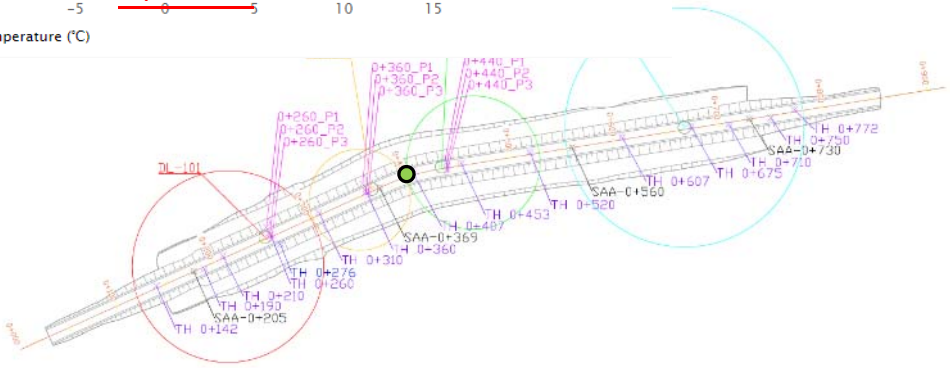
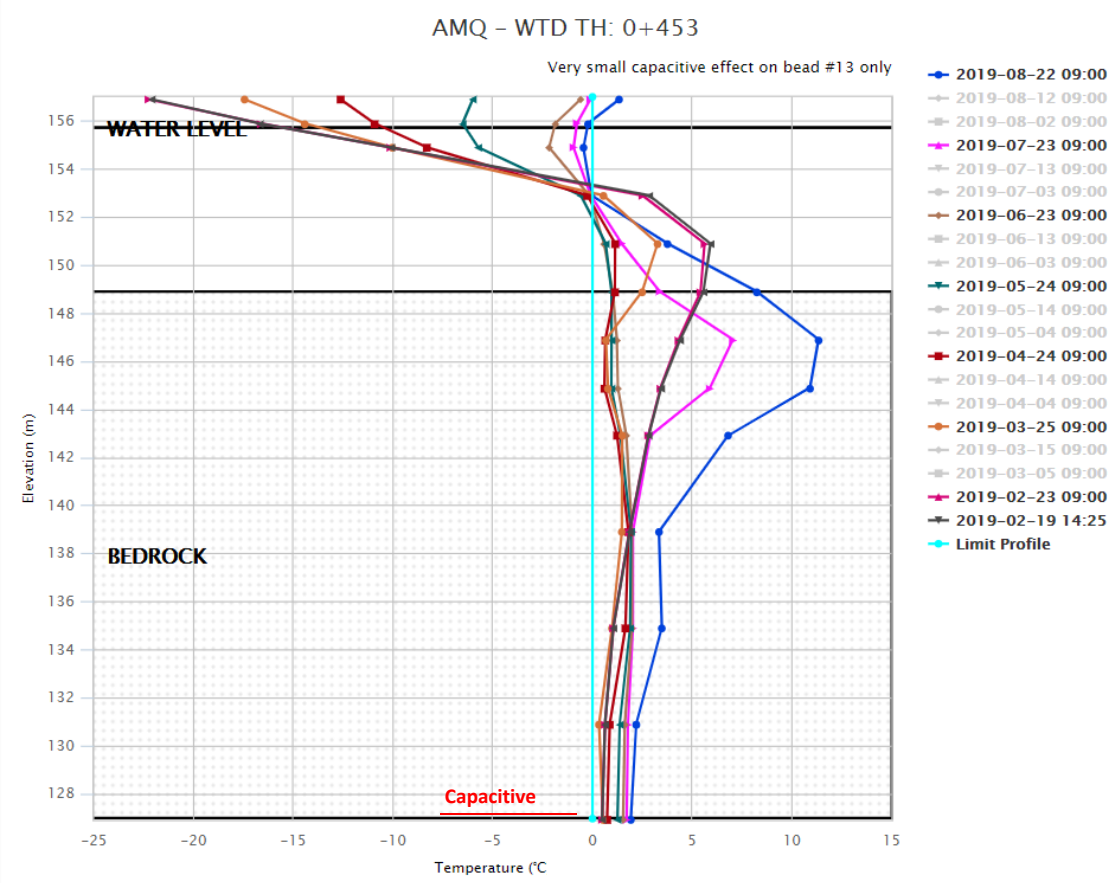


Thermistor TH 0+453 / TH-7



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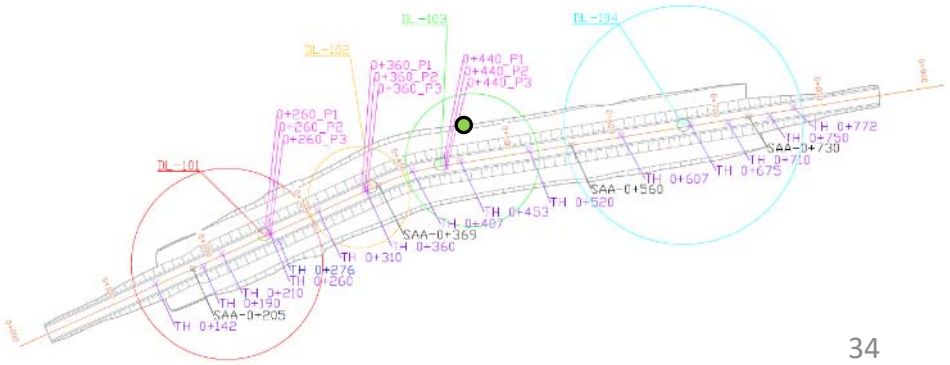
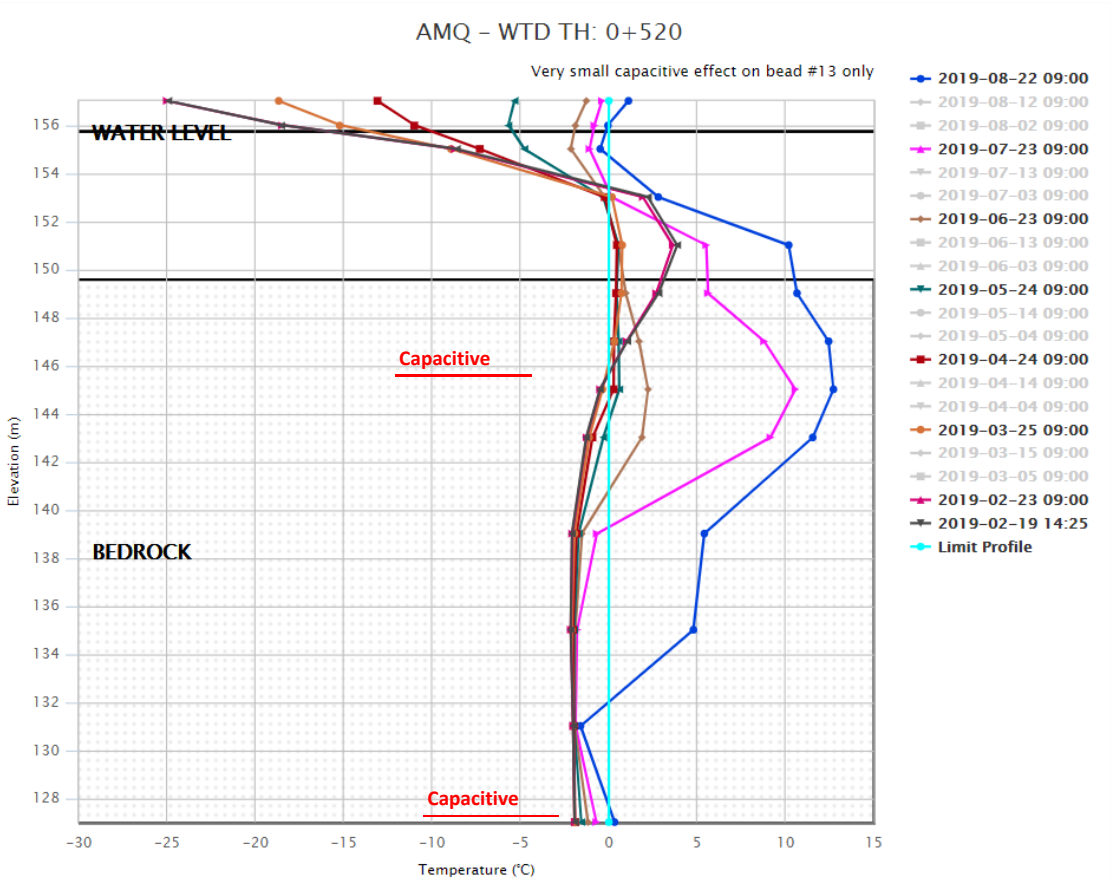
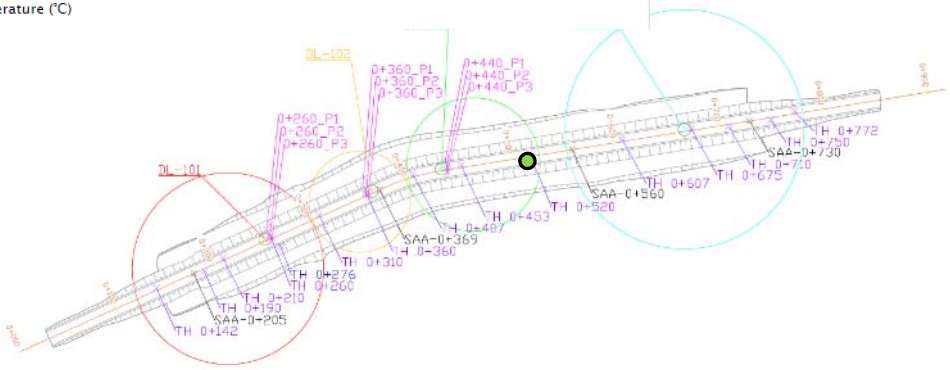


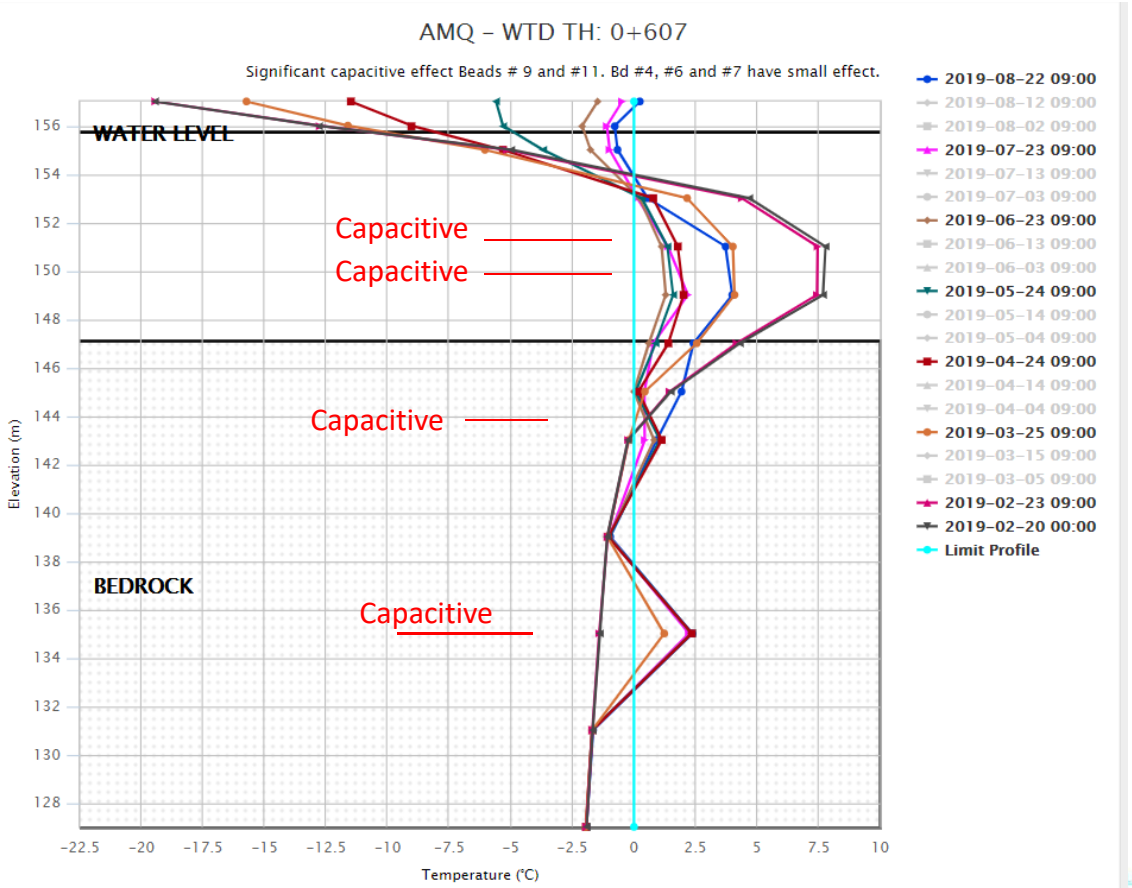
Thermistor TH 0+520 / TH-8



Comments:



Thermistor TH 0+607 / TH-9



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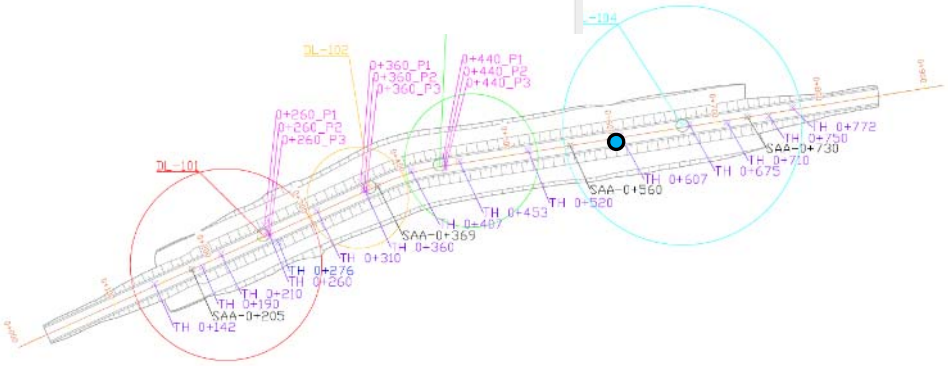
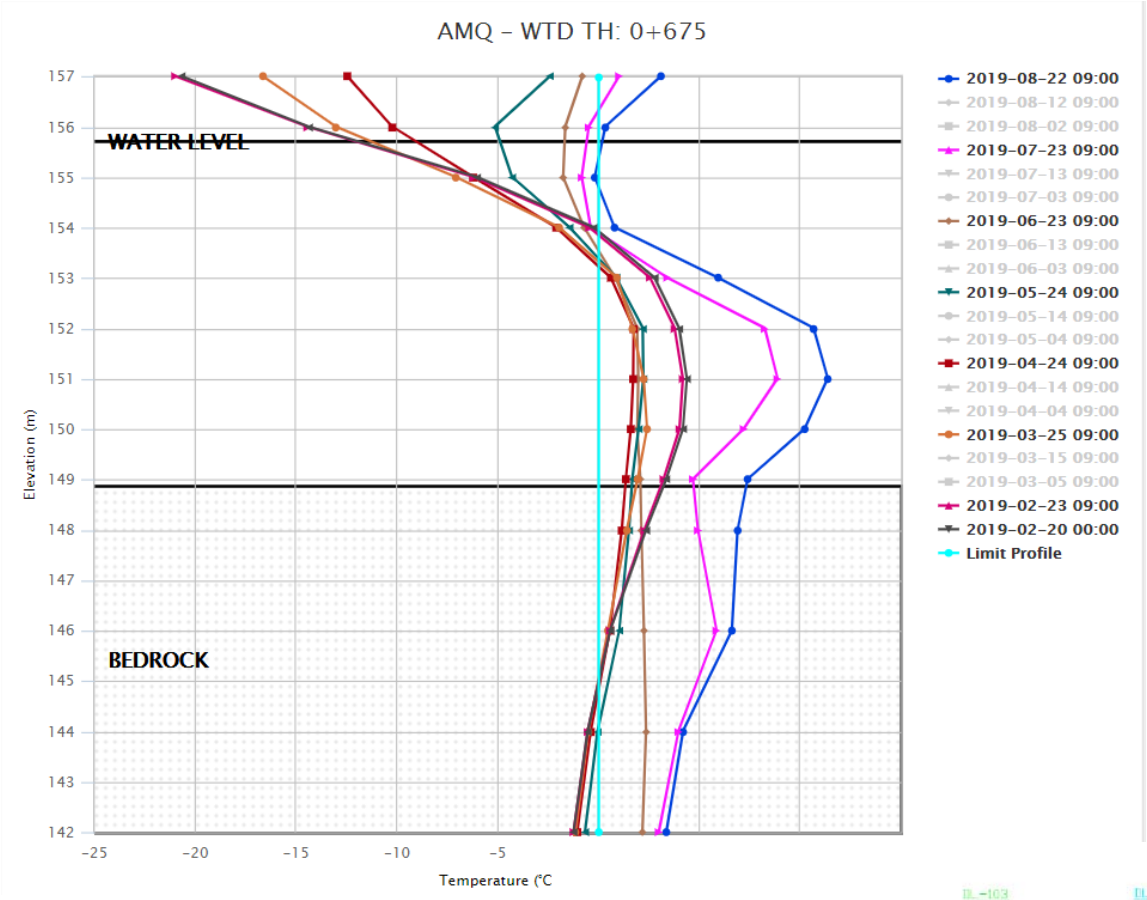


Thermistor TH 0+675 / TH-10



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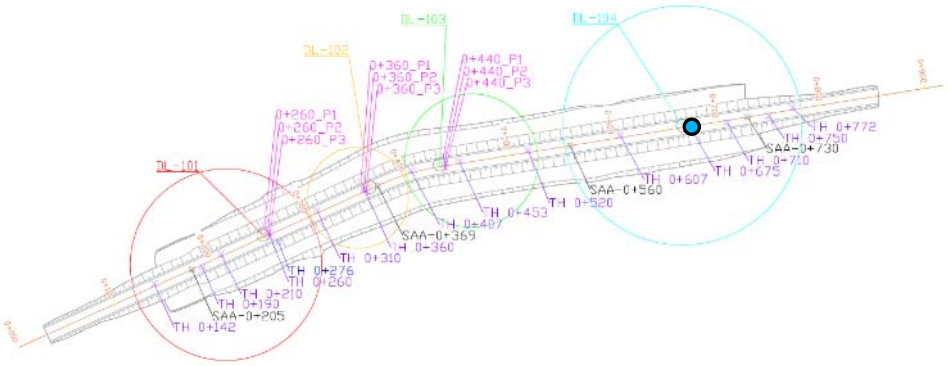
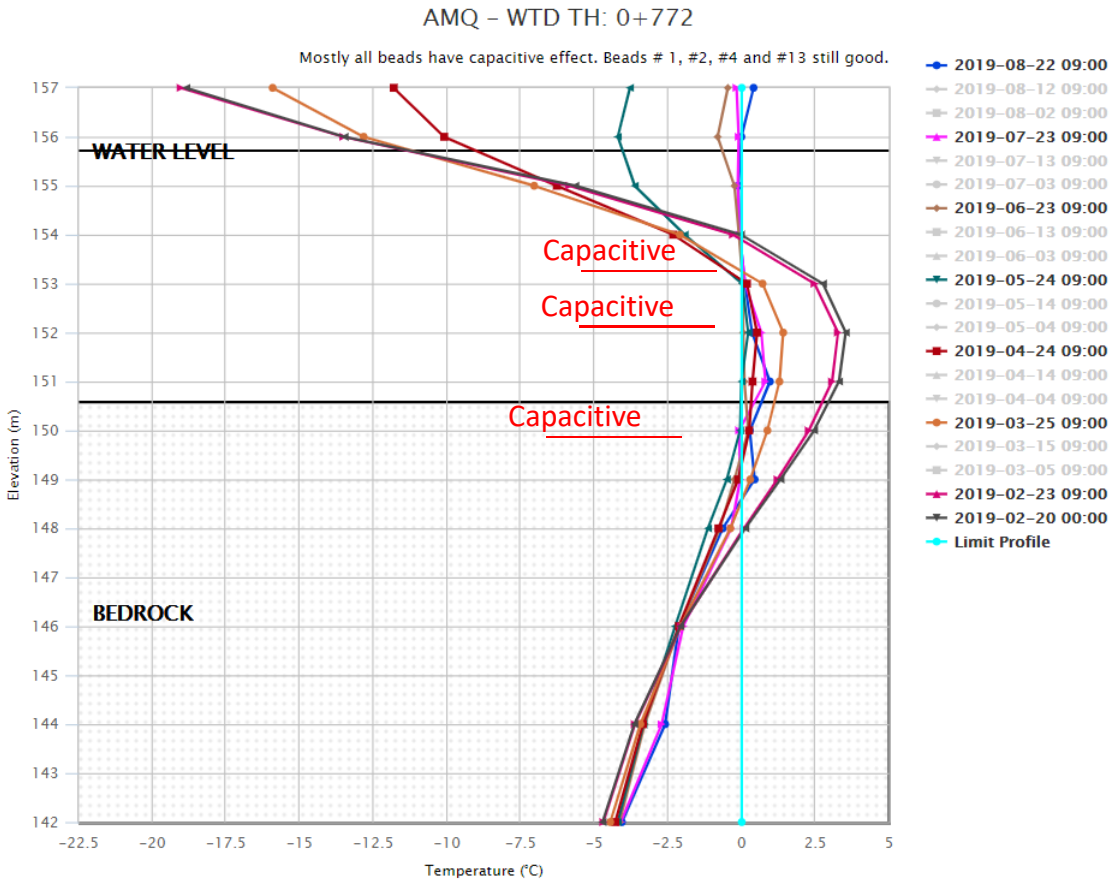


Thermistor TH 0+772 / TH-11



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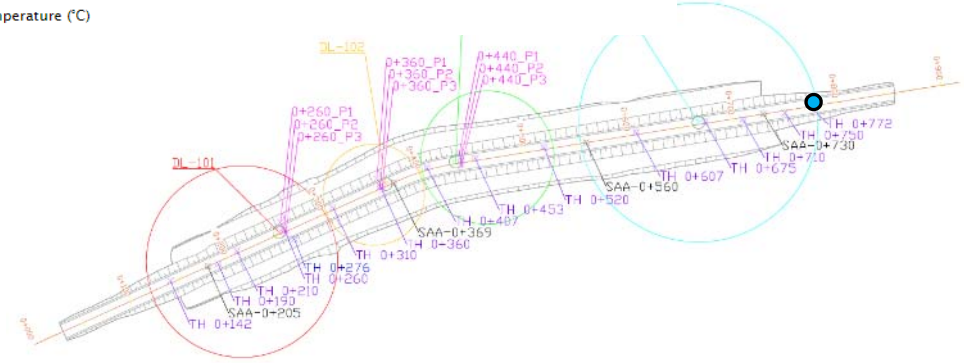
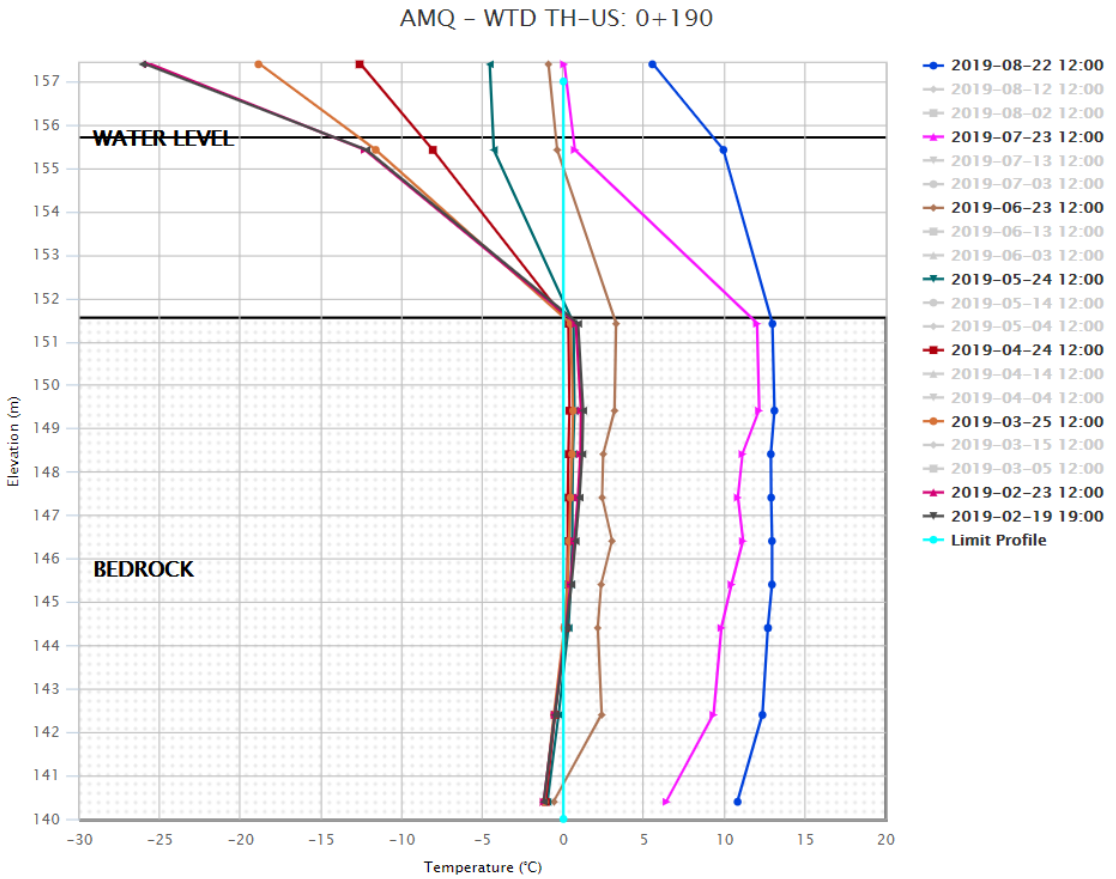


