WHALE TAIL PIT PROJECT

Water Quality Monitoring and Management Plan for Dike Construction and Dewatering

Prepared by:
Agnico-Eagle Mines Limited – Meadowbank Division

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EXECUTIVE SUMMARY

This Plan documents the Water Quality Monitoring and Management Plan for Dike Construction and Dewatering for the Whale Tail Pit and Haul Road project (Project). Water quality monitoring includes several parameters (e.g., nutrients and metals), but TSS and turbidity (primarily as a surrogate for TSS) are the major drivers of management and mitigative actions during construction of the Whale Tail Dikes. The plan is designed to prompt mitigation measures to control the releases of Total Suspended Solids (TSS) in the environment and reduce unacceptable changes to the water levels in the receiving environment. The monitoring and management plans are detailed and should serve as operating procedures for real-time actions in the field.

IMPLEMENTATION SCHEDULE

This Plan will be immediately implemented subject to any modifications proposed by the NWB as a result of the review and approval process.

DISTRIBUTION LIST

AEM – Environment Superintendent

AEM – Environmental Coordinator

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AEM - Dike Superintendent

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SECTION 1 • INTRODUCTION

This plan provides details of water quality monitoring and management actions specifically related to the dike construction and dewatering activities at Whale Tail Pit (Figure 1). The plan does not cover receiving environment nor compliance monitoring of lakes in the Whale Tail Pit area (Mammoth Lake, Whale Tail Lake [South Basin]) (as these are part of the Aquatic Effects Management Program).

Water quality monitoring includes several parameters (e.g., nutrients and metals), but TSS (Total Suspended Sediments) and turbidity (primarily as a surrogate for TSS) are the major drivers of management actions during construction and dewatering. The plan also includes mitigation measures to control the releases of TSS in the environment. The TSS/turbidity focus allows for direct monitoring of the major potential stressor in "real time", thus allowing timely identification and mitigation of potential issues related to dike construction or dewatering.

This plan includes the following components:

- Review of TSS/turbidity effects and existing federal guidelines (**Section 2**);
- License requirements for the protection of fish and fish habitat at Meadowbank **(Section 3);**
- Water quality monitoring and management plan for dike construction (**Section 4**);
- Water quality and lake level monitoring and management plan for dewatering (**Section 5**); and
- References (**Section 6**).

The monitoring and management plans are detailed and should serve as operating procedures for real-time actions in the field.

SECTION 2 • REVIEW OF TSS / TURBIDITY AND EXISTING FEDERAL GUIDELINES

2.1 REVIEW OF TSS / TURBIDITY EFFECTS

Suspended sediments, and associated effects on water clarity, have the potential to affect fish and fish habitat in a variety of ways, including but not limited to:

- Smothering of deposited eggs or siltation of spawning habitats;
- Smothering of benthic invertebrate communities;
- Decreased primary productivity caused by reduced light penetration;
- Reduced visibility, which may decrease feeding efficiency and/or increase predator avoidance; and
- Clogging and abrasion of gills.

Fisheries and Oceans Canada (DFO) has produced a report on effects of sediment on fish and their habitat (DFO, 2000). That report is based primarily on a more detailed paper by Birtwell (1999). The review by Birtwell is in turn based on a few sources, the most recent and comprehensive of which was prepared by Caux et al. (1997).

The general findings for effects of TSS on fish and fish habitat indicate the following:

- Effects of TSS depend on both the concentration of TSS and duration of exposure;
- Effects of TSS can also be influenced by the size and shape of suspended particles;
- Concentrations of TSS that are lethal to fish over acute exposures (i.e., hours) range from hundreds to hundreds of thousands of mg/L;
- Sublethal effects on fish (e.g., reduced growth, changes in blood chemistry, histological changes) associated with chronic (weeks to months) exposures tend to be exhibited at TSS concentrations ranging from the tens to hundreds of mg/L;
- There is considerable uncertainty about potential effects of low TSS concentrations (less than tens of mg/L) over long time periods;
- Overall, the most sensitive group of aquatic organisms to TSS appears to be salmonids, and guidelines are developed to protect this group;
- Adult salmonids are generally more sensitive to short duration, high concentrations of suspended sediments than juvenile salmonids. However, both juvenile and adult fish have the potential to avoid high concentrations of suspended sediments; and
- Low suspended sediment levels are known to cause egg mortality (40%) to rainbow trout at long durations (7 mg/L at 48 days). Guidelines for long-term exposure reflect these findings.

2.2 REVIEW OF EXISTING FEDERAL GUIDELINES

Based on the findings regarding effects of suspended sediment, guidelines for TSS as well as turbidity have been put forth by various federal agencies.

TSS

The Canadian Council of Ministers of the Environment (CCME) specifies separate guidelines for TSS for clear flow and high flow periods. The guidelines are derived primarily from Caux et al. 1997. In the case of application to the Project Lakes, the clear flow guidelines would be most relevant – even during freshet one would not expect to see large natural fluctuations in TSS except in localized areas for short periods.

The guidelines put forth by the CCME recognize that the severity of effects of suspended sediments is a function of both the concentration of suspended sediments and the duration of exposure. Guidelines are intended to protect the most sensitive taxonomic group (salmonids) and the most sensitive life history stages. The following table summarizes the available guidelines applicable to clear water (CCME) and to mine-related effluent discharges (MMER).

Table 2.1: Existing Federal TSS Guidelines

Source	Short-Term Exposure	Long-Term Exposure
CCME 1999	Anthropogenic activities should not increase suspended sediment concentrations by more than 25 mg/L over background levels during any short-term exposure period (e.g., 24-hr)	For longer term exposure (e.g., 30 days or more), average suspended sediment concentrations should not be increased by more than 5 mg/L over background levels
MMER 2002	Maximum authorized concentration in a composite effluent sample = 22.5 mg/L. Maximum authorized concentration in a grab sample of effluent = 30 mg/L.	Maximum authorized monthly mean effluent concentration = 15 mg/L [1].

The guidelines above are based on hundreds of studies in different environments (see Caux et al. 1997). Some of the studies may not be particularly relevant to the case of suspended sediment associated with dike construction and dewatering in a lake environment. Consequently, it is worth considering whether all aspects of existing guidelines are applicable to dike construction and monitoring at Whale Tail Pit. There are two particular aspects that warrant discussion.

First, in relation to short-term exposure guidelines, it is important to note that guidance is based on findings for adults and juveniles (which are more sensitive than eggs and larvae over short durations), and that the guidance is based primarily on reviews looking at application to stream environments. In a stream environment, compared to a lake environment, it is difficult for fish to swim away from suspended sediments because the high degree of mixing in the water column facilitates higher uniformity in TSS concentrations. In contrast, in lakes, in particular for sediment plumes associated with construction activities or discharges, high TSS concentrations would generally be expected to be localized, with dilution over distance. In a lake situation, adult and juvenile fish (the most sensitive life stages to short-term exposure) should readily be able to swim away from a sediment plume.

