Baseline Data Collection Plan

Mon Gold Property

Version 3.0

Mon Gold Mine
Sixty North Gold Mining Ltd
February 2025

Concordance Table

Revision 1.0	Initial Plan	Accommodated
Revision 2.0	• The Baseline Data Collection Plan should be rigorous and scientifically defensible. • The Baseline Data Collection Plan should facilitate a complete understanding of site physiography, hydrology, hydrogeology, and water quality, with rationale to support the sampling methods, location, and frequency. • The Baseline Data Collection Plan should investigate and monitor permafrost conditions to determine its influence on the Project area's hydrology. The seasonal effects of permafrost must be reflected in the sampling strategy. • The Baseline Data Collection Plan should include detailed information on climatic conditions to understand and interpret the results of a data collection program. • The Baseline Data Collection Plan should be designed so that samples are collected at an appropriate frequency over an extended period of time, prior to operations, to reflect natural temporal and spatial variances to help distinguish potential project effects on the receiving environment versus baseline conditions. Format matches ECCC formats.	• Revised • More rigorous throughout. • Permafrost determined by reports of long term frozen ground and thermistors. • Archival climatic conditions will be reviewed. • Planned.
Revision 3.0 1	The Baseline Data Collection Plan should be rigorous and scientifically defensible.	Understood, and stated
2	The Baseline Data Collection Plan should facilitate a complete understanding of site physiography, hydrology, hydrogeology, and water quality, with rationale to support the sampling methods, location, and frequency.	Understood
3	The Baseline Data Collection Plan should investigate and monitor permafrost conditions to determine its influence on the Project area's hydrology. The seasonal effects of permafrost must be reflected in the sampling strategy.	Understood, this is addressed in groundwater sampling protocol, Hydrological data
4	The Baseline Data Collection Plan should include detailed information on climatic conditions to	Understood. More detail from the

	understand and interpret the results of a data collection program.	Yellowknife Airport Site will be collected.
5	The Baseline Data Collection Plan should be designed so that samples are collected at an appropriate frequency over an extended period of time, prior to operations, to reflect natural temporal and spatial variances to help distinguish potential project effects on the receiving environment versus baseline conditions.	Operations started in 1938 1960-1964,1989 -1997 and again in 2020 to present. Natural temporal and spatial variances on the receiving environment can only reflect this reality.
6	References to MMER are updated to reference MDMER, and all references related to the MDMER are reviewed to ensure information is current.	MDMER is to outline the process for listing water bodies frequented by fish to Schedule 2 of the *Metal and Diamond Mining Effluent Regulations* (MDMER) to designate them as tailings impoundment areas (TIAs). We do not plan to use this.
7	Remove the discussion of Metal and Diamond Mining Effluent Regulations (MDMER) or justify the relevance to baseline data collection.	Agree
8	The three models mentioned in the introduction of the Baseline Data Collection Plan Version 2 Plan need to be discussed in the revised (Version 3) Plan along with a rationale for why the selected model was chosen.	Discussed with rationale presented under Models for Presentation.

Contents

Executive Summary

This Baseline Data Collection Plan involves

1. Cultural data
2. Geological Data
3. Biological Data
4. Hydrological Data

Much of this data exists from work carried out on the property since 1938, the details of which will be consolidated into a format that can be used to evaluate these data

No format for a Baseline Data Collection report can be found on the MVLWB site, so this was developed in consultation with others working in the area and responses from the MVLWB on earlier submissions. The Baseline Data Collection Plan will remain flexible so modifications and additions can be added as needed. See Models for Presentation for further details.

Introduction

This report is to describe how and what data will be collected. It will outline how this data can be evaluated. Three models for presentation were reviewed and much of this plan was developed directly from Environment Canada Metal Mining Technical Guidance for Environmental Effects Monitoring. This will be a rigorous and scientifically supported plan. Much of the plan is drawn directly from Metal Mining Technical Guidance for Environmental Monitoring. All data collected will be done so that is rigorous, and scientifically defensible. It will clearly and completely describe the site physiography, hydrology, hydrogeology, and water quality, with rationale to support the sampling methods, location, and frequency.