Thermistor TH 0+190 (u/s) / TH-12



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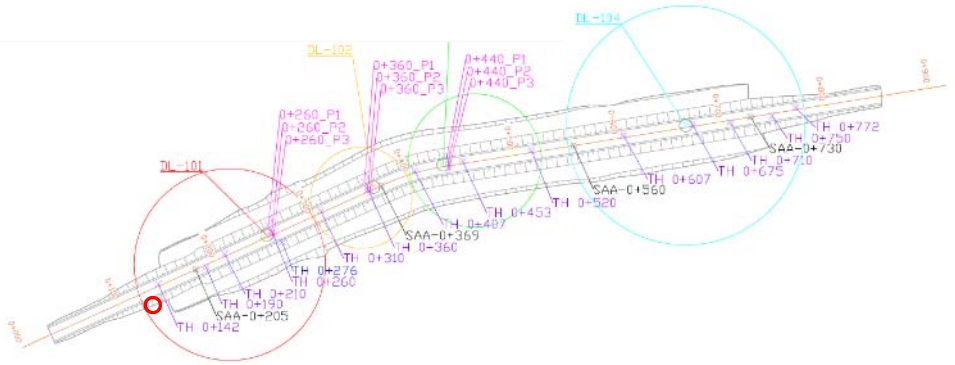
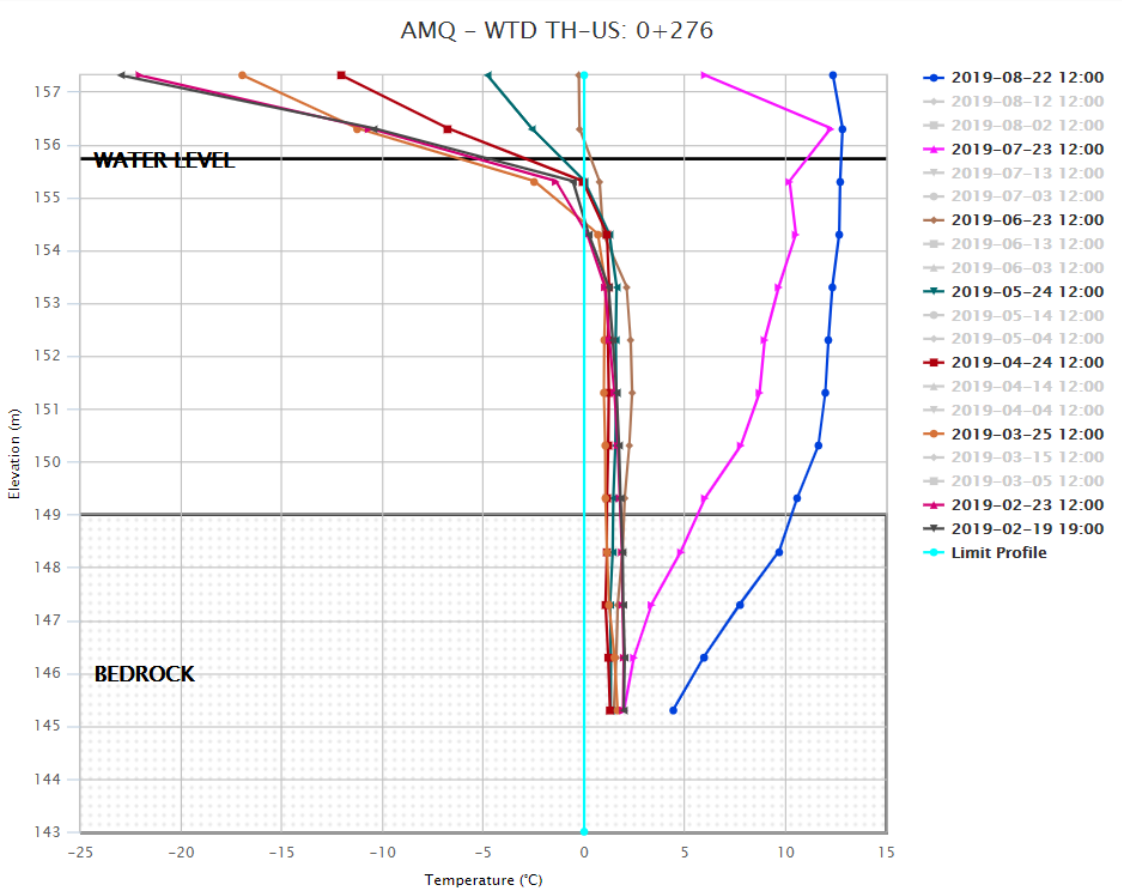


Thermistor TH 0+276 (u/s)



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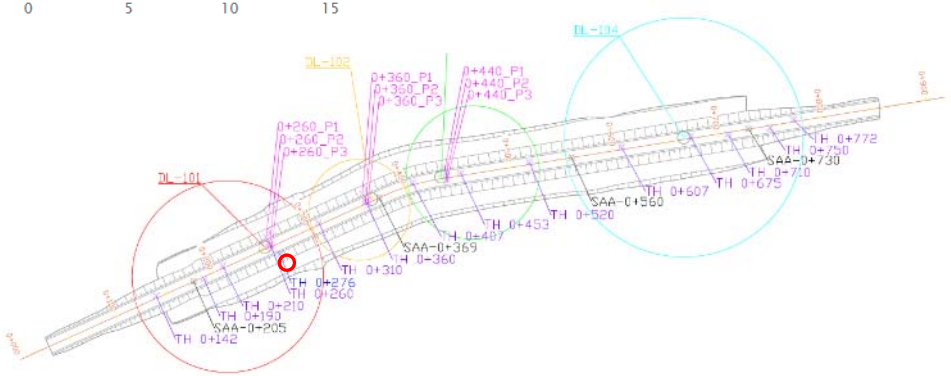
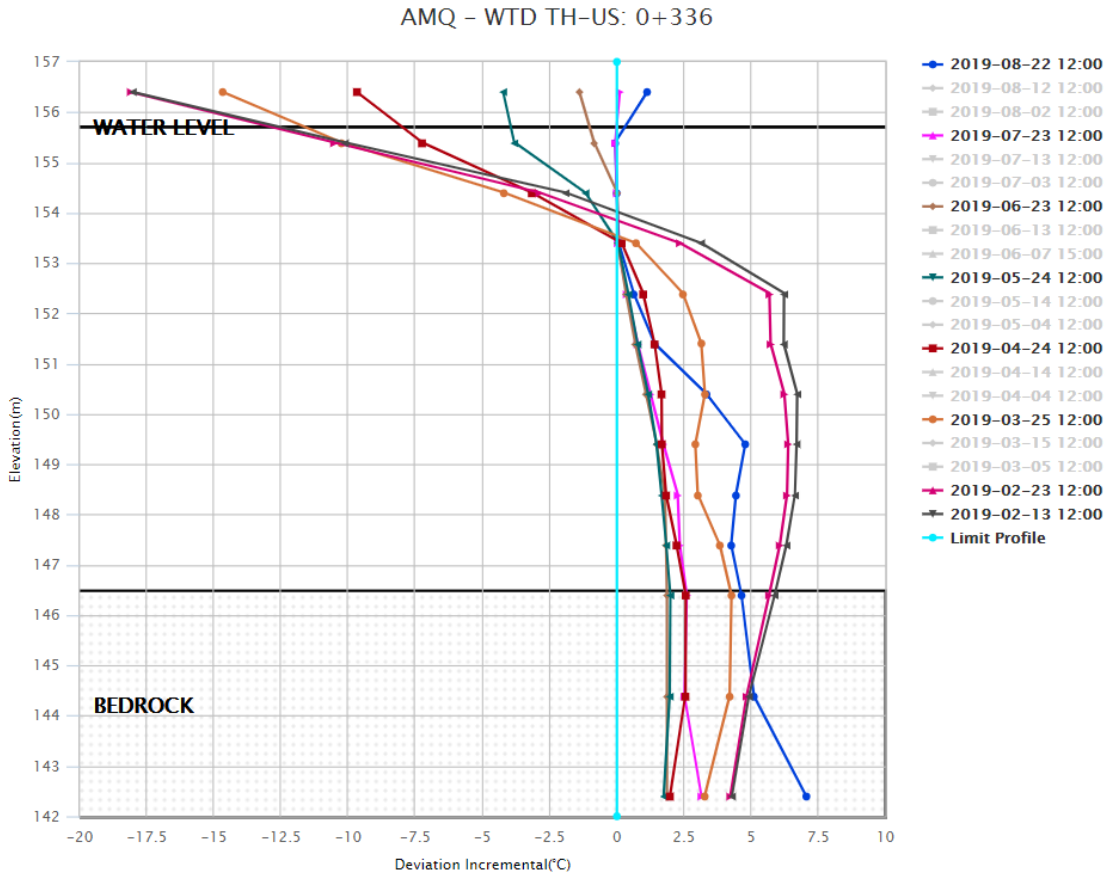


Thermistor TH 0+336 (u/s)