[2] For purposes of calculating monthly means, any values below detection limits are set at one-half of the detection limit.

Second, in relation to long-term exposure guidelines, it is important to note that guidance is heavily influenced by findings indicating the sensitivity of eggs to low-level exposure to TSS over long durations. Consequently, the long-term exposure guidelines would be rather conservative if applied during times when eggs are not present, or in areas of a lake or stream that are not spawning habitat.

Turbidity

Turbidity guidelines put forth by the CCME (1999) are based on extrapolation from the TSS guidance above, adjusted by a factor of about 3:1 (a typical average ratio for TSS: turbidity). In the case of turbidity for clear water, CCME (1999) recommends a maximum increase of 8 NTUs from background levels for a short-term exposure (e.g., 24-h period), and a maximum average increase of 2 NTUs from background levels for a longer term exposure (e.g., 30-d period).

CCME (1999) notes that in some cases short-term resuspension of sediments and nutrients in the water column can augment primary productivity, and in other cases changes in light penetration may be inconsequential if a system is limited by other factors such as nutrients. The Caux et al. (1997) study considered effects of suspended sediment not only on fish but also on algae and zooplankton. In the end, the recommendations put forth by Caux et al. (1997) are based mainly on the most sensitive taxonomic group, which is salmonids.

However, research has shown that widespread, chronic turbidity can result in reduced light penetration and subsequent reductions of primary productivity (DFO, 2000; CCME, 1999; Lloyd et al., 1987). Consequently, water clarity is of concern at broader spatial scales and longer timeframes, such as the proposed dewatering activities.

It should be noted that DFO’s report on effects of sediment on fish and their habitat (DFO, 2000) endorses the guidelines for TSS put forth by the CCME (1999), but does not recommend following guidelines for turbidity. Rather, turbidity may be used as a surrogate for suspended sediment only when the relationship between the two parameters is established for a particular waterbody.

SECTION 3 • STANDARDS FOR THE PROTECTION OF FISH AND FISH HABITAT

During dike construction activities for the Project, the following maximum monthly mean (MMM) and short term maximum (STM) TSS concentrations will be met in accordance with the Type A Water Licence.

Table 3.1: Maximum Allowable TSS Concentrations During Dike Construction[1]

Parameter	Maximum Monthly Mean (mg/L)	Short Term Maximum (mg/L)
TSS in areas where there is spawning habitat and at times when eggs or larvae are expected to be present	6	25
TSS in all other areas and at times when eggs/larvae are not present	15	50
TSS in impounded areas (e.g. North Basin of Whale Tail Lake) at all times in all areas	15	50

Consistent with other operations (i.e. Meadowbank Mine), Agnico Eagle proposed to meet the maximum monthly mean and short term maximum concentrations presented in Table 3.2 during dewatering at the Project.

Table 3.2: Maximum Allowable Water Quality Concentrations During Dewatering

Parameter	Maximum Monthly Mean	Short Term Maximum
Total Suspended Solids	15.0 mg/L	22.5 mg/L
Turbidity	15 NTU	30 NTU
pH	6.0 to 9.0	6.0 to 9.0
Total Aluminum	1.5 mg/L	3.0 mg/L

Trigger values have been developed with corresponding management action plans; should TSS concentrations in the water body exceed the trigger values during either dike construction or dewatering, a management action plan consisting of a series of steps to be undertaken will be initiated. The trigger value for the short term maximum concentration is a single sample that exceeds the STM concentration. The trigger value for the maximum monthly mean is a 7-day moving average concentration that exceeds the MMM. The management action plans for the dike construction STM and MMM are discussed in detail in Section 4 and for dewatering in Section 5.

[1]Adapted from Meadowbank Mine Type A 2AM MEA1525 Part D Item 7

SECTION 4 • WATER QUALITY MONITORING AND TSS MANAGEMENT PLAN FOR DIKE CONSTRUCTION

During dike construction, both the dike material itself as well as the disturbed material on the lake floor (particularly in the deep areas of the lakes) will contribute to increases in concentrations of suspended sediments in the water column. In the absence of sediment control measures, suspended sediment plumes would be expected to migrate to the southeast with wind-driven (prevailing winds from the northwest) currents.

The key means for minimizing suspended sediment discharges from the dike construction zones during dike construction include the deployment of turbidity curtains and water treatment. Similar mitigation measures were applied during the construction of the Meadowbank East dike, South Camp dike, and Bay Goose dike (Phase I) will be used during the construction of the Whale Tail Dike and Mammoth Dike.

4.1 ACTION PLAN FOR TSS MANAGEMENT

The following elements will be included in the Whale Tail Pit TSS management plan:

- Deploy one length of turbidity curtains downstream of the dike and ensure curtains are situated in appropriate locations to minimize escape of sediments below the curtains.
- Minimize water current out of the construction area to reduce potential for outflow of turbid water; this will be done by 1), if permits are received, slow-pace winter construction of a causeway about 25 m wide (the downstream portion of the dike), and 2) open-water installation of pumps in front of the rock platform deposition creating a no-current to inward-current zone inside the curtains. This should create an average negative pressure and will cause 'clean' water to move through the causeway into the trench, that will be backfilled with gravel to form the cutoff wall.
- Provide a wind-breaker to protect turbidity curtains against the effects of high winds; this will be achieved by winter construction of the causeway or by rapidly advancing the platform immediately once the lake is open water. Since the causeway is the downstream portion of the dike, it will be the same height as the dike. The concept of the causeway was developed based on observations from the 2009 wind storm event that the integrity of the inner curtain portion closer to the rock platform was not affected by wind activity.
- Following the construction of the causeway, install curtains that have a reduced height and length to make them less prone to breakage from wind action; this will be achieved by 1) installation of the inner turbidity curtains in small cell-like patterns along the causeway to prevent wholesale breakage of the curtain due to effect of high winds, and 2) installation of outer curtains, as much as possible, in depths of no more than 10 m to reduce the effects of high winds.
- Reduction of the TSS loading inside the turbidity curtains; this is achieved by 1) the above mentioned pumping of water in front of the rock platform construction, and 2) pumping of water from the trench (the water with the highest TSS concentrations), both to be treated at the dewatering water treatment plant.

In summary, the corner stone of this TSS management plan is the inclusion of the construction of a causeway or downstream platform (either in the winter or immediately as the ice thaws) to provide wind and water current protection. Ideally this causeway should be completed before turbidity curtain deployment. If constructed in the winter, the construction of the causeway will require breaking the ice in front of the rock platform. This type of construction is consistent with works completed at the Meadowbank Mine in the spring of 2009 for the construction of 2 dewatering jetties in the northwest arm of Second Portage Lake; an efficient and safe ice breaking technique and a low turbidity rock deposition process were developed.