OVERVIEW OF THE METAL MINING ENVIRONMENTAL EFFECTS MONITORING PROGRAM

This first chapter provides an overview of the metal mining EEM program, including a decision tree to assist mines in identifying an appropriate path, based on their respective situation, as they move through the EEM program. Additional information and documents are available on the EEM website (https://www.canada.ca/en/environment-climate-change/services/managing-pollution/environmental-effects-monitoring/metal-mining-technical-guidance/metal-mining-technical-guidance-environmental-effects-monitoring.html).

The Metal Mining Effluent Regulations

The MMER permit the deposit of mine effluent if the effluent pH is within a defined range. The existing license provides specific guidance. Concentrations of the MMER deleterious substances in the effluent has specified authorized limits. Discharge limits have been established as minimum national standards based on best available technology economically achievable at the time that the MMER were promulgated. To assess the adequacy of the effluent regulations for protecting the aquatic environment, the MMER include EEM requirements to evaluate the potential effects of effluents on fish, fish habitat and the use of fisheries resources.

Regulations amending the MMER were published in the Canada Gazette, Part II, in October 2006. The purpose of these amendments was to clarify the regulatory requirements by addressing matters, related to the interpretation and clarity of the regulatory text, which had emerged from the implementation of the Regulations. Further amendments to the MMER are to be anticipated as the science evolves.

Additional amendments have occurred at later dates and on several occasions; however, these did not pertain to the EEM requirements. Additional amendments to the MMER were published in the Canada Gazette, Part II, in February 2012. The following changes were made to improve the EEM provisions of the MMER:

- modifications to the definition of an “effect on fish tissue” in order to be consistent with the Health Canada fish consumption guidelines and to clarify that the concentration of total mercury in tissue of fish from the exposure area must be statistically different from and higher than its concentration in fish tissue from the reference area;
- addition of selenium and electrical conductivity to the list of parameters required for effluent characterization and water quality monitoring;
- exemption for mines, other than uranium mines, from monitoring radium 226 as part of the water quality monitoring, if 10 consecutive test results showed that radium 226 levels are less than 10% of the authorized monthly mean concentration (see subsection 13(2) of the Regulations);
- change to the time frame for the submission of interpretative reports for mines with effects on the fish population, fish tissue and benthic invertebrate community from 24 to 36 months;
- change to the time frame for the submission of interpretative reports for magnitude and geographic extent of effects and for investigation of cause of effects from 24 to 36 months; and
- minor changes to the wording for consistency within Schedule 5.

EEM studies are designed to detect and measure changes in aquatic ecosystems (i.e., receiving environments). The metal mining EEM program is an iterative system of monitoring and interpretation phases that is used to assess the effectiveness of environmental management measures, by evaluating the effects of effluents on fish, fish habitat and the use of fisheries resources by humans.

EEM goes beyond the end-of-pipe measurement of chemicals in effluent to examine the effectiveness of environmental protection measures directly in aquatic ecosystems. Long-term effects are assessed using regular cyclical monitoring and interpretation phases designed to investigate the impacts on the same parameters and locations. In this way, both a spatial and temporal characterization of potential effects to assess changes in receiving environments are obtained.

EEM studies consist of:

- effluent and water quality monitoring studies comprising effluent characterization, sublethal toxicity testing and water quality monitoring (MMER, Schedule 5, Part 1); and
- biological monitoring studies in the aquatic receiving environment to determine if mine effluent is having an effect on fish, fish habitat or the use of fisheries resources (MMER, Schedule 5, Part 2).

Models for Presentation

We examined presenting a Baseline Data Collection Plan as a greenfield project, assuming no commercial activity has occurred on this site. That was rejected due to the 90 years of mining activity here. We also considered presenting a baseline data collection plan as a closure option, as presented in Metal Mining Technical Guidance for Environmental Effects Monitoring, and determined that this is not the best option, so it was determined to continue on in the format that was originally submitted, and modified as recommended during technical reviews by MVLWB.