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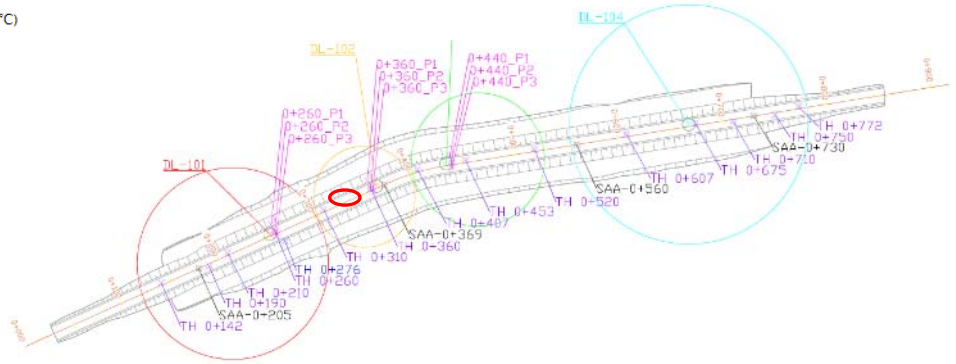
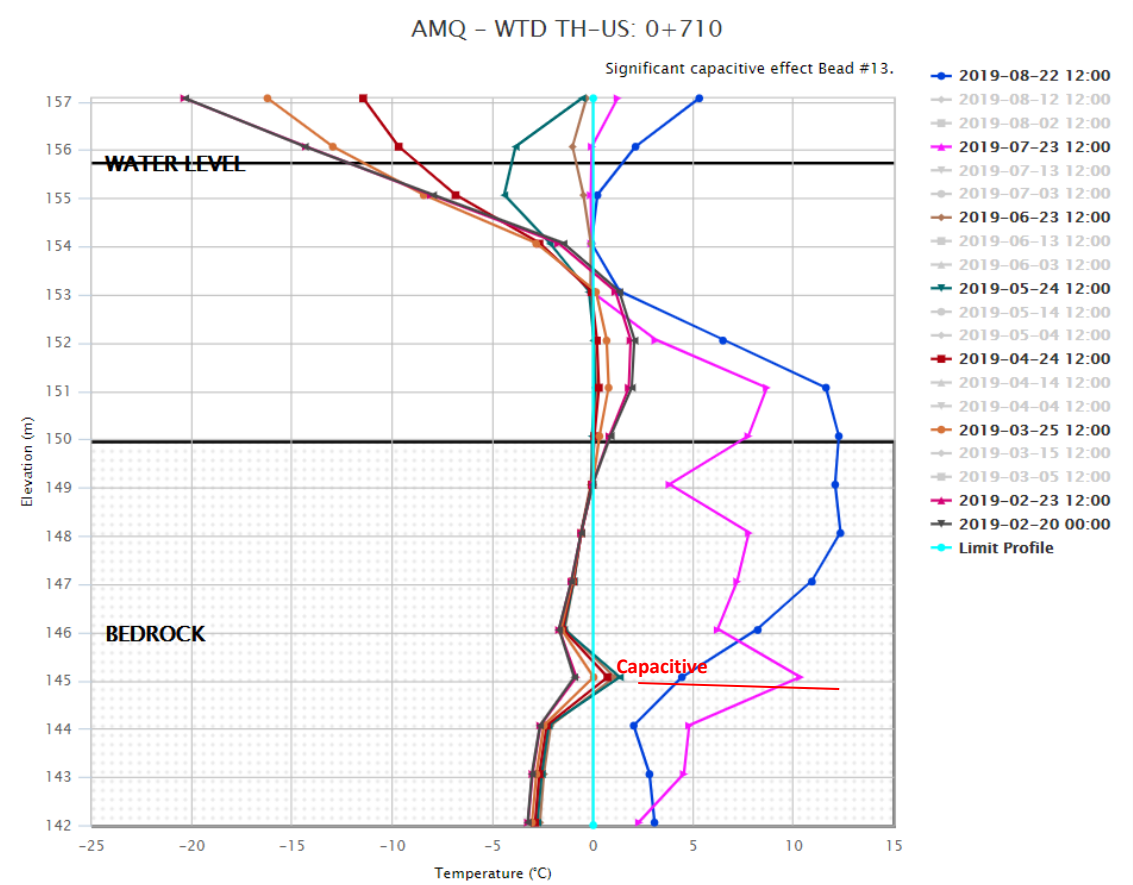
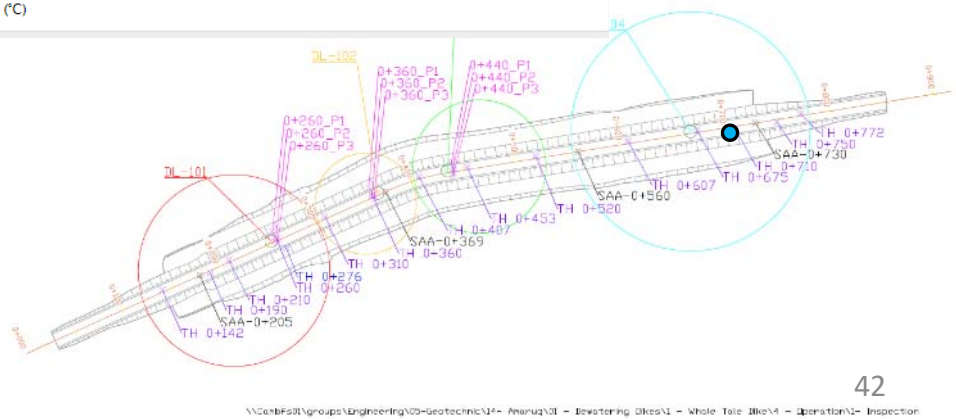


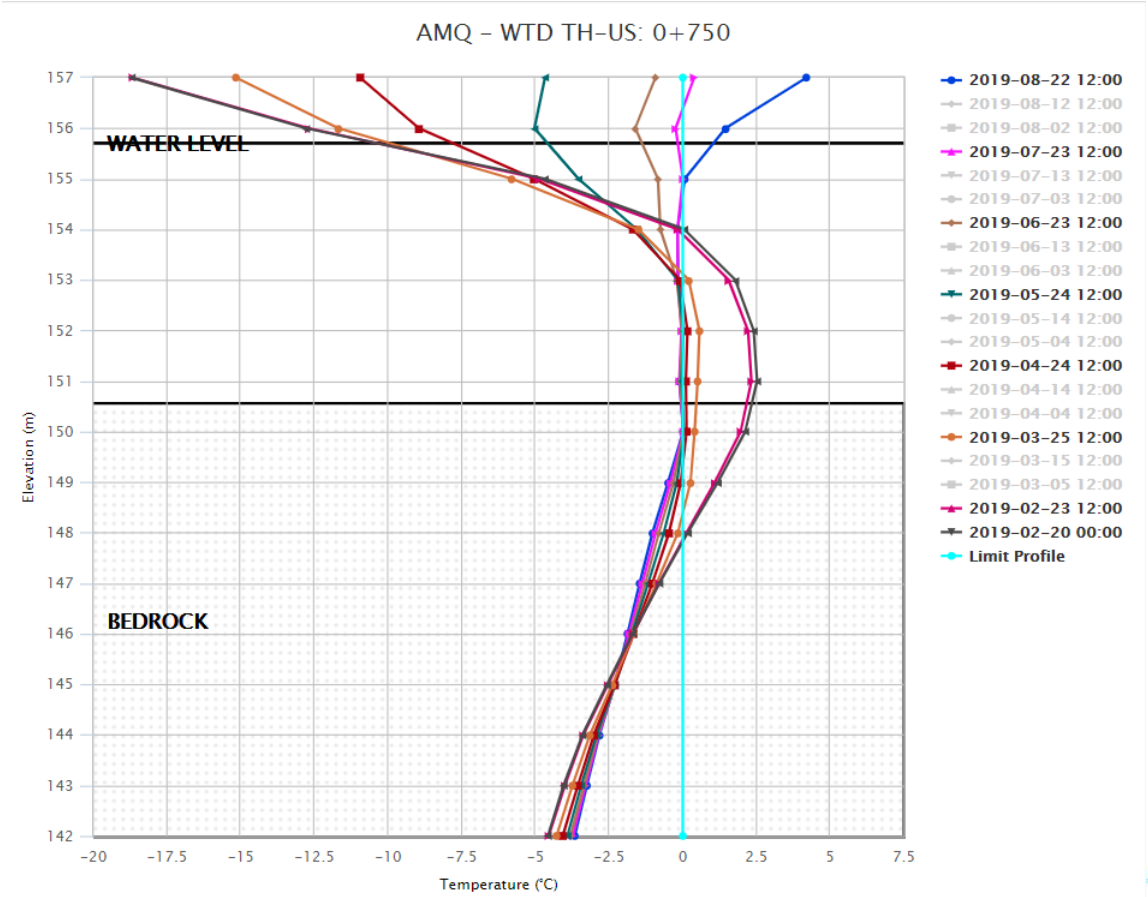
Thermistor TH 0+710 (u/s) / TH-13



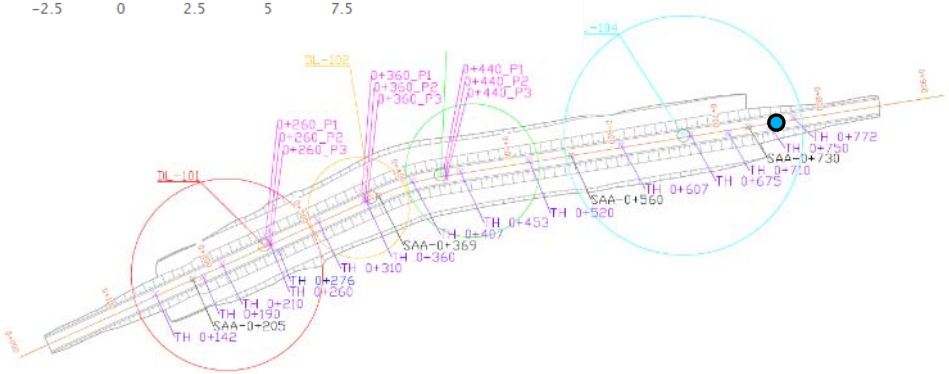
Comments:



Thermistor TH 0+750 (u/s) / TH-14

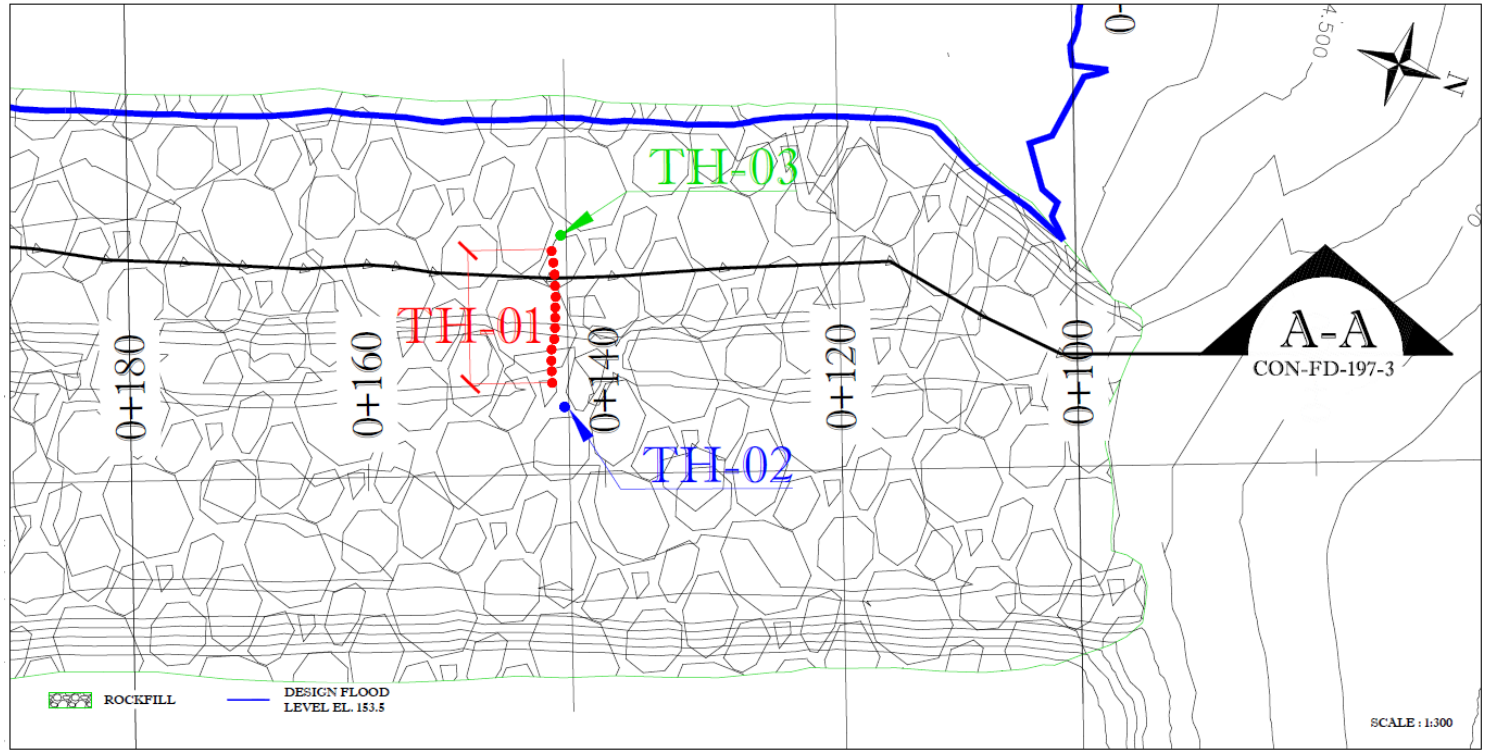


Comments:

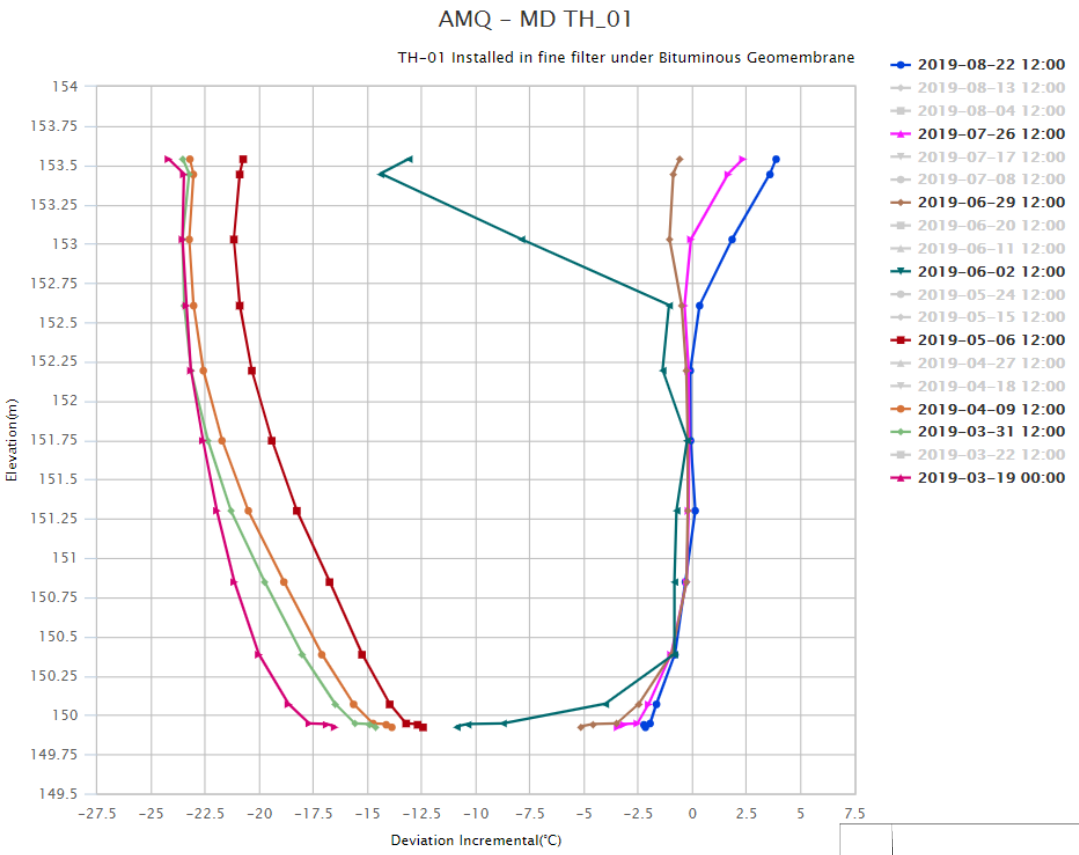


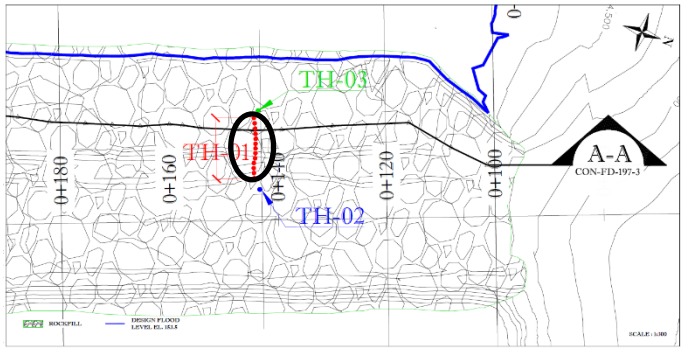
Mammoth Dike Aerial View

Plan View of Instruments Location



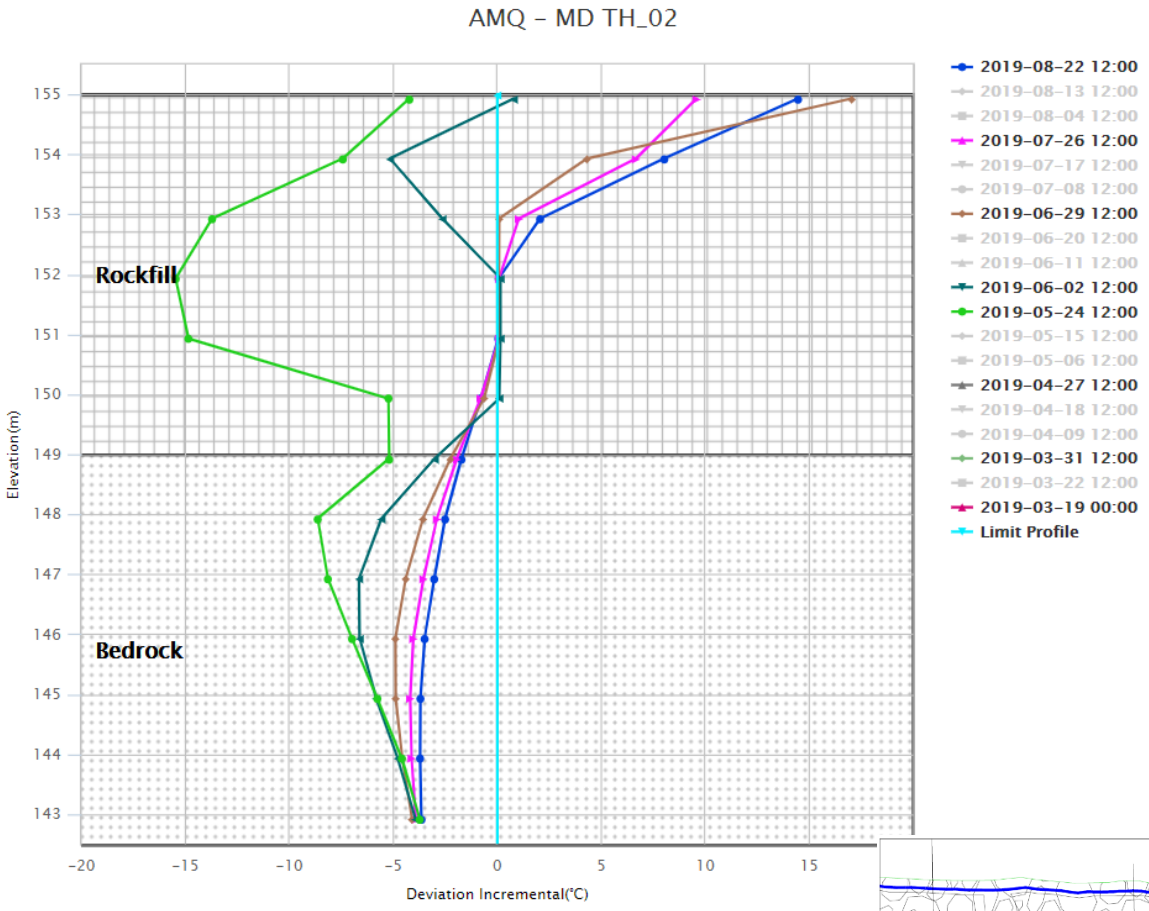
Thermistor MD TH-01/ MD-19-01

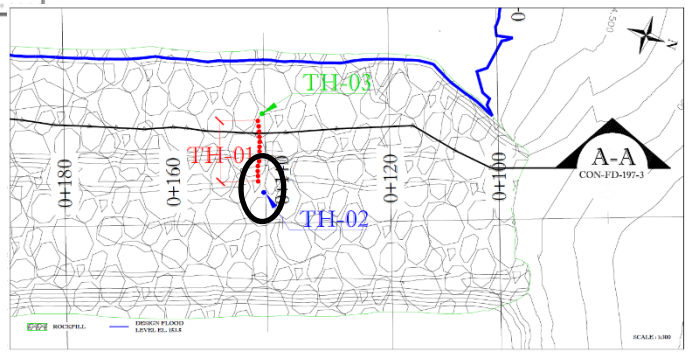




Comments:

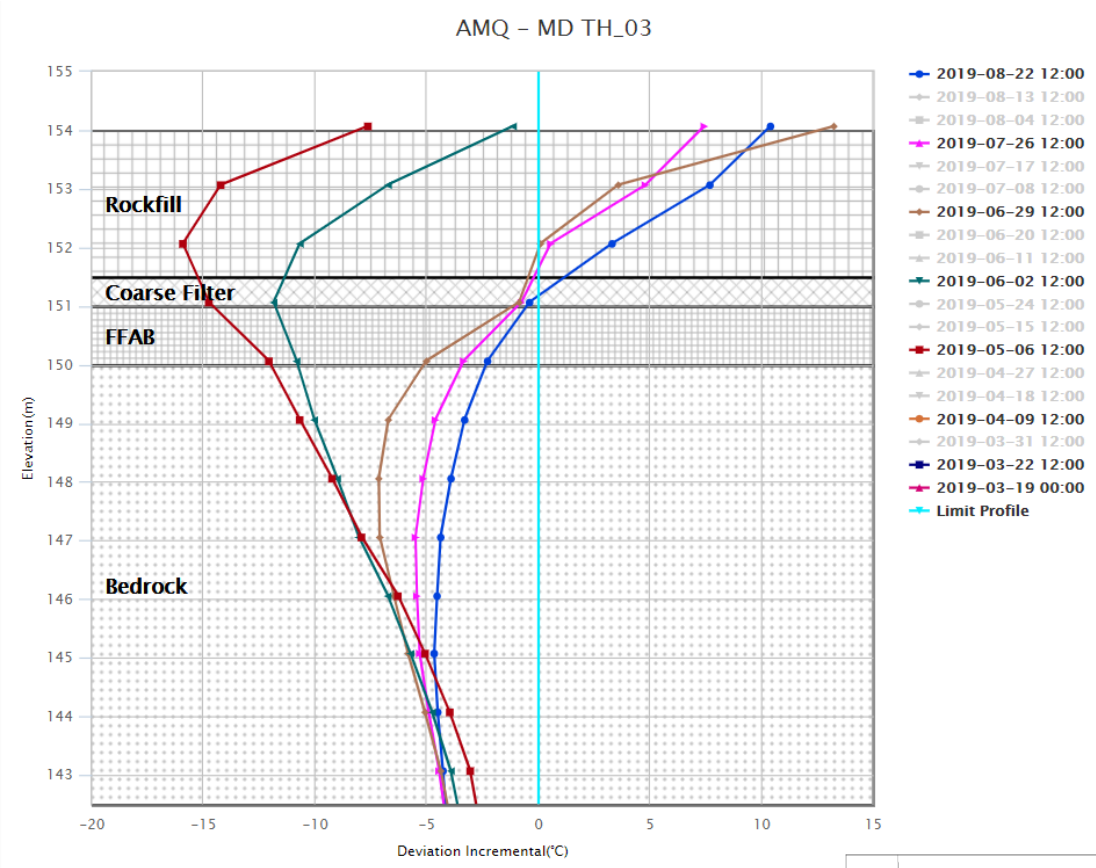
Thermistor MD TH-02/ MD-19-02

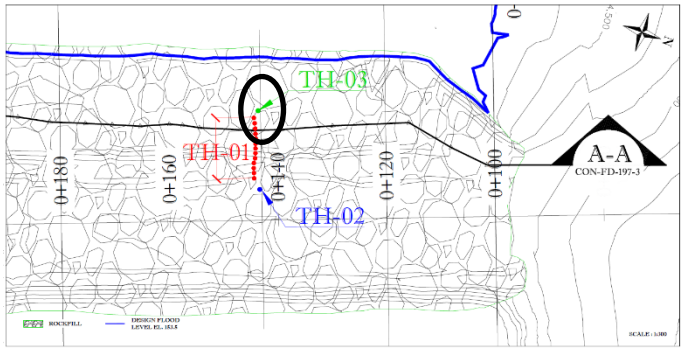




Comments:

Thermistor MD TH-03/ MD-19-03

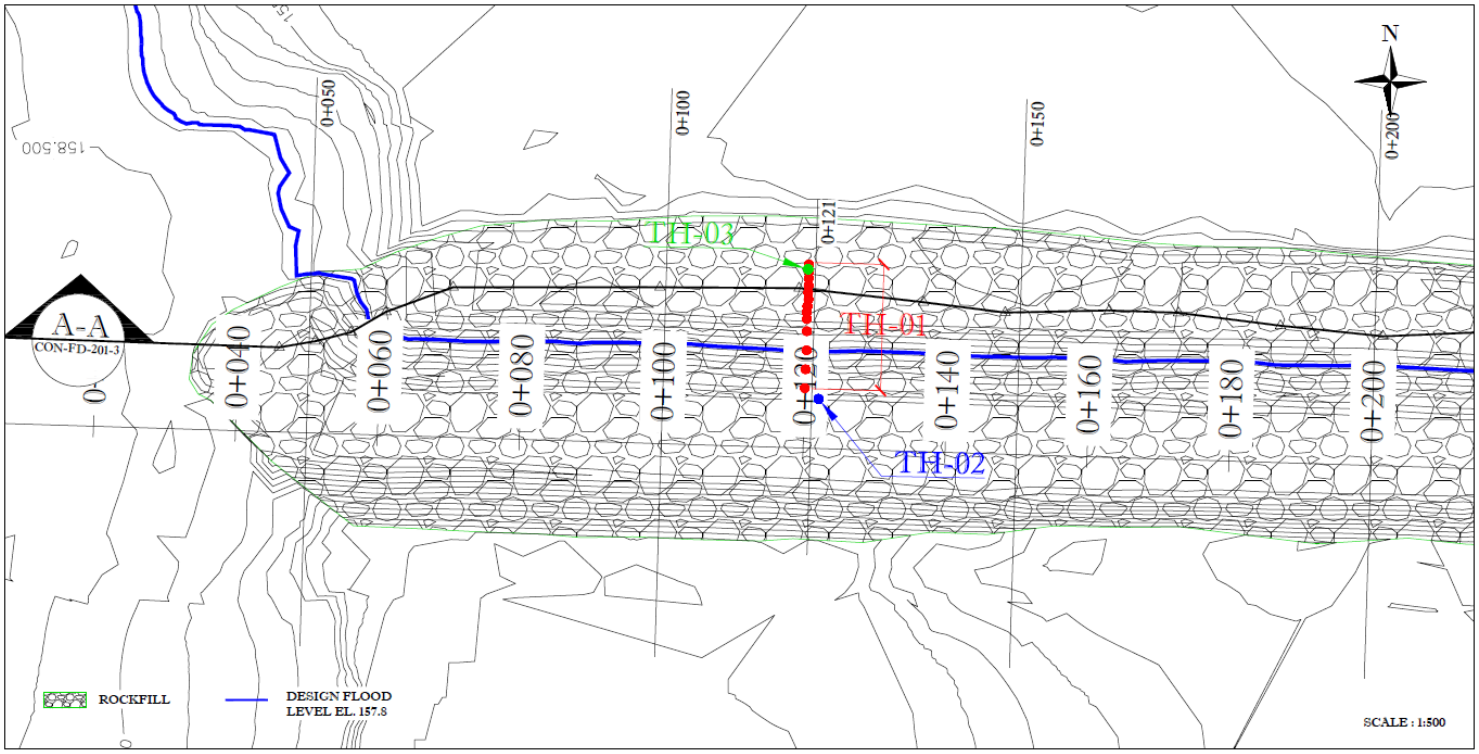




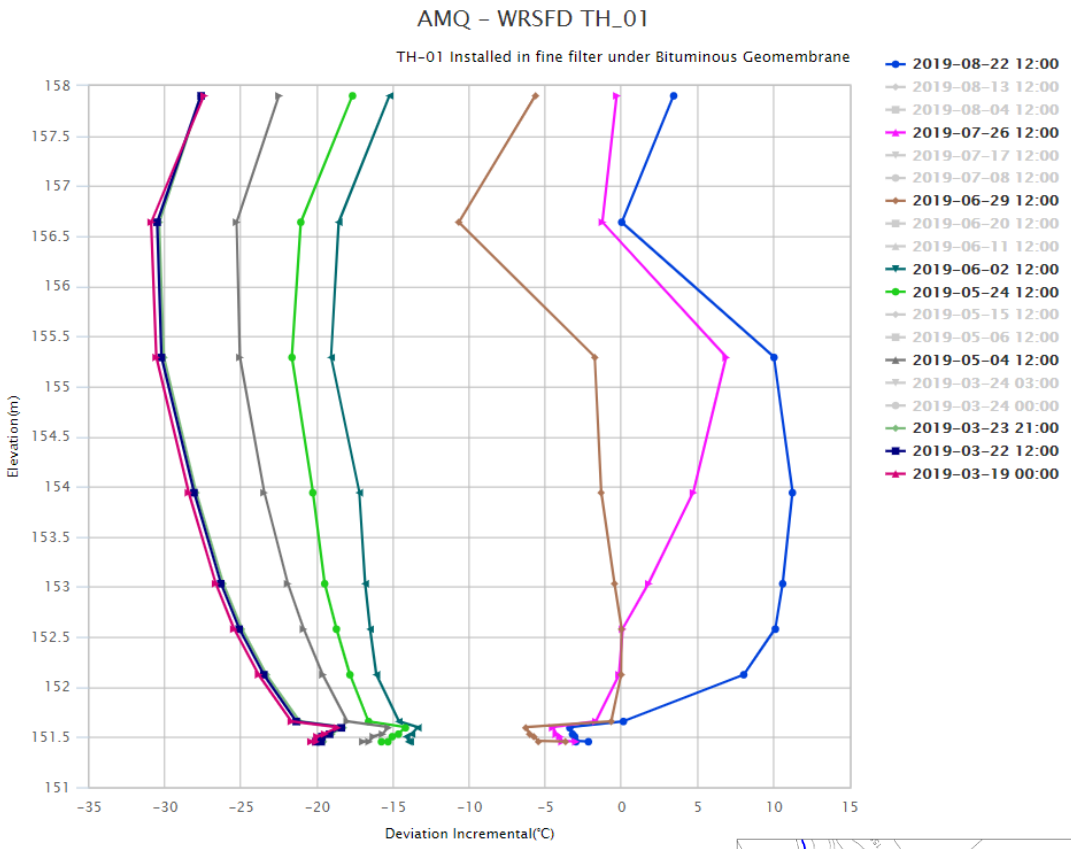
Comments:

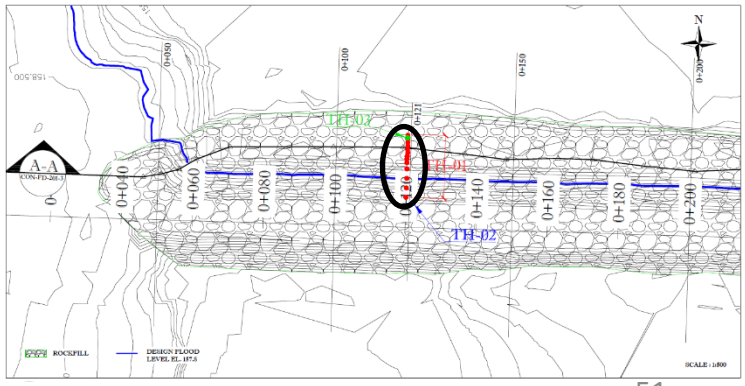
WRSF Dike Aerial View

Plan View of Instruments Location



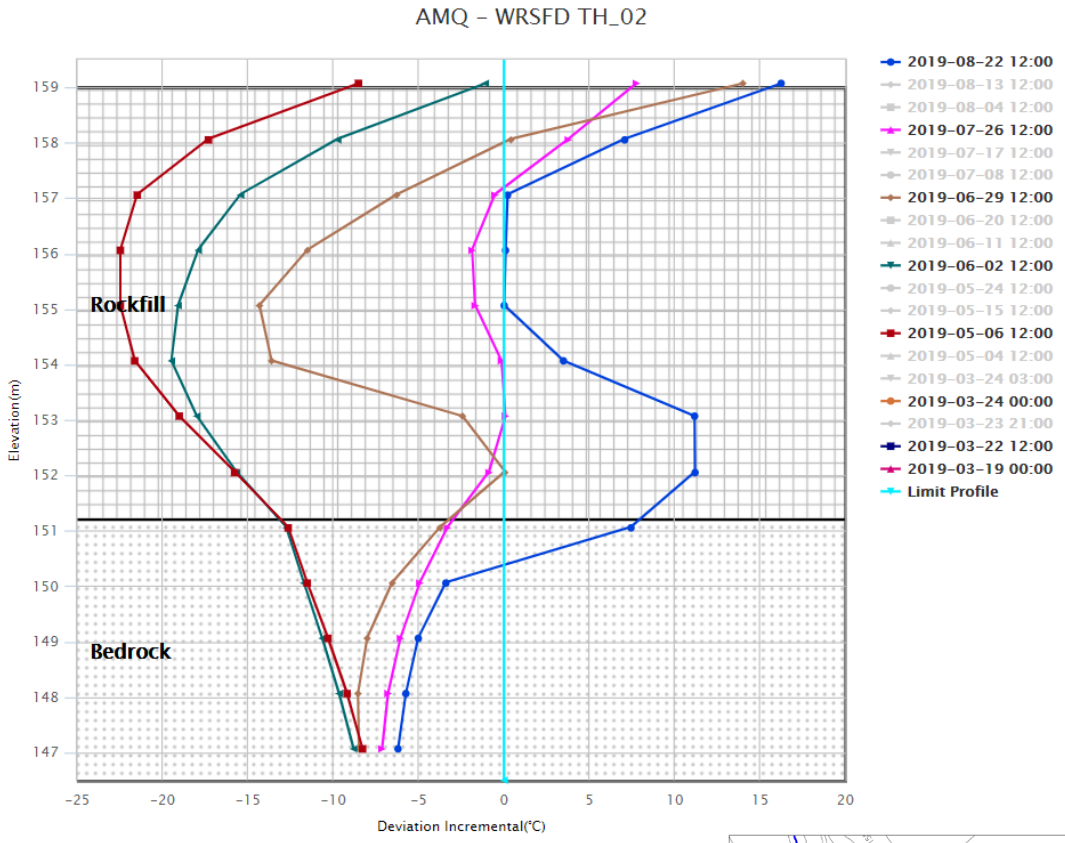
Thermistor WRSF TH-01/ WRSF-19-01



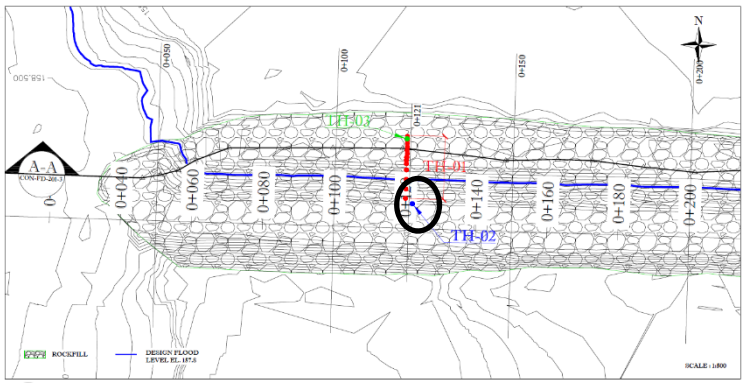


Comments:

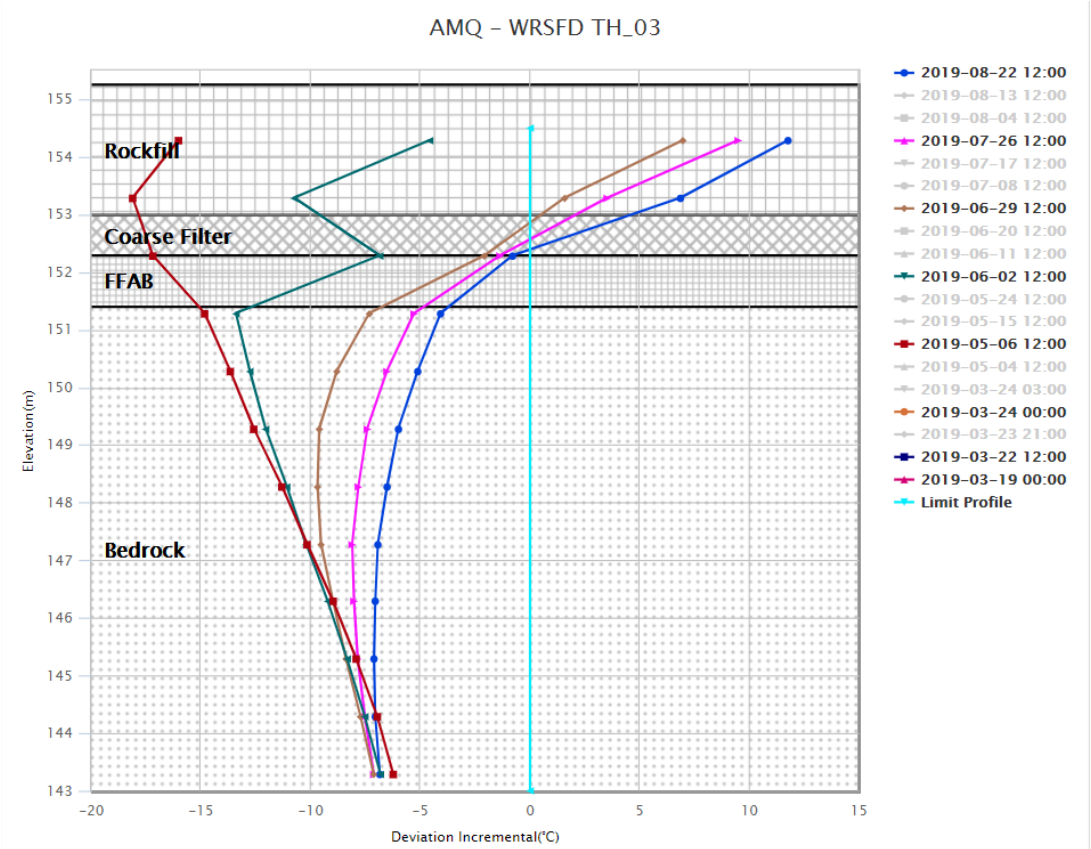
Thermistor WRSF TH-02/ WRSF-19-02

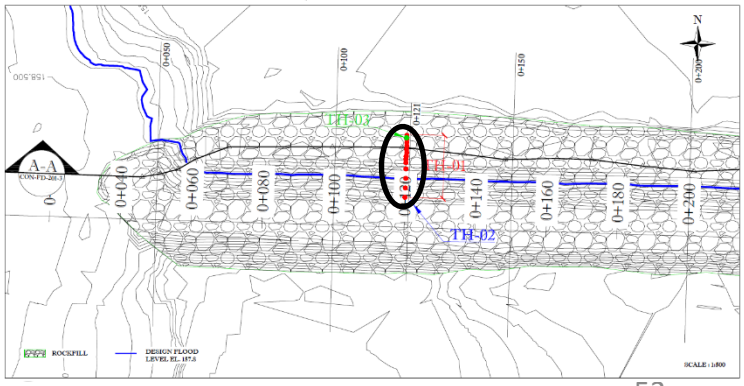


Comments:



Thermistor WRSF TH-03/ WRSF-19-03





Comments:

Appendix E

List of Reference Documents Sent by AEM

Table E-1: Documentation Available for Whale Tail Dike

Document identification number ("file name" if ID unavailable)	Document name ("description" if no document name)	Date
"AMQ WTD 0+205TH SAA X and Y.csv"	"Whale Tail Dike inclinometers raw data"	Raw data available up to June 26, 2019
"AMQ WTD 0+366TH SAA X and Y.csv"		
"AMQ WTD 0+560TH SAA X and Y.csv"		
"AMQ WTD 0+726TH X and Y.csv"		
"AMQ WTD 0+260 Pz1.csv"	"Whale Tail Dike piezometers raw data"	
"AMQ WTD 0+260 Pz2.csv"		
"AMQ WTD 0+260 Pz3.csv"		
"AMQ WTD 0+360 Pz1.csv"		
"AMQ WTD 0+360 Pz2.csv"		
"AMQ WTD 0+360 Pz3.csv"		
"AMQ WTD 0+440 Pz1.csv"		
"AMQ WTD 0+440 Pz2.csv"		
"AMQ WTD 0+440 Pz3.csv"		
"AMQ WTD Whale Tail North Pz Downstream.csv"		
"AMQ WTD Whale Tail South Pz Upstream.csv"		
"WTD TH142 TH190 TH210 TH260 THLAKE.csv"	"Whale Tail Dike thermistors raw data"	
"WTD TH310 TH360.csv"		
"WTD TH407 TH453 TH520.csv"		
"WTD TH607 TH675 TH710 TH750 TH772.csv"		
"Bi-weekly WTD Instrumentation Report.pdf"	Whale Tail Dike Dewatering Instrumentation Report – May 6th 2019	2019-05-06
"WTD Dewatering Instrumentation Report - 4-15-2019.pdf"	Whale Tail Dike Instrumentation Report	N/A
"WTD Dewatering Instrumentation Report INSTRUMENTS -5-29-2019.pptx"	Whale Tail Dewatering Instrumentation Report	2019-05-31
"WTD Dewatering Instrumentation Report INSTRUMENTS -6-03-2019.pdf"	Whale Tail Dewatering Instrumentation Report	2019-06-03
"WTD Instrumentation Report 05-20-2019.pdf"	Whale Tail Dike Dewatering Instrumentation Report	2019-05-20
"WTD Instrumentation Report 06-22-2019.pdf"	Whale Tail Dike Dewatering Instrumentation Report	2019-06-22
"2019-03-06 - Simplified Surveillance Form - Whale Tail Dike.pdf"	Simplified Surveillance Form of Whale Tail Dike	2019-03-06
"2019-03-07 - Simplified Surveillance Form.pdf"		2019-03-07
"Simplified Surveillance Form - 2019-03-08.pdf"		2019-03-08
"Simplified Surveillance Form - 2019-03-09.pdf"		2019-03-09
"Simplified Surveillance Form - 2019-03-10.pdf"		2019-03-10
"Simplified Surveillance Form - 2019-03-11.pdf"		2019-03-11
"Simplified Surveillance Form - 2019-03-12.pdf"		2019-03-12
"Simplified Surveillance Form - 2019-03-13.pdf"		2019-03-13
"Simplified Surveillance Form - 2019-03-14.pdf"		2019-03-14

Document identification number ("file name" if ID unavailable)	Document name ("description" if no document name)	Date
"Simplified Surveillance Form - 2019-03-15.pdf"		2019-03-15
"Simplified Surveillance Form - 2019-03-16.pdf"		2019-03-16
"Simplified Surveillance Form - 2019-03-17.pdf"		2019-03-17
"Simplified Surveillance Form - 2019-03-18.pdf"		2019-03-18
"Simplified Surveillance Form - 2019-03-19.pdf"		2019-03-19
"Simplified Surveillance Form - 2019-03-20.pdf"		2019-03-20
"Simplified Surveillance Form - 2019-03-26.pdf"		2019-03-26
"Simplified Surveillance Form - 2019-03-28.pdf"		2019-03-28
"Simplified Surveillance Form - 2019-03-29.pdf"		2019-03-29
"Simplified Surveillance Form - 2019-03-30.pdf"		2019-03-30
"Simplified Surveillance Form - 2019-03-31.pdf"		2019-03-31
"Simplified Surveillance Form - 2019-04-01.pdf"		2019-04-01
"Simplified Surveillance Form - 2019-04-03.pdf"		2019-04-03
"Simplified Surveillance Form - 2019-04-04.pdf"		2019-04-04
"Simplified Surveillance Form - 2019-04-05.pdf"		2019-04-05
"Simplified Surveillance Form - 2019-04-06.pdf"		2019-04-06
"Simplified Surveillance Form - 2019-04-07.pdf"		2019-04-07
"Simplified Surveillance Form - 2019-04-09.pdf"		2019-04-09
"Simplified Surveillance Form - 2019-04-10.pdf"	Simplified Surveillance Form of Whale Tail Dike	2019-04-10
"Simplified Surveillance Form - 2019-04-11.pdf"		2019-04-11
"Simplified Surveillance Form - 2019-04-13.pdf"		2019-04-13
"Simplified Surveillance Form - 2019-04-14.pdf"		2019-04-14
"Simplified Surveillance Form - 2019-05-04.pdf"		2019-05-04
"Simplified Surveillance Form - 2019-05-05.pdf"		2019-05-05
"Simplified Surveillance Form - 2019-05-06.pdf"		2019-05-06
"Simplified Surveillance Form - 2019-05-07.pdf"		2019-05-07
"Simplified Surveillance Form - 2019-05-08.pdf"		2019-05-08
"Simplified Surveillance Form - 2019-05-09.pdf"		2019-05-09
"Simplified Surveillance Form - 2019-05-10.pdf"		2019-05-10
"Simplified Surveillance Form - 2019-05-11.pdf"		2019-05-11
"Simplified Surveillance Form - 2019-05-13.pdf"		2019-05-13
"Simplified Surveillance Form - 2019-05-15.pdf"		2019-05-15
"Simplified Surveillance Form - 2019-05-16.pdf"		2019-05-16
"Simplified Surveillance Form - 2019-05-17.pdf"		2019-05-17
"Simplified Surveillance Form - 2019-05-18.pdf"		2019-05-18
"Simplified Surveillance Form - 2019-05-20.pdf"		2019-05-20
"Simplified Surveillance Form - 2019-05-22.pdf"		2019-05-22

Document identification number ("file name" if ID unavailable)	Document name ("description" if no document name)	Date
"Simplified Surveillance Form - 2019-05-27.pdf"	Simplified Surveillance Form of Whale Tail Dike	2019-05-27
"Simplified Surveillance Form - 2019-05-30.pdf"		2019-05-30
"Simplified Surveillance Form - 2019-05-31.pdf"		2019-05-31
"Simplified Surveillance Form - 2019-06-01.pdf"		2019-06-01
"Simplified Surveillance Form - 2019-06-02.pdf"		2019-06-02
"Simplified Surveillance Form - 2019-06-03.pdf"		2019-06-03
"Simplified Surveillance Form - 2019-06-04.pdf"		2019-06-04
"Simplified Surveillance Form - 2019-06-05.pdf"		2019-06-05
"Simplified Surveillance Form - 2019-06-06.pdf"		2019-06-06
"Simplified Surveillance Form - 2019-06-07.pdf"		2019-06-07
"Simplified Surveillance Form - 2019-06-08.pdf"		2019-06-08
"Simplified Surveillance Form - 2019-06-09.pdf"		2019-06-09
"Simplified Surveillance Form - 2019-06-10.pdf"		2019-06-10
"Simplified Surveillance Form - 2019-06-11.pdf"		2019-06-11
"Simplified Surveillance Form - 2019-06-13.pdf"		2019-06-13
"Simplified Surveillance Form - 2019-06-14.pdf"		2019-06-14
"Simplified Surveillance Form - 2019-06-16.pdf"		2019-06-16
"Simplified Surveillance Form - 2019-06-17.pdf"		2019-06-17
"Simplified Surveillance Form - 2019-06-19.pdf"		2019-06-19
"Simplified Surveillance Form - 2019-06-21.pdf"		2019-06-21
"Simplified Surveillance Form - 2019-06-23.pdf"		2019-06-23
"Simplified Surveillance Form - 2019-06-24.pdf"		2019-06-24
"Simplified Surveillance Form - 2019-06-25.pdf"		2019-06-25
"Simplified Surveillance Form - 2019-06-26.pdf"		2019-06-26
"WT_BATHY BEDROCK.dwg"	"As-built drawings"	N/A
"WT_BATHY LAKE BED.dwg"		
"WT_COARSE FILTER 153.5.dwg"		
"WT_FINE FILTER 148.dwg"		
"WT_FINE FILTER 153.5.dwg"		
"WT_GROUND EXCAVATION.dwg"		
"WT_INVERT_COARSE_FILTER.dwg"		
"WT_INVERT_FINE_FILTER.dwg"		
"WT_INVERT_ROCKFILL.dwg"		
"WT_TOP DIKE AFTER DRILLING.dwg"		
"WT-MASTER AS-BUILT QUANTITIES.dwg"		
"WT-SIDE_PAD_ROCKFILL_AS-BUILT.dwg"		
"WT-SIDE_PAD_ROCKFILL_BACKFILL.dwg"		