Additionally, Agnico Eagle has developed a low-impact construction technique for the placement of the rock platform beginning with the rock selection process in the quarries or open pit. Rock containing more fines is not selected for construction. During the platform construction, to minimize the impact of material deposition, the rock is deposited on the platform and then pushed with a dozer into the lake. Given the quantity of material that needs to be deposited, these are the only mitigation measures that can be effectively implemented during the very short construction period to minimize suspended sediments in the lake environment.

In addition to the causeway, installation of turbidity curtains downstream will ensure the protection of the receiving environment. The other mitigation measures will be deployed during the open water season to 1) minimize sediment loading in the construction zone (installation of pumps in front of the rock platform during platform construction and in the trench excavation, and treatment) and 2) reduce the effects of high winds (installation of the outside curtain in an area where water depth is no more than 10 m, if possible).

Specific TSS management frameworks were developed for periods of ice-up (when the lake is ice-covered) and open water construction.

4.1.4.1 TSS Mitigation for Dike Construction During the Ice-up Period

Since turbidity curtains cannot be deployed in the winter, other TSS mitigation measures were developed by the Meadowbank team for the causeway construction. The first mitigation measure is to advance the rock platform at a very slow rate, approximately 2 400 tonnes per day (up to 10 times lower than during the open water season). The rate of construction will be used to control the TSS loading. Given that the winter construction activities do not have the same time constraints as open water construction, a less productive method of rock deposition can be used. Secondly, sediment dispersion will be decreased during winter construction of the causeway, as ice-cover will eliminate wind-driven currents and allow sediment to settle. Lastly, a shovel will be used to deposit the rock through the ice openings. In combination, these mitigative measures should reduce the sediment resuspension and dispersion, especially in shallow water. Nevertheless, the possibility of sediment re-suspension and dispersion will be monitored as discussed below in Section 4.2.

4.1.4.2 TSS Mitigation for Dike Construction During the Open Water Period

Turbidity curtains are an integral part of the TSS management plan during the open water period. Based on the experience gained at Meadowbank Mine during the 2008 and 2009 construction seasons, some changes to the turbidity curtain deployment strategy will be implemented to increase their effectiveness during the Whale Tail Dike construction. The outer turbidity curtains will be located downstream of the deep depressions in the lake to minimize gravity induced slippage of sediments under the curtains. In addition, where feasible, the outer turbidity curtains will be deployed in areas with a maximum water depth of 10 m to minimize the effect of wind. The inner turbidity curtains will be deployed in short spans using the dike platform or causeway as the initial and final anchor points, reducing the length of the curtains and the consequent effect of wind.

Based on experience from previous years at the Meadowbank Mine, there is a 2-week open water window during which turbidity curtain installation can be done prior to the start of the construction. A tentative schedule for the Project is provided in Table 4.1.

As a supplementary measure to protect the fish while the fishout is taking place, a turbidity curtain will be deployed concurrently with the start of the dike construction on the north side of the dike. This should minimize the effect on the fish that will remain in the basin while the fishout takes place.

In addition to the installation of turbidity curtains, the following mitigative measures could be applied during dike construction to minimize sediment loading in the construction zone:

- A pump will be installed in the water in front of the construction platform to neutralize the current created by the displacement of water from the deposition of rock in the lake.
- In addition to creating a ‘current neutral’ zone, pumping out water directly ahead of the rock platform will remove some sediment and reduce the loading in the construction zone.
- During the construction activities in the trench, a pump will be placed in the trench to first create a ‘current neutral’ zone, minimizing expulsion of the sediment laden water. The pump capacity will be approximately 10,000 m^3 per day. This water will be treated using the dewatering water treatment plant prior to discharge to the environment. .
- In addition to creating a ‘current neutral’ zone in the trench, pumping out water will remove some sediment and reduce the loading in the construction zone.

With the combination of the three types of mitigation measures: causeway, turbidity curtains and pump and treat, Agnico Eagle is confident that the construction of the Whale Tail Dike and Mammoth Dike will be constructed with the best available practices and that the TSS will be controlled.

Table 4.1: Tentative Schedule

Tentative Schedule of Work	Activity
January to June 2018	Construction of the Causeway
May to July 2018	Preparation of turbidity curtains on land Laying down the pipes leading to the water treatment plant Preparing the pump installations on land
June to July 2018	Deployment of outer turbidity curtains Excavation of Abutment
July 2018	Start of platform construction at both ends of the Whale Tail Dike If deemed necessary, pump water in front of the two rock platform advances; placement of the inner turbidity curtains as the rock face advances.
July to August 2018	Start of the trench excavation and filling If deemed necessary, pump water in the trench
July to August 2018	Planned completion of rock platform Rock platform pump shutdown
August to September 2018	Planned completion of backfilled trench Trench pump shutdown End of the TSS producing activities and start of the settling period
August to November 2018	Planned completion of compaction Start of cement and bentonite cut-off wall installation Casing installation for injection Drilling bedrock and injection Installation of instrumentation
September to October 2018	Continuing into the dewatering phase in March 2019

4.2 WATER QUALITY MONITORING

Water quality monitoring includes several parameters (e.g., nutrients and metals), but TSS and turbidity (primarily as a surrogate for TSS) are the major drivers of management actions during construction. The TSS/turbidity focus allows for direct monitoring of the major potential stressor, thus allowing timely identification and mitigation of potential issues.

4.2.1 Monitoring Locations

The TSS management plan has been developed for lake ice-up and open water construction seasons. Different locations for routine monitoring have been developed for these two periods.

If permitted, during the lake ice-up period, moving stations will be established around the deposition area as close as safety permits on either side of the causeway and in front of the causeway; these stations will move in conjunction with work development. Background levels were measured prior to construction and this data will be used for reference. TSS will be sampled at all monitoring stations on a weekly basis.

During open water construction of the Whale Tail Dike and Mammoth Dike, routine monitoring will be established at a distance of 50 to 100 m from the turbidity curtains as proposed in Figure 1.

4.2.2 Monitoring Plan

Agnico Eagle is committed to proactive and effective response to any potential TSS problems; the monitoring program has been designed to provide quick feedback. Based on experience at the Meadowbank Mine, this is not possible using TSS as a direct measure, because of the time required to analyze TSS in the field. Consequently, and consistent with the recommendations of the DFO (DFO, 2000), Agnico Eagle has developed a relationship between turbidity and TSS, allowing the use of turbidity as a surrogate for TSS and obtaining real time results. The TSS-turbidity relationship was developed using paired data collected across a range of TSS sources and concentrations and previously approved in the Meadowbank Water Quality Monitoring and Management Plan for Dike Construction and Dewatering. The resulting linear regression was as follows:

$\log10(\text{turbidity}) = 0.62196 + (0.95619 * \log10(\text{TSS}))$ [$p<0.001$; r2-adj = 0.81]

where turbidity is measured in NTUs in the field using an Analite NEP 160 meter, and TSS is measured in the lab as mg/L.