Climate Studies

Climate, including all atmospheric data will be drawn from appropriate long-term sites, primarily base stations at Yellowknife Airport. This data is available from EECC from Yellowknife A station since 1953, and from other station in and around Yellowknife more recently. These data will be collected and synthesized in the following Baseline Data Interpretation Plan.

Effluent and Water Quality Monitoring Studies

Effluent Characterization

Effluent characterization is conducted by analyzing a sample of effluent and recording the hardness, electrical conductivity and alkalinity, as well as the concentrations of aluminum, cadmium, iron, molybdenum, selenium, ammonia and nitrate (MMER, Schedule 5, subsection 4(1)). Mercury in effluent is also analyzed and recorded but may be discontinued if the concentration is less than 0.10 µg/L in 12 consecutive samples (MMER, Schedule 5, subsection 4(3)). Guidance on effluent characterization can be found in Chapter 5. Other parameters relevant to EEM, such as arsenic, copper, cyanide, lead, nickel, zinc, total suspended solids and radium 226, are also analyzed as part of Schedule 4.

Sublethal Toxicity Testing

Sublethal toxicity testing is conducted on effluent from the mine's final discharge point that has potentially the most adverse environmental impact (MMER, Schedule 5, subsection 5(2)). This testing monitors effluent quality by measuring survival, growth and/or reproduction endpoints in marine or freshwater organisms in a controlled laboratory environment. In the case of effluent deposited into marine or estuarine waters, sublethal toxicity testing is conducted on a fish species, an invertebrate species and an algal species. In the case of effluent deposited into freshwater, sublethal toxicity testing is conducted on a fish species, an invertebrate species, a plant species and an algal species (MMER, Schedule 5, subsection 5(1)). Guidance to determine the appropriate final discharge point to sample can be found in Chapter 2. Guidance on sublethal toxicity testing can be found in Chapter 6.

Water Quality Monitoring

Samples for water quality monitoring are collected from the exposure area surrounding the point of entry of the effluent into water from each final discharge point and the related reference areas, as well as from the sampling areas selected for the biological monitoring study (MMER, Schedule 5, subsection 7(1)). Water temperature and dissolved oxygen concentrations are recorded for all samples. As for effluent characterization, the concentrations of aluminum, cadmium, iron, molybdenum, selenium, ammonia and nitrate are measured and recorded in water quality monitoring. Mercury in the water quality monitoring samples is also analyzed and recorded if required for effluent characterization (MMER, Schedule 5, subsection 4(3)). In the case of effluent deposited into freshwater, the pH, hardness, electrical conductivity and alkalinity are recorded. In the case of effluent deposited into estuarine waters, the pH, hardness, electrical conductivity, alkalinity and salinity are recorded. In the case of effluent deposited into marine waters, the salinity is recorded. The concentrations of the following deleterious substances set out in Schedule 4 are also recorded: arsenic, copper, cyanide (if used as a process reagent), lead, nickel, zinc, total suspended solids and radium 226 (unless the conditions specified in subsection 13(2) of the Regulations are met) (MMER, Schedule 5, paragraph 7(1)(d)). Guidance on water quality monitoring can be found in Chapter 5.

Biological Monitoring Studies

Biological monitoring studies are conducted in 36- or 72-month phases. The requirements for each study are dependent on the results of studies from the previous phase(s). Biological monitoring studies to assess effects are described in section 1.3.2.3 and biological monitoring studies to investigate effects are described in section 1.3.2.4. To assess effects, biological monitoring studies are conducted for the following three components (MMER, Schedule 5, section 9):

- fish population to assess effects on fish health;
- benthic invertebrate community to assess fish habitat or fish food; and
- mercury concentration in fish tissue to assess the human usability of the fisheries resources, in terms of fish consumption.

To investigate effects, biological monitoring studies are conducted for the purpose of:

- assessing the magnitude and geographic extent of effects; and
- determining the cause(s) of effects.

Defining and Confirming Effects

The studies on the fish population, fish tissue, and benthic invertebrate community are conducted in both exposure and reference areas. The exposure area refers to all fish habitat and waters frequented by fish that are exposed to effluent, and the reference area refers to water frequented by fish that is not exposed to effluent and that has fish habitat that, as far as is practical, is most similar to that of the exposure area (MMER, Schedule 5, section 1).

