

## **Appendix 16**

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### **Whale Tail 2019 Geotechnical Inspection Implementation Plan**

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## 2019 Amaruq Annual Geotechnical Inspection Implementation Plan



Recommendation Number	Priority Level <sup>(1)</sup>	Location	Year <sup>(2)</sup>	Recommendation	Action Plan/Follow-up	Status	Completion Date
2019_AG_1	4	Whale Tail Dike	2019	Cracking. Monitor any cracking evolution, reprofile if required.	After the inspection the thermal cover construction was completed and these cracks are no longer observable	Complete	-
2019_AG_2	4	Whale Tail Dike	2019	Cracks downstream of the cutoff wall. Cracks are closer to the cutoff wall on the downstream side. Monitor any cracking evolution, reprofile if required.	After the inspection the thermal cover construction was completed and these cracks are no longer observable	Complete	-
2019_AG_3	4	Whale Tail Dike	2019	Subsidence and cracks. Monitor any evolution of subsidence and cracking. Remove any deleterious materials and compact the additional rockfill layer.	After the inspection the thermal cover construction was completed and the deleterious material removed. Subsidence is no longer observable	Complete	-
2019_AG_4	3	Whale Tail Dike	2019	Differential settlement along the downstream edge of the western end of the crest. Add some rockfill material and compact.	After the inspection the thermal cover construction was completed. Differential settlement no longer observable	Complete	-
2019_AG_5	4	Whale Tail Dike	2019	Small holes located close to the downstream safety berm. Follow up any settlement at that location once the rockfill material is added on top.	After the inspection the thermal cover construction was completed. Hole no longer observable	Complete	-
2019_AG_6	3	Whale Tail Dike	2019	Presence of deleterious materials above elevation 157.0 m. Remove deleterious materials above elevation 157.0 m.	After the inspection the thermal cover construction was completed and the deleterious material was removed	Complete	-
2019_AG_7	3	Whale Tail Dike	2019	Shrinkage cracks around CB piles. Proceed with final earthworks by adding rockfill on top of the cutoff wall before the thaw front reaches the top of the cement-bentonite piles.	After the inspection the thermal cover construction was completed. Shrinkage cracks are no longer observable	Complete	-
2019_AG_8	3	Whale Tail Dike	2019	Crest materials require profiling and compaction (east abutment). Proceed with final grade and compaction on the crest.	After the inspection the thermal cover construction was completed. Crest was profiled and compacted	Complete	-
2019_AG_11	4	Whale Tail Dike	2019	Missing a handle. Add a handle to properly secure the door.	An handle will be add to the door	Not Started	Jan-20
2019_AG_12	3	Whale Tail Dike	2019	Instability (cracks with local subsidence). Re-slope this section and complete earthworks (add and compact rockfill to final lines and grades).	After the inspection the thermal cover construction was completed. The section was re-sloped	Complete	-
2019_AG_13	4	Whale Tail Dike	2019	Unknown upstream water level. A stake showing the operational and maximum water levels shall be installed to monitor the water level in real time.	Piezometers were added into WTS to monitor water level which is more reliable than the stake proposed. If the piezometers break they will be replaced.	Closed	Freshet 2020
2019_AG_14	3	Whale Tail Dike	2019	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 equipment used at Amaruq.	Berm has been removed to allow access.	Closed	-
2019_AG_15	4	Whale Tail Dike	2019	Water accumulation. Re-profile the platform toward the downstream so the water can drain away.	The platform was reprofiled to facilitate drainage of water	Complete	-
2019_AG_16	3	Whale Tail Dike	2019	Presence of cement on the downstream platform and access road. Remove the cement material from the surface.	Cement material was removed and area capped with NAG rockfill.	Complete	-
2019_AG_17	3	Whale Tail Dike	2019	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.	Cement material was removed and area capped with NAG rockfill.	Complete	-