A turbidity meter will be used to perform the analysis at each station. One or two times per day a vertical profile will be conducted at each station, at two meter intervals. All values are recorded but for compliances purposes only the maximum value in the profile is used. Raw turbidity data will be handled in the following manner to facilitate comparisons to the maximum allowable TSS concentrations:

Comparisons to Short-Term Maximum (STM)

1. Calculate the 24-hr station mean for turbidity for each station based on the measured maximum values over the past 24 hours.
2. Use the TSS-turbidity regression (using the site-specific TSS:Turbidity) to estimate 24-hr mean TSS.
3. Calculate the moving average of each stations.
4. Compare to appropriate STM value.

Example*: Maximum turbidity values of 2.4, 3.0 and 1.2 NTUs were measured in depth profiles at Station Y over the last 24 hours, for a 24-hr mean of 2.2 NTU. Using the TSS:Turbidity relationship, the 24-hr mean TSS concentration would be 6.6 mg/L.*

Comparisons to Maximum Monthly Mean (MMM)

1. Calculate the 30-day moving average of each stations (24-hr mean TSS values) for the previous 30 days.

2. Compare this to the appropriate MMM value.

Routine water quality will also be conducted on a weekly basis. Water quality sampling parameters shall include:

- Physical parameters: hardness, pH, total dissolved solids, total suspended solids;
- Anions and nutrients: ammonia, alkalinity – bicarbonate, alkalinity – carbonate, alkalinity – hydroxide, alkalinity – total; chloride, silicate, sulfate, nitrate, nitrite, total kjeldahl nitrogen, orthophosphate, total phosphate;

- Organic parameters: chlorophyll a, dissolved organic carbon, total organic carbon;
- Total and dissolved metals.

During summer, a broad survey for turbidity will be conducted once a week in Whale Tail Lake (South Basin) and Mammoth Lake.

4.3 STANDARD OPERATING PROCEDURES FOR MONITORING AND MANAGEMENT OF TSS

The Standard Operating Procedure (SOP) for monitoring and management of total suspended sediments during dike construction is shown in Figures 2 and 3. Importantly, the SOP strives for proactive prevention and mitigation of problems. Monitoring will be conducted during daylight hours when conditions are safe for workers. The causeway will be constructed January to June 2018. The SOPs for monitoring and management of total suspended solids during ice-up conditions will be different than for summer conditions. Consequently, the two types of SOPs are detailed below. All monitoring results will be included in the Monthly Monitoring Program Summary Report.

SOP for Winter Construction

The SOP contains the following key elements:

1. Given the slow pace of deposition, routine TSS and turbidity monitoring will be done once per day (weather/logistics permitting). Each monitoring event will measure TSS/turbidity at one or more established stations. TSS will be sampled weekly at all monitoring stations at the maximum value.

2. Given that no turbidity curtain can be installed, the TSS trigger levels will be conservative. If during construction of the causeway, the TSS concentration (or turbidity as a surrogate) in a single sample exceeds 50% of the Short Term Maximum (after September 1), 25 ppm, the construction front will be moved to the other end of the causeway while the TSS settles at the original construction area. Construction will continue at the original construction area as soon as AEM has demonstrated that TSS levels are within 50% of the limit. In addition, an observation of the causeway construction sequence will be completed daily to determine if the rock deposition method is being conducted according to specifications; corrective actions will be taken if necessary.

3. If 50% of the 25 mg/L (ppm) trigger for TSS is exceeded on both ends of the causeway, construction will stop until AEM has demonstrated that TSS levels are within 50% of the limit.

4. Report all actions and findings to the regulators in a report no later than 7 days after the noted exceedance.

5. Sediment traps have been installed and will provide data on sedimentation effects, if any, from the winter construction. The traps will be removed and replaced prior to the start of the summer construction activities.

SOP for Open Water Construction

The SOP contains the following key elements:

1. Routine TSS monitoring will include two monitoring events per day (weather/logistics permitting), approximately every 8 hours during daylight. Each monitoring event will

include (a) inspection of silt curtain integrity/deployment, and (b) measurement of TSS/turbidity at one or more established stations (see # 2 for more details).

2. Stations for routine monitoring have been established 50 to 100 meters outside of the silt curtains. All stations will be sampled at every event.

3. If there is a silt curtain problem, it will be immediately fixed.

4. If TSS levels (or turbidity as a surrogate) in a single sample exceeds the Short Term Maximum, this will trigger a series of actions. First, the silt curtain will be inspected in more detail to identify any obvious problems. If there are no obvious problems, mitigative measures will be considered such as adjusting construction practices if possible (e.g., more careful placement of materials), modification of silt curtain deployment, or deployment of additional silt curtains. As an additional safeguard, visual inspections of the silt curtain and the turbidity of water will also be taken into account in construction decisions.

5. As monitoring continues, the 24-hour average TSS concentrations for each stations will be calculated. Should the 24-hour average exceed the Short Term Maximum at any sampling location, AEM will stop construction, advise the regulators and take the following actions:

   i. Verify the physical extent of the problem.

   ii. Verify that all mitigation measures are working according to best practices.

   iii. Where deficiencies are noted, correct mitigation measures to established best practices and increase inspection frequency at areas of noted deficiencies for the rest of the construction period.

   iv. Once best practices have been re-established and AEM has demonstrated TSS levels are within the limit, restart the construction activities.

   v. Trigger a site specific Effects Assessment Study (EAS).

   vi. Report all actions and findings to the regulators in a report no later than 7 days after the noted exceedance.

6. If the 7-day moving average TSS concentration at any sampling location exceeds the maximum monthly mean, this will trigger a series of actions:

   i. Advise regulators;

   ii. Verify the physical extent of the problem.

   iii. Determine if the average has been heavily influenced by one or more events that have been addressed.

   iv. Verify the state of mitigation measures against best practice.

   v. Where deficiencies are noted, correct mitigation measures to established best practices and increase inspection frequency at areas of noted deficiencies for the rest of the construction period.

   vi. Report all actions and findings to the regulators in a report no later than 7 days after the noted triggering event.

7. Should the mean of the 30-day moving average for at any sampling location exceed the Maximum Monthly Mean, AEM will stop construction the regulators and take the following actions:

   i. Verify the physical extent of the problem.

   ii. Verify that all mitigation measures are working according to best practices.

   iii. Where deficiencies are noted, correct mitigation measures to established best practices and increase inspection frequency at areas of noted deficiencies for the rest of the construction period.

   iv. once best practices have been re-established and AEM has demonstrated TSS levels are within the limit, restart the construction activities.

   v. Trigger the EAS.

   vi. Report all actions and findings to the regulators in a report no later than 7 days after the noted exceedance.