The MMER defines effects on the fish population, fish tissue, and benthic invertebrate community (MMER, Schedule 5, section 1) and further prescribes the data assessment required for specific indicators (MMER, Schedule 5, section 16). An “effect” on the fish population or benthic invertebrate community is defined as a statistical difference between data collected in an exposure area and in a reference area or sampling areas within an exposure area where there are gradually decreasing effluent concentrations at increasing distances from the effluent discharge. An effect on fish tissue refers to concentrations of total mercury, exceeding 0.5 micrograms per gram (µg/g) wet weight in fish tissue taken in an exposure area and that are statistically different from and higher than the concentrations of total mercury in fish tissue taken in a reference area. Chapter 8 provides information on conducting statistical analyses on EEM data.

Data collected on specific-effect endpoints (Tables 1-1 and 1-2) are assessed to determine if statistical differences are present in order to establish if there are any effects on the indicators. To confirm that observed effects are not artifacts (or due to confounding factors) and are mine-related, biological monitoring studies to assess effects are repeated in a subsequent three-year phase. If a similar type of effect (same endpoint in same direction from zero relative to reference levels) on the fish population, fish tissue or benthic invertebrate community is determined in studies from two consecutive phases, the effect is considered confirmed (MMER, Schedule 5, section 19). Confirmation of an effect for fish endpoints need not be limited to the same sex or same species, unless site-specific conditions warrant a different approach.

If effects are confirmed in one or more components (fish population, fish tissue, benthic invertebrate community), the mine must investigate those effects in subsequent phases (section 1.3.2.3). All confirmed effects must be investigated. If the lack of effects is confirmed in all three components, a mine must proceed to a reduced biological monitoring frequency (MMER, Schedule 5, paragraph 22(2)(b)).

Attributing cause of an effect to a mine's effluent may be difficult in some circumstances. Environment Canada recommends that where the previous study has determined there is an effect, and there is doubt that the effect is caused by the mine effluent, the second study confirming the effect be designed in a way that maximizes the confidence in establishing that the effect is or is not mine-effluent-related. Adjustments to the study design to eliminate confounding factors are described in the other chapters and could include increased sampling effort in both reference and exposure areas; increase or change in sampling areas; or the use of alternative studies, such as mesocosms or caged bivalves.

Historical Information

Mines may have conducted biological monitoring studies prior to becoming subject to the MMER. These studies may be used as part of the EEM program if they determine whether the effluent was causing an effect on fish population, fish tissue or the benthic invertebrate community. However, if the mine operation or environmental conditions changed or any event which may have modified biological effects occurred after the historical monitoring was conducted, then any historical data should be used with caution when interpreting currently observed effects. The results of the historical biological monitoring studies must be submitted to the Authorization Officer3 along with a report that contains scientific data to support the results, not later than 12 months after the day on which the mine becomes subject to the Regulations (MMER, Schedule 5, paragraph 14(b)). Refer to sections 1.4.2 and 1.4.5 for requirements on timelines for submission of study design and interpretative reports for mines using historical information. Further details on historical information are provided in Chapter 13.

Biological Monitoring Studies to Assess Effects

To assess effects, biological monitoring studies are conducted for the three components: fish population, fish tissue (mercury concentration) and benthic invertebrate community.

Fish Population Survey

A fish population survey (Chapter 3) measures indicators of fish population health in exposure and reference areas, or along an exposure gradient, to determine if mine effluent has an effect on fish. A fish survey is required if the concentration of effluent in the exposure area is greater than 1% at a distance of 250 metres from the final discharge point (Schedule 5, paragraph 9(b)).

The MMER defines the fish population survey effect indicators as growth, reproduction, condition and survival (MMER, Schedule 5, subparagraph 16(a)(i)). When conducting a standard adult fish survey, the collection of adult males and females of two sentinel species is recommended. Data collected on the specific effect endpoints listed in Table 1 are evaluated to determine if statistical differences in the effect indicators are present.

Table 1. Recommended data collection and endpoints for fish.