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2019_AG_18	4	Whale Tail Dike	2019	Trapped snow. Follow up settlement of the downstream platform due to snow melt.	Platform/road condition was monitored and corrected as required	Complete	-
2019_AG_19	2	Whale Tail Dike	2019	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.	A comprehensive sampling program was done. Results show that the material flowing in the trench is not cement but lakebed sediment. The source of these sediment is likely caused by permafrost degradation on the East abutment	Complete	-
2019_AG_20	2	Whale Tail Dike	2019	Seepage. Follow up seepage at 0+276 once the downstream water level drops.	Seepage pumping station have been installed and the seepage is being monitored	Complete	-
2019_AG_21	2	Whale Tail Dike	2019	Seepage monitoring using a V-notch weir. Continue seepage rate monitoring.	Seepage rate monitoring is part of the regular instrumentation follow-up and is reported on a monthly basis.	Complete	-
2019_AG_22	2	Whale Tail Dike	2019	Seepage. Monitor channels (e.g. using V-notch weirs) to assess any change of seepage rate with time.	Seepage rate monitoring is part of the regular instrumentation follow-up and is reported on a monthly basis.	Complete	-
2019_AG_23	4	North East Dike	2019	Cracking. Monitor any cracking evolution, reprofile if required.	The cracks are inspected on a regular basis and their status is reported in the geotechnical inspection report.	Complete	-
2019_AG_24	3	North East Dike	2019	Sink holes. Add rockfill material to fill the holes and continue monitoring at that location.	The depression is inspected on a regular basis and their status is reported in the geotechnical inspection report.	Complete	-
2019_AG_25	4	North East Dike	2019	Potholes. Monitor potholes, reprofile the crest if required.	The pothole is inspected on a regular basis and their status is reported in the geotechnical inspection report.	Complete	-
2019_AG_26	3	North East Dike	2019	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.	As north-East dike will be dismantled in 2020 AEM will not pursue this recommendation and instead ensure that proper water management practice is used to minimize ponding of water against NE Dike at freshet	Closed	-
2019_AG_27	4	North East Dike	2019	Minor differential settlement toward the downstream slope. Monitor for any evolution of the settlement and reprofile if required.	The differential settlement is inspected on a regular basis and their status is reported in the geotechnical inspection report.	Complete	-
2019_AG_28	3	North East Dike	2019	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 drainage at the toe area, and reprofile if required.	Drainage was promoted at the toe of the area. The circular network of cracks are inspected on a regular basis and their status is reported in the geotechnical inspection report.	Complete	-
2019_AG_29	4	North East Dike	2019	Settlement. Monitor for any evolution of the settlement and reprofile if required.	The settlement is inspected on a regular basis and their status is reported in the geotechnical inspection report.	Complete	-
2019_AG_30	3	North East Dike	2019	Water ponding. Promote drainage away from the toe and monitor for any sign of seepage.	Drainage was promoted at the toe of the area. The seepage is inspected on a regular basis and their status is reported in the geotechnical	Complete	-
2019_AG_31	4	North East Dike	2019	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.	AEM will add a system to NE pond to ensure real time monitoring of the water level at freshet.	Not started	Freshet 2020
2019_AG_32	4	WRSF Dike	2019	Minor deformations. Monitor deformations and reprofile if required.	The deformation is inspected on a regular basis and their status is reported in the geotechnical inspection report.	Complete	-
2019_AG_33	4	WRSF Dike	2019	Cracking. Monitor cracking around the instrumentation shelter and reprofile if required.	The cracking is inspected on a regular basis and their status is reported in the geotechnical inspection report.	Complete	-
2019_AG_34	4	WRSF Dike	2019	Missing a handle. Add a handle to properly secure the door.	An handle will be added to properly secure the door.	Not Started	20-Jan