8. Follow-up monitoring of the benthic community will be conducted in the event of any exceedance. While it would be expected that any adverse effects from sediment deposition would not be permanent, plume deposition areas will be monitored in the year following construction (and the next year if significant adverse effects are found). A control-impact design will be used to test for differences in benthic community (e.g., abundance and diversity) between the deposition area and an area (similar depth and substrate characteristics) unaffected by construction activities.

9. High value habitat identified in close proximity to the construction areas will be subject to a higher level of protection (i.e., lower trigger values for TSS) than other areas during the fall spawning season; sediment deposition rates will also be monitored in the high value habitat areas using sediment traps. High value habitat areas will be determined prior to the start of construction. Results will be compared across monitoring points and to existing literature on effects of deposited sediment.

4.4 QA/QC FOR TURBIDITY MEASUREMENTS

The purpose of quality assurance and quality control (QA/QC) for turbidity measurements is to ensure that the field data collected are representative of the water sampled. Since turbidity will be used as a surrogate for Total Suspended Solids (TSS) there are two important objectives to ensure the turbidity measurements meet the QA/QC standard: ensure the turbidity meters are properly calibrated (i.e. their readings have high precision and accuracy) and collect TSS samples to complete a paired TSS-turbidity measurement comparison to the updated TSS-turbidity regression correlation. Furthermore, data quality is assured throughout the collection and analysis of samples using standard procedures, certified laboratories and by staffing with trained technicians.

The establishment of a site specific TSS-turbidity relationship at Meadowbank is based on rigorous statistical analysis of the turbidity data collected and paired with collected TSS water samples that were submitted to a certified laboratory (Azimuth, 2010). Data from Bay-goose dike construction provided the basis for the TSS-turbidity relationship using a McVan's Analite NEP160-3-05R portable turbidity meter/logger with a high sensitivity NEP260 90° probe. Accordingly the most updated TSS-turbidity regression correlation for dike construction monitoring is based on TSS being measured in a certified laboratory in mg/L and turbidity being measured in NTUs in the field using an Analite NEP 160 meter (Azimuth, 2010). The relationship developed at Meadowbank will be used to guide the monitoring program including QA/QC measurements at the Whale Tail Pit and Haul Road Project.

4.4.1 Turbidity Meter Calibration

To meet these objectives, turbidity will be measured using a McVan's Analite NEP160-3-05R portable turbidity meter/logger with a high sensitivity NEP260 90° probe. The meter will be calibrated and properly maintained following the manufacturers instructions. Turbidity meters will be calibrated before each sampling event (i.e. daily, in most cases), using the manufactured specified calibration solution.

SECTION 5 • WATER QUALITY AND LAKE LEVEL MONITORING AND MANAGEMENT PLAN FOR DEWATERING

5.1 WATER QUALITY MONITORING AND MANAGEMENT DURING DEWATERING ACTIVITIES

During dewatering of the Whale Tail Lake (North Basin), there is potential for sediments to become suspended as exposed substrates slump. Suspended sediments could then enter the water pipe(s) and be discharged to Mammoth Lake and/or Whale Tail Lake (South Basin). In addition, the discharge itself could disturb the bottom sediments in the lakes and lead to increased levels of suspended sediments. The following plans will mitigate against possible problems with suspended sediments and other key parameters (i.e., pH and aluminum) during dewatering:

- Intake pipe(s) will be located at a sufficient distance from shore (minimum 10 meters) and, to the extent possible, in areas with highest water depth. As dewatering progresses, intakes can only be located in deep basins.

Monitoring during dewatering will be primarily focused at the water intake pumps or at the outlets of the water treatment plant, but will also include the receiving environment of Mammoth Lake and/or Whale Tail Lake (South Basin). Unlike monitoring during dike construction, where turbidity was used solely as a real-time surrogate for estimating TSS (see Section 4), turbidity measurements will be used two- fold: as a surrogate for TSS (using an established site-specific relationship) and directly as an indicator of water clarity.

5.1.1 Dewatering Location

Two locations may be used to dewater Whale Tail Lake (North Basin). The first location will be Whale Tail Lake (South Basin) which will receive the first approximately 66% of the water volume (if it meets discharge criteria). If water continues to meet discharge criteria, the remaining water volume will continue to be discharged into the South Basin. However, conservatively, Agnico Eagle has assumed the remaining 34% may require treatment. If so, it will be pumped to the water treatment plant (WTP) and then discharged to Mammoth Lake.

The WTP will be used when the water quality monitoring from Whale Tail Lake (North Basin) indicates the water does not meet license criteria. The WTP will be bypassed when the water quality monitoring indicates the license criteria are being met; in this event water will be discharged directly to Whale Tail Lake (South Basin).

5.1.2 Standard Operating Procedure for Monitoring And Management During Dewatering

The Standard Operating Procedure (SOP) for monitoring and management of suspended sediments and other key parameters during dewatering is shown in Figure 4. Importantly, the SOP strives for proactive prevention and mitigation of problems. Monitoring will be conducted under direction of Agnico Eagle's environmental supervisor on-site. All monitoring results will be included in the Monthly Monitoring Program Summary Report.

The SOP contains the following key elements:

1. Routine monitoring of TSS/turbidity at the WTP water outlets (when the WTP is in operation) or at the water intake pump(s) (when the WTP is not in use) will be conducted daily, or as per the Type A Water Licence; in addition, a visual inspection of the impounded area for sediment slumps and/or resulting plumes will be completed.

2. Water samples will be collected by opening a valve at the outlet of the WTP or at the water intake pump. Water samples from each monitoring station will be collected every day, or as per the Type A Water Licence and sent to an accredited laboratory for Turbidity and TSS.

3. Monitoring for other required parameters (i.e., pH and aluminum) will be completed as per the Type A Water Licence and MMER sampling requirements at the outlet of the WTP or at the water intake pump; water samples will be collected in the same manner as described above for the turbidity sample.

4. TSS/turbidity will be measured in the receiving environment on a weekly basis; monitoring will take place approximately 30 - 100 meters from end-of-pipe, dependent on stable ice conditions during ice-up.

5. If parameter levels in a single sample from the WTP outlet or intake pump exceed the STM, this will trigger a series of actions. First, visual inspections will try to identify any obvious source of slumping on the lake edges to determine if the source of sediment is likely to be short-term or more continuous. Second, mitigative measures will be considered, such as movement of the intake pipe(s) and/or putting the WTP in recirculation mode.

6. If the moving 24-hour average turbidity value exceeds the STM, then dewatering will shut down or the WTP will be put in recirculation mode while (a) mitigative measures are considered, (b) monitoring continues, (c) weather shifts (if weather is a factor), and (d) Agnico Eagle provides an appropriate course of action to regulators. Dewatering will resume once the conditions that led to the elevated turbidity levels have been addressed.