Effect Indicators	Effect Endpoints
Growth (energy use)	Size-at-age (body weight relative to age)
Reproduction (energy use)	Relative gonad size (gonad weight to body weight)
Condition (energy storage)	Condition (body weight to length) Relative liver size (liver weight to body weight)
Survival	Age

Although the standard fish survey is recommended above, other survey designs, modified methods such as a non-lethal fish survey (Chapter 3) or alternative methods (Chapter 9) may be considered under conditions where the standard survey is not effective or practical.

Benthic Invertebrate Community Survey

Mines must conduct a benthic invertebrate community survey (Chapter 4) to determine if their effluent has an effect on fish habitat. Benthic invertebrates are collected to determine if there are changes in the effect indicators between exposure and reference areas or along an effluent concentration gradient. Data collected on the specific effect endpoints listed in Table 2 are evaluated to determine if statistical differences in the effect indicators are present (Schedule 5, subparagraph 16(a)(iii)). See Chapter 4 for definitions and other details on benthic invertebrate community endpoints.

Table 2. Recommended data collection and endpoints for benthic invertebrates.

Effect Indicators	Effect Endpoints
Total benthic invertebrate density	Number of animals per unit area
Evenness index	Simpson's evenness
Taxa richness	Number of taxa
Similarity index	Bray-Curtis index

If the designs in Chapter 4 are not effective or practical, an alternative survey may be appropriate (Chapter 9).

Fish Tissue Survey

A fish tissue survey (Chapter 3, section 3.11) is conducted to assess if mercury from mining effluent may affect the use of the fisheries resources. A survey respecting the fish tissue is required if, during effluent characterization, the concentration of total mercury in the effluent is equal to or greater than 0.10 µg/L (MMER, Schedule 5, paragraph 9(c)).

Biological Monitoring Studies to Investigate Effects

To investigate effects, mines assess the magnitude and geographic extent of all confirmed effects and investigate their causes.

Magnitude and Geographic Extent

When the results of the two previous biological monitoring studies indicate a similar type of effect (same endpoint, same direction from zero) on the fish population, fish tissue or the benthic invertebrate community, an assessment of the magnitude and geographic extent of the effect is required (MMER, Schedule 5, paragraph 19(1)(d)). Magnitude and geographic extent must be assessed for all confirmed effects. The assessment of the magnitude and geographic extent may require additional monitoring efforts to extend the sampling area further downstream, or the necessary information may already exist as part of previous study results. Guidance on magnitude and geographic extent studies can be found in Chapters 2, 4 and 7.

Investigation of Cause

If the results of the previous biological monitoring study indicate the magnitude and geographic extent of an effect on the fish population, fish tissue or benthic invertebrate community, an investigation of cause (IOC) study is required (MMER, Schedule 5, subsection 19(2)). The goal of an IOC study is to determine the cause of each confirmed effect. Guidance on IOC studies can be found in Chapter 12.

Steps in Conducting and Reporting Environmental Effects Monitoring Studies

Conducting and reporting EEM studies, as per the MMER, involves the following key steps:

- Conduct and submit results for effluent characterization, sublethal toxicity testing and water quality monitoring
- Submit study design
- Conduct biological monitoring study
- Conduct data assessment
- Submit interpretative report

Conduct and Submit Results for Effluent Characterization Sublethal Toxicity Testing and Water Quality Monitoring

Effluent characterization is conducted four times per calendar year and not less than one month apart, with the first characterization carried out not later than six months after the day on which the mine becomes subject to the MMER (Schedule 5, subsection 4(2)). Effluent characterization is conducted on an aliquot of effluent collected for the analysis of deleterious substances under Schedule 4. Refer to Chapter 5 for more information on effluent characterization.