Document identification number ("file name" if ID unavailable)	Document name ("description" if no document name)	Date
"DS Investigation April-May 2019.pdf"	Whale Tail Dike Downstream Toe Investigation Report	N/A
"Change in TARP level of WTD Dike - Dewatering (004).pdf"	Whale Tail Dike – Change in TARP Level During Dewatering	2019-05
"AMQ Dewatering Dike Instrumentation Report.docx"	Inspection Report – Instrumentation Monitoring and Field Observation Summary	N/A
"AMQ Dewatering Dike Instrumentation Report Appendixx.pptx"	Whale Tail Dewatering Instrumentation Report	N/A

Table E-2: Documentation Available for North East Dike

Document identification number ("file name" if ID unavailable)	Document name ("description" if no document name)	Date
NED-VIR-001	North East Dike Visual Inspection Report	2019-05-30
NED-VIR-001	North East Dike Visual Inspection Report	2019-06-22
"ACAD-CON-FD-195_NED AS-BUILT.dxf"	"As-built drawing of North East Dike"	N/A
"Change in TARP level of NE Dike.pdf"	NE Dike – Change in TARP Level	2019-07-06

Table E-3: Documentation Available for WRSF Dike

Document identification number ("file name" if ID unavailable)	Document name ("description" if no document name)	Date
"WRSF TH1 TH2 TH3.csv"	"WRSF Dike thermistors raw data"	Raw data available up to June 26, 2019
WRSF-VIR-001	WRSF Dike Visual Inspection Report	2019-05-30
WRSF-VIR-002	WRSF Dike Visual Inspection Report	2019-06-23
"ACAD-CON-FD-196_WRSF AS-BUILT.dxf"	"As-built drawing of WRSF Dike"	N/A
"Change in TARP level of WRSF Dike.pdf"	WRSF Dike – Change in TARP Level	2019-07-06

Table E-4: Documentation Available for Mammoth Dike

Document identification number ("file name" if ID unavailable)	Document name ("description" if no document name)	Date
"AMQ MD TH01 TH02 TH03.csv"	"Mammoth Dike thermistors raw data"	Raw data available up to June 26, 2019
MD-VIR-001	Mammoth Dike Visual Inspection Report	2019-05-30
MD-VIR-001	Mammoth Dike Visual Inspection Report	2019-06-22
"ACAD-CON-FD-197_MAM AS-BUILT.dxf"	"As-built drawing of Mammoth Dike"	N/A

Table E-5: Documentation Available for the Other Structures

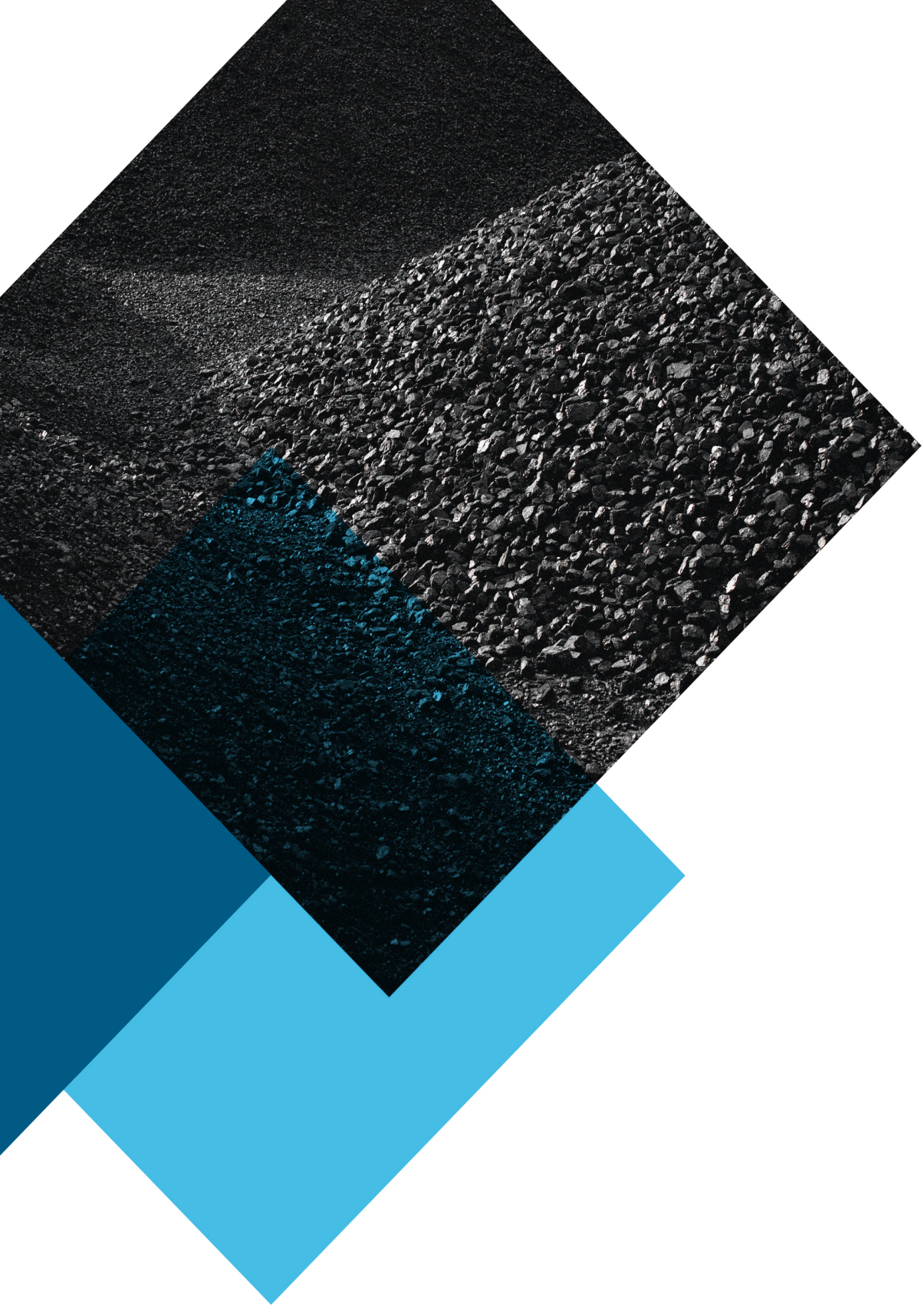
Document identification number ("file name" if ID unavailable)	Document name ("description" if no document name)	Date
Drawing 61-695-230-200	Whale Tail Attenuation Pond Access Ramp Plan / Cross-Sections	2019-02-06
"Dewatering Ramp Remediation.pdf"	WTD Dewatering Ramp remediation	N/A
"2019-07-30_AMQ Main Dewatering Ramp inspection.msg"	"Email by Christian Tremblay"	2019-07-31

Document identification number ("file name" if ID unavailable)	Document name ("description" if no document name)	Date
DWT-IR-01	Dewatering Infrastructures Inspection Checklist	2019-03-04
DWT-IR-02		2019-03-07
DWT-IR-03		2019-03-25
DWT-IR-04		2019-03-31
DWT-IR-05		2019-04-13
DWT-IR-06		2019-05-11
DWT-IR-07		2019-05-23
DWT-IR-08		2019-06-09
DWT-IR-09		2019-06-23
DWT-IR-10		2019-08-05
"Dewatering Ramp - Simplified Surveillance Form - 2019-03-28.pdf"	Simplified Surveillance Form	2019-03-29
"Dewatering Ramp - Simplified Surveillance Form - 2019-03-29.pdf"		2019-03-29
"Dewatering Ramp - Simplified Surveillance Form - 2019-03-30.pdf"		2019-03-30
"Dewatering Ramp - Simplified Surveillance Form - 2019-03-31.pdf"		2019-03-31
"Dewatering Ramp - Simplified Surveillance Form - 2019-04-01.pdf"		2019-04-01
"Dewatering Ramp - Simplified Surveillance Form - 2019-04-03.pdf"		2019-04-03
"Dewatering Ramp - Simplified Surveillance Form - 2019-04-04.pdf"		2019-04-04
"Dewatering Ramp - Simplified Surveillance Form - 2019-04-05.pdf"		2019-04-05
"Dewatering Ramp - Simplified Surveillance Form - 2019-04-06.pdf"		2019-04-06
"Dewatering Ramp - Simplified Surveillance Form - 2019-04-07.pdf"		2019-04-07
"Main Dewatering Ramp - Simplified Surveillance Form - 2019-04-09.pdf"		2019-04-09
"Main Dewatering Ramp - Simplified Surveillance Form - 2019-04-10.pdf"		2019-04-10
"Main Dewatering Ramp - Simplified Surveillance Form - 2019-05-05.pdf"		2019-05-05
"Main Dewatering Ramp - Simplified Surveillance Form - 2019-05-06.pdf"		2019-05-06
"Main Dewatering Ramp - Simplified Surveillance Form - 2019-05-07.pdf"		2019-05-07
"Main Dewatering Ramp - Simplified Surveillance Form - 2019-05-08.pdf"		2019-05-08
"Main Dewatering Ramp - Simplified Surveillance Form - 2019-05-09.pdf"		2019-05-09
"Main Dewatering Ramp - Simplified Surveillance Form - 2019-05-10.pdf"		2019-05-10
"Main Dewatering Ramp - Simplified Surveillance Form - 2019-05-11.pdf"		2019-05-11
"Main Dewatering Ramp - Simplified Surveillance Form - 2019-05-13.pdf"		2019-05-13
"2019-07-30_Main Dewatering Ramp - Simplified Surveillance Form.pdf"		2019-07-30

Document identification number ("file name" if ID unavailable)	Document name ("description" if no document name)	Date
"CON-QT-046_SD.pdf"	"Plan view of the as-built ditch with final quantities"	2018-09-30
"CON-QT-077_SD.pdf"	"Plan view and cross sections of the as-built ditch"	2019-10-02
Drawing 61-417-230-220	Plan & Profile – Exploration Pad	2019-05-08
Drawing 61-417-230-226	Cross Section and Details	2017-06-15
"CON-FD-198_AMQ FUEL FARM AS-BUILT.pdf"	"Amaruq fuel storage facility as-built plan view and cross sections"	2019-04-17
Drawing 61-403-230-200	Cross Section – Fuel Tank Farm #1 - Pad "K" – Retention Pond and Pad "K"	2018-06-01
Drawing 61-417-230-266	Existing Situation – Final WTP Pad Expansion - Phase II	2018-10-22
"Scope of Work - Mammoth Lake Diffusers.pdf"	Mammoth Lake Permanent Diffusers – Scope of Work	2019-03

Table E-6: General Documentation

Document identification number ("file name" if ID unavailable)	Document name ("description" if no document name)	Date
6117-005-210-001	Amaruq Mine Site Arrangement – Permitting	2019-04-30
"AMQ_SITE_MAP.dwg"	"General layout of the Amaruq mine site"	N/A
"OMS Whale Tail Water Management - March 2019.pdf"	Water Management Infrastructures Operation, Maintenance and Surveillance Manual (Version 1)	2019-03
"Water Level - Dewatering.xls"	"Water level monitoring of Meadowbank and Amaruq ponds, basins and lakes"	Data available up to July 14, 2019
"2019-07-13_Amaruq_Pipe_Layout.pdf"	"General pump layout of the Amaruq mine site"	N/A



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