7. If the 7-day moving average TSS or turbidity concentration at the WTP outlet or intake pump exceeds the MMM, this will trigger a series of actions. First, visual inspections will try to identify any obvious source of slumping on the lake edges to determine if the source of sediment is likely to be short-term or more continuous. Second, mitigative measures will be considered, such as movement of the intake pipe(s) and/or putting the WTP in recirculation mode.

8. If the 30-day moving average Maximum Monthly Mean is exceeded, then dewatering will shut down or the WTP will be put in recirculation mode while (a) mitigative measures are considered, (b) monitoring continues, and (c) AEM provides an appropriate course of action to regulators. Dewatering will resume once the conditions that led to the elevated TSS levels have been addressed.

5.2 LAKE LEVEL MONITORING DURING DEWATERING ACTIVITIES

In addition to the monitoring and management of suspended sediments, a hydraulic monitoring plan has been developed to monitor the following components:

- Water levels in Mammoth Lake and Whale Tail Lake (South Basin) will be monitored on a regular basis while dewatering activities are occurring; and
- Outlet erosion inspections to monitor outlet stability, including potential erosion and/or ice damming within the outlets.

Mammoth Lake, and Whale Tail Lake (South Basin) water levels will be surveyed at a location of sufficient distance from the outlets to limit potential lake level drawdown effects. Lake water levels will be monitored weekly during the freshet and ice-free period, and weekly during the ice-up period, dependent of the ice conditions and worker safety.

The outlet of the raised Whale Tail Lake (South Basin) and Mammoth Lake, will be visually inspected to confirm that no significant erosion of the channel bed or channel banks, or ice damming has occurred. Significant ice damming observed within the outlets will be removed as soon as possible to minimize potential reductions in channel capacity. The regular inspection program will occur during the freshet and ice free period at a minimum of once every two weeks.

SECTION 6 • REFERENCES

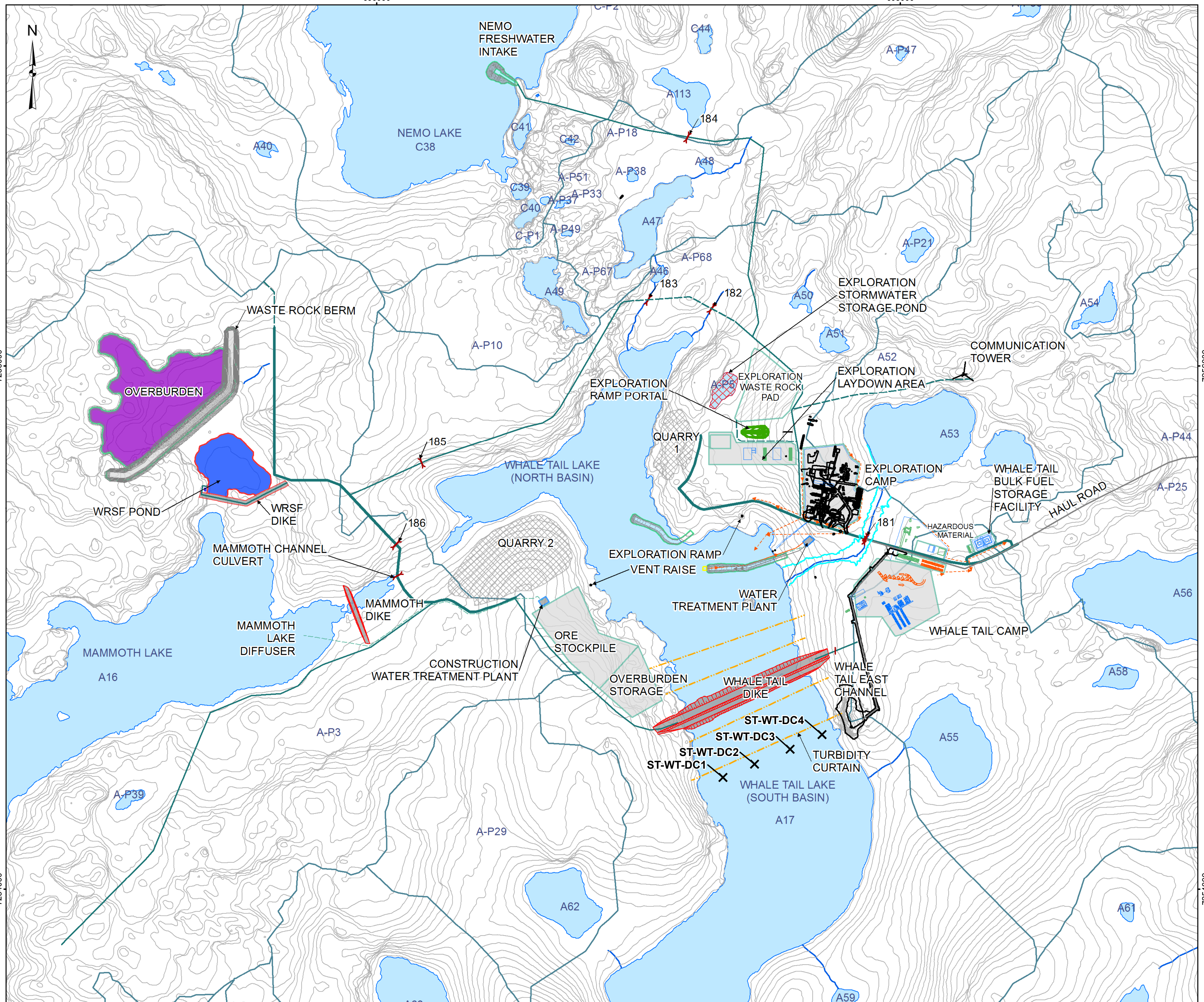
Birtwell, I. 1999. The effects of sediment on fish and their habitat. Canadian Stock Assessment Secretariat Research Document 99/139, DFO, 34p.

Caux, P.Y., D.R.J. Moore, and D. MacDonald. 1997. Ambient water quality guidelines for turbidity, suspended and benthic sediments – technical appendix. Prepared for BC Ministry of Environment, Lands and Parks.

CCME. 1999 (updated 2002). Canadian Water Quality Guidelines for the Protection of Aquatic Life – Total Particulate Matter.

DFO. 2000. Effects of sediment on fish and their habitat. Habitat Status Report 2000/01 E, DFO Pacific Region, January 2000, 9p.

Lloyd, D.S., J.P. Koenings and J.D. LaPerriere. 1987. Effects of turbidity in fresh waters of Alaska. North American Journal of Fisheries Management 7:18-33.