Sublethal toxicity tests are conducted two times each calendar year for three years, and once each year after the third year. Sublethal toxicity tests are conducted on an aliquot of effluent collected for the analysis of deleterious substances under Schedule 4. The first testing is to occur not later than six months after the mine becomes subject to the Regulations (MMER, Schedule 5, subsection 6(1)). Sublethal toxicity testing may be conducted once each calendar year, if the results of six sublethal toxicity tests conducted (after December 31, 1997), on a fish species, an invertebrate species and either an aquatic plant species or an algal species, are submitted to the Authorization Officer not later than six months after the mine becomes subject to the Regulations (MMER, Schedule 5, subsection 6(2)). Refer to Chapter 6 for more information on sublethal toxicity testing.

Water quality monitoring is conducted, starting not later than six months after the day on which the mine becomes subject to the Regulations, four times per calendar year, on samples collected not less than one month apart, while the mine is depositing effluent. Water quality monitoring is also conducted on samples collected at the same time that the biological monitoring studies are conducted (MMER, Schedule 5, subsection 7(2)). Refer to Chapter 5 for more information on water quality monitoring.

An annual report on the effluent and water quality monitoring studies conducted during a calendar year is submitted to an Authorization Officer not later than March 31 of the following year (MMER, Schedule 5, section 8). Most of the annual effluent and water quality monitoring reporting requirements may be met by submitting the data results electronically to Environment Canada using the “Regulatory Information Submission System” (RISS) provided on the following website: https://www.risssitdr.ec.gc.ca/riss/Global/Index.aspx. For the reporting requirements that are not supported by the RISS, a hard copy submission is required to be submitted to Environment Canada also not later than March 31 of the following year. These requirements include the methodologies used to conduct effluent characterization, sublethal toxicity testing and water quality monitoring, as well as the quality assurance and quality control measures implemented and data related to the implementation of those measures.

Submit Study Design

The study design describes how the biological monitoring study will be conducted to meet the regulatory requirements (MMER, Schedule 5, sections 10 and 19). This guidance document is intended as a starting point for study designs and allows for flexibility in the design of studies to accommodate site-specific needs. Various examples of potential study designs are presented in Chapter 4 (see also Chapters 2, 3, 9 and 12 for information related to study designs). When multiple mines discharge to the same drainage basin, joint EEM studies are encouraged, where practical.

The first study design is submitted not later than 12 months after the day on which the mine becomes subject to the Regulations (MMER, Schedule 5, paragraph 14(a)) or not later than 24 months after the day on which the mine becomes subject to the MMER for mines submitting historical information (MMER, Schedule 5, paragraph 14(b)). The study design for the first, second or subsequent biological monitoring study is submitted to the Authorization Officer at least six months before the biological monitoring study is conducted (MMER, Schedule 5, subsections 15(1) and 19(1)). For mines that have applied to become recognized closed mines, the final study design is submitted not later than 6 months after providing the notice informing of the intention to become a recognized closed mine (MMER, Schedule 5, subsection 23(1)).

A mine could be conducting different types of studies, such as a standard fish survey and a magnitude and geographic extent study for the benthic invertebrate community, at the same time. The study design would then describe how these two studies would be conducted.

The information to be provided in the study design depends on the type of biological monitoring study to be conducted.

Study Design for Biological Monitoring Studies to Assess Effects

In cases where effects have not been assessed or confirmed, where the most recent interpretative report indicates the cause of the effect or where the 2 most recent interpretative reports indicate no effects, the designs for biological monitoring studies shall include (MMER, Schedule 5, section 11; guidance in Chapter 2):

- a site characterization that describes effluent mixing in the exposure area and a measure of the effluent concentration at 250 metres from the final discharge point;
- descriptions of the exposure and reference area habitat;
- the type of production process and the environmental protection practices at the mine;
- a summary of any federal, provincial or other laws applicable at the mine regarding effluent and environmental monitoring; and
- a description of any anthropogenic, natural and other factors not related to the effluent that may reasonably be expected to contribute to any observed effect.

Also included is the scientific rationale for selecting the fish species, sampling areas, sample size, sampling periods, and field and laboratory methodologies, as well as the methodology for determining whether the effluent has an effect on the fish population, fish tissue or benthic invertebrate community. Descriptions of the quality assurance and quality control measures that will be implemented to ensure validity of the data collected must also be included as must the summaries of results from previous biological monitoring studies.