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2019_AG_35	4	WRSF Dike	2019	Cracking. Monitor cracking along the pipe and reprofile if required.	The cracking is inspected on a regular basis and their status is reported in the geotechnical inspection report.	Complete	-
2019_AG_36	3	WRSF Dike	2019	Exposed thermistor cable. Protect the cable from weather and animals.	The cable will be protected from weather and animals.	Not Started	Freshet 2020
2019_AG_37	4	WRSF Dike	2019	Water ponding. Re-profile the platform so that the water drains in the basin.	AEM will develop a strategy to minimise water accumulation on the platform	Not Started	Summer 2020
2019_AG_38	4	WRSF Dike	2019	Variability in the slope angle. Monitor and profile the slope if any instability.	The slope condition is reviewed on regular basis and their status is reported in the geotechnical inspection report.	Complete	-
2019_AG_39	3	WRSF Dike	2019	Water ponding. Monitor water ponding for any signs of seepage water.	Water ponding at the time of the inspection was not due to seepage. The downstream area is inspected on a regular basis for seepage and any observation is reported.	Complete	-
2019_AG_40	4	WRSF Dike	2019	Water elevation is above its operational level. Continue monitoring on a daily basis until the water level decreases to its operational level.	Discussion were held with the designer following the inspection and the operational level in summer condition was increased to El. 156.15 m. Additional pumping systems were also put in place to decrease the water	Complete	-
2019_AG_41	4	WRSF Dike	2019	Lack of operating stake. Install a stake showing operating and maximum water levels.	AEM will add a system to NE pond to ensure real time monitoring of the water level at freshet.	Not Started	Freshet 2020
2019_AG_42	4	Mammoth Dike	2019	Cracking. Monitor any cracking evolution, reprofile if required.	The cracks are inspected on a regular basis and their status is reported in the geotechnical inspection report.	Complete	-
2019_AG_43	4	Mammoth Dike	2019	Slightly uneven surface. As the crest is not used as a road, continue monitoring deformations of the crest periodically and reprofile if required.	The crest is inspected on a regular basis and its status is reported in the geotechnical inspection report.	Complete	-
2019_AG_44	4	Mammoth Dike	2019	Potholes. Monitor potholes, reprofile the crest if required.	The crest is inspected on a regular basis and its status is reported in the geotechnical inspection report.	Complete	-
2019_AG_45	4	Mammoth Dike	2019	No deformation observed. Monitor for any deformation in the downstream pond area.	The downstream area is inspected on a regular basis and its status is reported in the geotechnical inspection report.	Complete	-
2019_AG_46	3	Mammoth Dike	2019	Water ponding. Dry the downstream area of Mammoth Dike by pumping the water out.	A freshet management strategy for 2020 is being developed and will include measure to minimise the quantity of water ponding in this area	Ongoing	Summer 2020
2019_AG_48	4	Mammoth Dike	2019	Missing a handle. Add a handle to properly secure the door.	A handle will be add to properly secure the door	Not Started	20-Jan
2019_AG_49	4	Mammoth Dike	2019	Unknown water level. Install a stake showing operating and maximum water levels.	A piezometer was installed into Mammoth Lake to provide real time water level measurement which is more reliable than the stake proposed. AEM will investigate further the possibility of adding a stake as an additional	Closed	-
2019_AG_50	2	Main Dewatering Ramp	2019	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.	The ramp is inspected on a regular basis and the results are reported in a geotechnical inspection report. Mitigation/repair will be done if required.	Complete	-
2019_AG_51	2	Main Dewatering Ramp	2019	Probable instability of the ten-metre-high embankment during dewatering. Review the design and reroute the ramp if instability conditions are confirmed.	The dewatering ramp performance was adequate during the main dewatering activity and did not required a routing modification. The ramp is inspected on a regular basis and the results are reported in a	Complete	-
2019_AG_52	4	Main Dewatering Ramp	2019	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.	The ramp is inspected on a regular basis and the results are reported in a geotechnical inspection report.	Complete	-