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LEGEND

- ✕ TURBIDITY MONITORING STATION
- ROAD
- TEMPORARY ROAD
- COLLECTION CHANNEL
- CULVERT
- CONTACT WATER PUPE
- FRESHWATER PIPE
- TURBIDITY CURTAIN
- DIKE
- OVERBURDEN
- QUARRY
- STORM WATER STORAGE POND
- NATURAL WATERSHED
- POND/SUMP
- WATERBODY
- WATERCOURSE

REFERENCE

1. INFRASTRUCTURE OBTAINED FROM AGNICO EAGLE MINES LIMITED FROM 6108-600-210-001_R2(2018)s.dwg.
2. WATERCOURSE AND WATERBODY DATA OBTAINED FROM PHOTOSAT

DATUM: NAD 83 CSRS PROJECTION: UTM ZONE 14

300 0 300

METRES

PROJECT

AGNICO EAGLE

AGNICO EAGLE MINES LIMITED:
MEADOWBANK DIVISION
WHALE TAIL PIT PROJECT

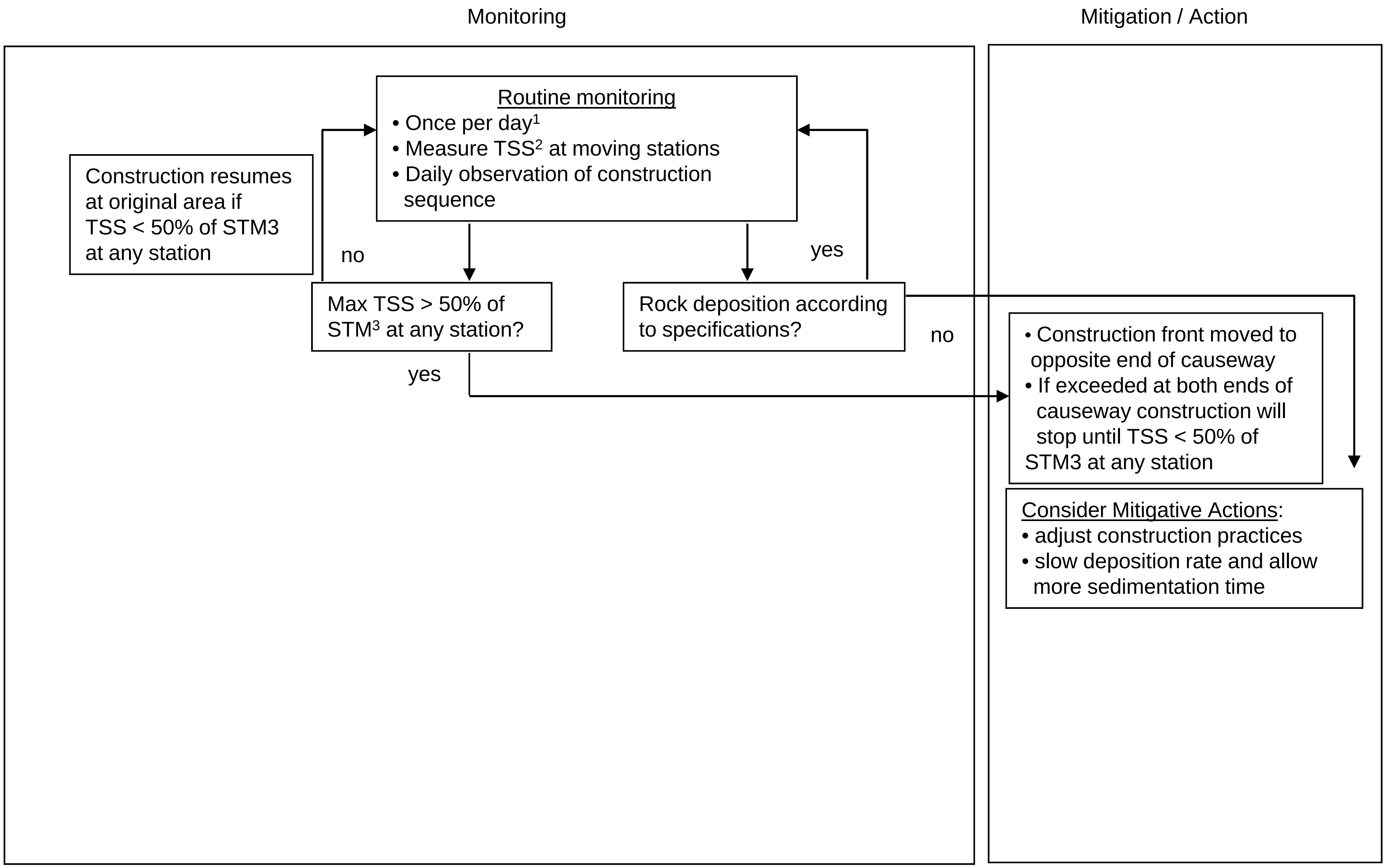
TITLE

TURBIDITY MONITORING STATIONS DURING DIKE CONSTRUCTION

Golder Associates

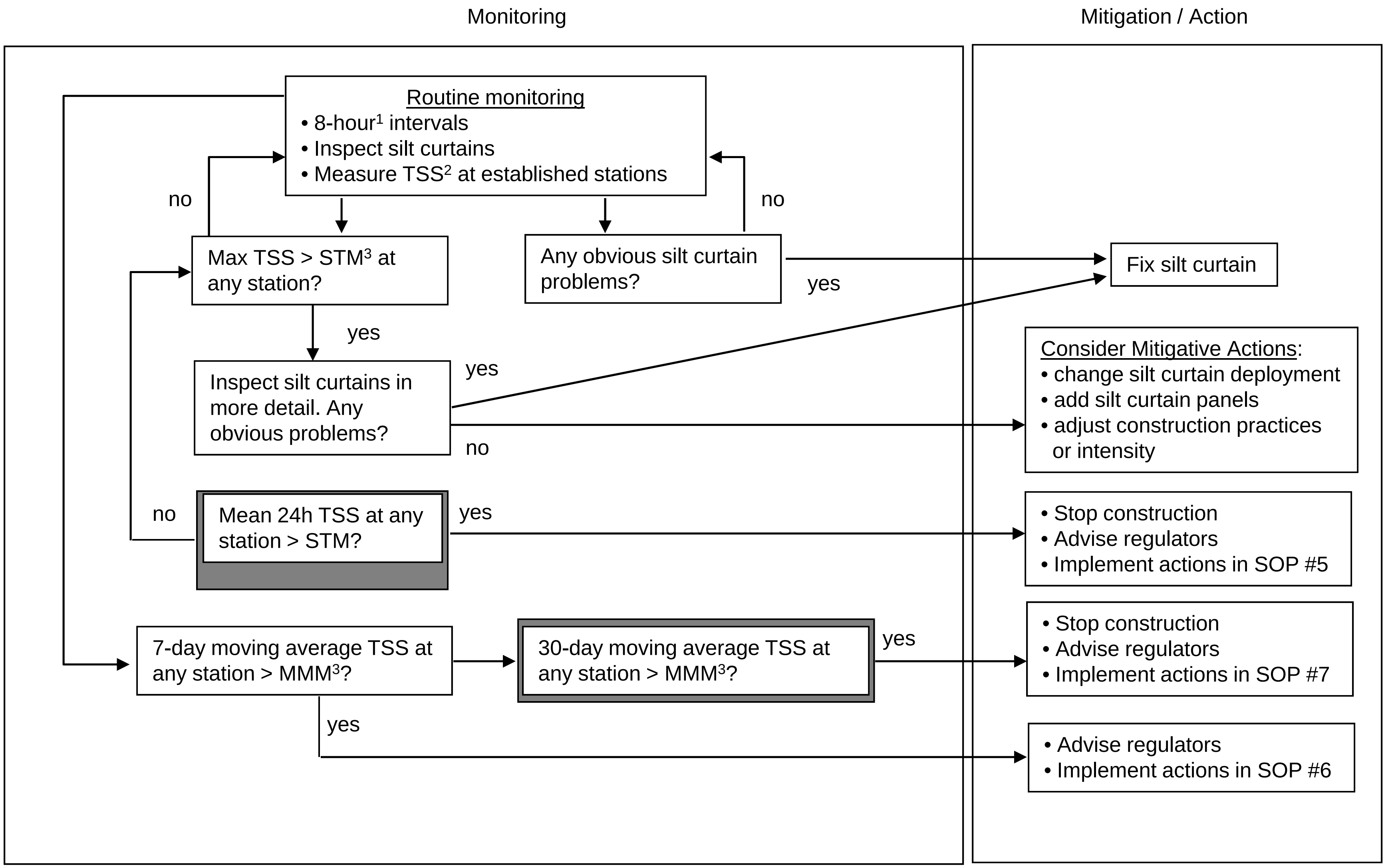
PROJECT		1541520	FILE No.
DESIGN	CP	16 May 2016	SCALE AS SHOWN — REV. 0
GIS	MH	16 May 2016	
CHECK	JR	21 Jun. 2016	FIGURE 1
REVIEW	CP	21 Jun. 2016	