Where available, historical data may provide useful information for site characterization and assist in developing EEM study designs, using lessons learned in previous monitoring. If historical information was submitted, the first study design must include a summary of the results of biological monitoring studies completed before the mine became subject to the Regulations.

Study Design for Biological Monitoring to Investigate Effects

If the results of the two previous studies indicate a similar type of effect (same endpoint in same direction from zero relative to reference levels) on the fish population, fish tissue or the benthic invertebrate community, the study design shall include, in addition to the information detailed in section 1.4.2.1, a description of one or more additional sampling areas within the exposure area that shall be used to assess the magnitude and geographic extent of the effect (MMER, Schedule 5, paragraph 19(1)(d)).

If the results of the previous biological monitoring study indicate the magnitude and geographic extent of an effect, the study design shall include a detailed description of the field and laboratory studies that will be used to determine the cause of the effect (MMER, Schedule 5, subsection 19(2)).

Conduct Biological Monitoring Study

The biological monitoring study is conducted according to the submitted study design. If circumstances arise that make it impossible to follow the study design, the owner or operator of the mine must inform the Authorization Officer without delay of the circumstances requiring deviation from the study design and of how the study will be conducted (MMER, Schedule 5, subsections 15(2) and 24(2)). It is recommended that the mine's environmental personnel or consultants also notify the Environment Canada regional EEM coordinator of any deviation from the study design.

Conduct Data Assessment

After completing the fieldwork, data assessment and interpretation are conducted to determine if mine effluent is causing an effect or effects (MMER, Schedule 5, section 16). Data assessment and interpretation also determine future monitoring requirements. The specific analyses conducted to determine if there are effects on fish population, fish tissue or the benthic invertebrate community are described in Chapter 8. Data assessment for mines that have confirmed effects entails determining the magnitude and geographic extent of the effect(s) and assessing cause(s) of any confirmed effect(s). Guidance on IOC studies can be found in Chapter 12.

Submit Interpretative Report

The first interpretative report is submitted not later than 30 months after the date on which the mine becomes subject to the Regulations or not later than 42 months after the date on which it becomes subject to the Regulations, if the mine has submitted a report utilizing historical biological monitoring information (MMER, Schedule 5, section 18).

Subsequent interpretative reports are submitted 36 or 72 months after the day on which the most recent interpretative report was required to be submitted, depending on the results of the previous interpretative report.

The supporting data from biological monitoring studies are submitted to Environment Canada in the electronic format provided on the EEM website: http://www.ec.gc.ca/eseeeem/ (see Chapter 10 for further information).

The MMER outline the information to be contained in interpretative reports for biological monitoring studies (MMER, Schedule 5, sections 17, 21 and 25). Chapter 10 describes interpretative reports in more detail. Brief descriptions of the different types of interpretative reports are provided below.

Interpretative Report for Biological Monitoring Studies to Assess Effects

Interpretative reports for biological monitoring studies to assess effects include, among other items, results of monitoring studies, raw data, results of data assessments, and identification of any effects.

Interpretative Report for Biological Monitoring Studies to Investigate Effects

If the magnitude and geographic extent of a confirmed effect on fish population, fish tissue or benthic invertebrate community is not known, then the interpretative report shall include, among other items, the results of a magnitude and geographic extent study. If the magnitude and geographic extent of the confirmed effect is known but the cause of the effect(s) is not known, the interpretative report shall include a description of the cause of the effect. The IOC interpretative report contains the study results and statement identifying the cause of the effect on fish population, fish tissue and/or benthic invertebrate community. If the cause of the effect(s) was not determined, an explanation of why and a description of any steps that must be taken in the next study to determine the cause shall be included in the interpretative report.

Recognized Closed Mines

An owner or operator of a mine that has ceased operation, and who intends to have that mine become a recognized closed mine, shall provide written notice of that intention to the Authorization Officer and shall maintain the mine's rate of production at less than 10% of its design-rated capacity for a continuous period of three years starting on the day that the written notice is received by the Authorization Officer. A final biological monitoring study must be conducted during the three-year period (MMER, section 32). The final study design shall be submitted to the Authorization Officer not later than six months after the closure notice is provided (MMER, Schedule 5, section 23). The mine shall base the final monitoring phase on the results of the previous biological monitoring study. The final interpretative report shall be submitted to the Authorization Officer not later than 36 months after the day on which the notice to close the mine was provided (MMER, Schedule 5, section 26). Effluent characterization, sublethal toxicity testing and water quality monitoring requirements continue until the mine becomes a recognized closed mine.