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2019_AG_53	4	Saline Protection Ditch	2019	Cracking. Monitor any cracking evolution, reprofile if required.	This structure construction was not completed at the time of the inspection. This was addressed with the structure construction completion.	Complete	-
2019_AG_54	3	Saline Protection Ditch	2019	Hole in the 0-20 mm material. Fill the hole with 0-20 mm material and monitor any subsequent settlement.	This structure construction was not completed at the time of the inspection. This was addressed with the structure construction completion.	Complete	-
2019_AG_55	2	Saline Protection Ditch	2019	Exposed geomembrane. Review the anchor design of the liner and cover the geomembrane with 0-20 mm material accordingly.	This structure construction was not completed at the time of the inspection. This was addressed with the structure construction completion.	Complete	-
2019_AG_56	3	Saline Protection Ditch	2019	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.	This structure construction was not completed at the time of the inspection. This was addressed with the structure construction completion.	Complete	-
2019_AG_57	3	Saline Protection Ditch	2019	Water ponding. Unblock the culvert to allow water flowing toward AP5.	This structure construction was not completed at the time of the inspection. Culvert was changed during the structure completion.	Complete	-
2019_AG_58	3	Site Haulage Road	2019	Blocked culvert. Remove materials to free the flow of water.	This structure construction was not completed at the time of the inspection. Culvert was changed during the structure completion	Not started	-
2019_AG_59	4	Site Haulage Road	2019	Deformations of the corrugated steel pipe. Water is still flowing through the culvert. Monitor for any excess deformation.	This culvert will be inspected at freshet and if the flow of water is impeded it will be fixed	Not started	-
2019_AG_60	3	Site Haulage Road	2019	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.	Culvert will be repaired to ensure proper drainage of the road at this location	Not Started	Freshet 2020
2019_AG_61	4	Site Haulage Road	2019	Culvert is too short/slope is too steep. Consider reprofiling the road with rockfill material around the culvert for a more stable structure.	This culvert will be inspected at freshet and if the flow of water is impeded it will be fixed	Not Started	Freshet 2020
2019_AG_62	3	Site Haulage Road	2019	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.	This portion of the road was widened and rebuilt in summer 2019. The main haulage roads are inspected every week and any defect is reported and corrected as needed.	Complete	Freshet 2020
2019_AG_63	1	Site Haulage Road	2019	Significant subsidence on the edge of the road. Potential safety hazard; reprofile that area and monitor any subsequent settlement. Review water management plan for that section.	This portion of the road was widened and rebuilt in summer 2019. The main haulage roads are inspected every week and any defect is reported and corrected as needed.	Complete	Septmber 2019
2019_AG_64	4	Site Haulage Road	2019	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.	Water was not transferred due to lack of pumps and piping. A freshet management strategy for 2020 is being developed and will include measures to promote drainage in this area.	Complete	-
2019_AG_65	3	Site Haulage Road	2019	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.	A freshet management strategy for 2020 is being developed and will include measure to promote drainage in this area	Ongoing	Freshet 2020



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2019_MG_12	3	Amaruq Tank Farm	2019	A tension crack was observed on the side of the excavation of the new tank farm and probably originates from settling of the thawing foundation, the winter construction and the steep side slope. It should be monitored for differential settlement that might affect liner integrity. Consideration to soften the side slope should be made if degradation of the conditions continues.	Monitor the tension crack on the side of the tank farm for differential settlement. Consider softening the side slope if it continues to get worse.	Ongoing	Freshet 2020
2019_AG_80	4	Water Treatment Plant Pad	2019	Cracking. Monitor any cracking evolution, reprofile if required.	The crack is being monitored and the slope will be reprofiled if necessary.	Ongoing	-
2019_AG_81	4	Water Treatment Plant Pad	2019	Raveling. Soften the slope and compact with crushed rock.	The slope was softened and compacted by an excavator.	Complete	-
2019_AG_82	4	Water Treatment Plant Pad	2019	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.	Monitoring performed by dewatering crew and Engineering.	Ongoing	-
2019_AG_85	3	Diffuser	2019	As per AEM, diffuser should have stalled in the bottom of Mammoth Lake. As per AEM, the diffuser will be reinstalled this year.	The diffuser has been installed successfully in the summer of 2019	Complete	-
2019_AG_86		General	2019	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), and monitoring of the corrective actions taken over time, if any.	Maintenance logs have been created for each structure that document observations, along with their respective date, activity, recommendation, action and TARP status.	Complete	-
2019_AG_87		General	2019	Review/improve internal procedures so that the TARP is 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.	The OMS manual describe the communication procedure to raise the TARP level and the step to take when abnormal observation are made. The procedure will be reviewed during the annual review of the OMS manual.	Complete	-
2019_AG_88		General	2019	Prepare a special TARP training for employees who have to work nearby these infrastructures. A trained employee may be able to detect and report abnormal situations.	Training required for the employee who have to work near these infrastructure is documented in the OMS manual. It is each department responsibility to ensure employee have sufficient knowledge of the OMS manual for their tasks. As a best practice, an OMS review session could be organised with employee who work near these infrastructure on a frequent basis.	Complete	Freshet 2020

1 : Priority Level Descriptions

P-1: A high priority or actual structure safety issues 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.

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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.							
P-4: Best Management Practice – further improvements are necessary to meet industry best practices or reduce potential risks.							
2 : Previous year recommendations are kept only if they are outstanding							