Figure 2: Standard Operating Procedures for Suspended Sediment Monitoring and Management During Winter Dike Construction



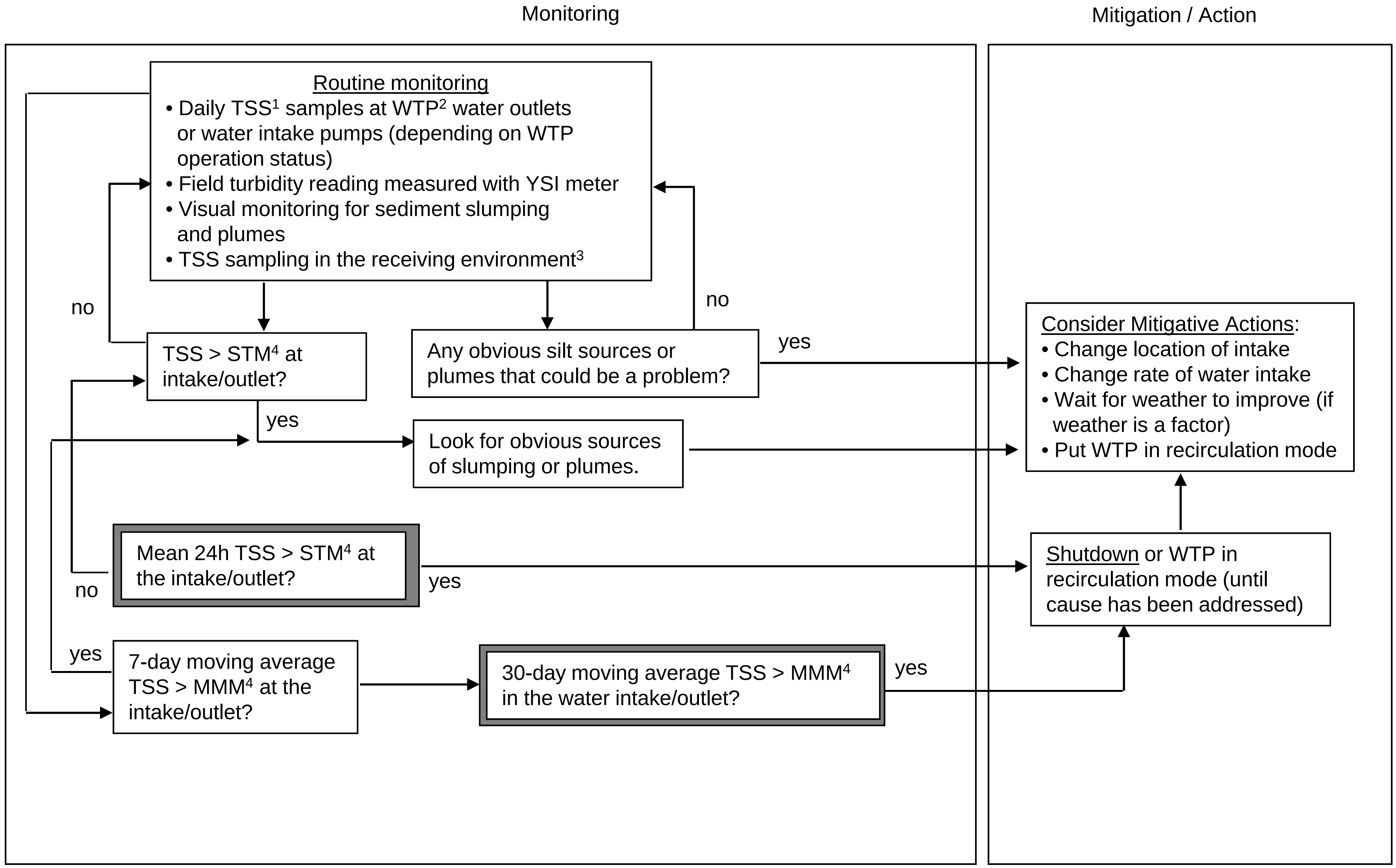
Notes: 1. During daylight hours and/or weather/logistics permitting. 2. TSS will be measured using turbidity as a surrogate 3. STM = short term maximum concentration of TSS. MMM = maximum monthly mean TSS concentration.

Figure 3: Standard Operating Procedures for Suspended Sediment Monitoring and Management During Summer Dike Construction



Notes: 1. During daylight hours and/or weather/logistics permitting. 2. TSS will be measured using turbidity as a surrogate 3. STM = short term maximum concentration of TSS. MMM = maximum monthly mean TSS concentration.

Figure 4: Standard Operating Procedures for Suspended Sediment Monitoring and Management During Lake Dewatering



Notes: 1. TSS will be measured using turbidity as a surrogate 2. WTP = Water Treatment Plant 3. Monitoring on a weekly basis 4. STM = short term maximum concentration of TSS; MMM = maximum monthly mean TSS concentration