Identifying a Path through the Metal Mining Environmental Effects Monitoring Program

The metal mining EEM program involves monitoring to assess effects, investigate confirmed effects (magnitude and geographic extent and IOC), and reassess effects. When an effect has been confirmed (i.e., similar type of effect in two consecutive studies), the mine is required to assess the magnitude and geographic extent of the effect (MMER, Schedule 5, paragraph 19(1)(d)), and then to investigate the cause of the effect (MMER, Schedule 5, subsection 19(2)).

Critical Effect Sizes

A critical effect size (CES) is a threshold above which an effect may be indicative of a higher risk to the environment. The Metal Mining EEM Review Team recommended that CESs be established for each of the metal mining EEM effect endpoints following the second national assessment of the EEM data from metal mines (Metal Mining EEM Review Team, 2007).

CESs for the fish population and benthic invertebrate community endpoints were initially developed for the pulp and paper EEM program after EEM data showed that most mills observed an effect in at least one of the effect indicators. Once validated, these CESs were adopted for use in the metal mining EEM program (Table 3).

Table 3. Critical Effects Studies endpoints.

Fish Effect Endpoints	**CES1**	**Benthic Effect Endpoints**	**CES1**
Weight-at-age[2]	± 25%	Density	± 2SD
Relative fish gonad size	± 25%	Simpson's Evenness	± 2SD
Relative liver size	± 25%	Taxa Richness	± 2SD
Condition	± 10%	Bray-Curtis Index	+ 2SD
Age[2]	± 25%		

[1]Differences in fish population effect endpoints are expressed as percentage (%) of reference mean, while differences in benthic effect endpoints are expressed as multiples of within-reference-area standard deviations (SDs).
[2]Problems associated with determining the age of some species of fish should be discussed and reviewed before effects on weight-at-age and age are used to choose a path through the EEM program. Refer to Chapter 3 for recommendations on age determination.

Magnitude of Confirmed Effects

The magnitude of each effect observed on fish population, fish tissue or benthic invertebrate community can be further evaluated to determine if the magnitude of a confirmed effect is above or below the CES. Table 4 outlines how effects from two consecutive studies are to be grouped to determine if confirmed effects are below or above the CES.

Table 4. Evaluation of a confirmed effect.

Confirmed effects above or equal to CES	Confirmed effects below CES
Similar effect(s) above or equal to CES observed in 2 consecutive phases	Similar effect(s) below CES observed in 2 consecutive phases
Similar effect(s) in 2 consecutive phases, with the effect(s) above or equal to CES in one phase and below CES in the other phase	Similar effect(s) in 2 consecutive phases, with the effect(s) above or equal to CES in one phase and below CES in the subsequent phase, if there is information available that

	may explain a change in the observed effects (e.g., improvement of effluent treatment)

Decision Process for the Metal Mining Environmental Effects Monitoring Program

Figure 1 is a decision tree to assist mines in identifying an appropriate path through the EEM program, based on their respective situation. CESs are applied to EEM results to assist mines in identifying the level of effort for investigations of confirmed effects. The structure of the decision tree is based on the MMER regulatory requirements, recent scientific knowledge and the experience and knowledge gained through implementing the EEM program.

Site-specific knowledge as well as effluent and water quality data need to be considered before identifying a mine's path through the EEM program. Confirmed effects in supporting endpoints are used as part of the site-specific evaluations to support decisions regarding a path forward (see chapters 3 and 4 for information on supporting endpoints). Mines are required to continue conducting effluent and water quality monitoring and reporting the results using the timeline prescribed in the MMER and as outlined in section 1.4.1 of this chapter. This requirement is independent of the timeline for conducting biological monitoring studies and submitting interpretative reports.

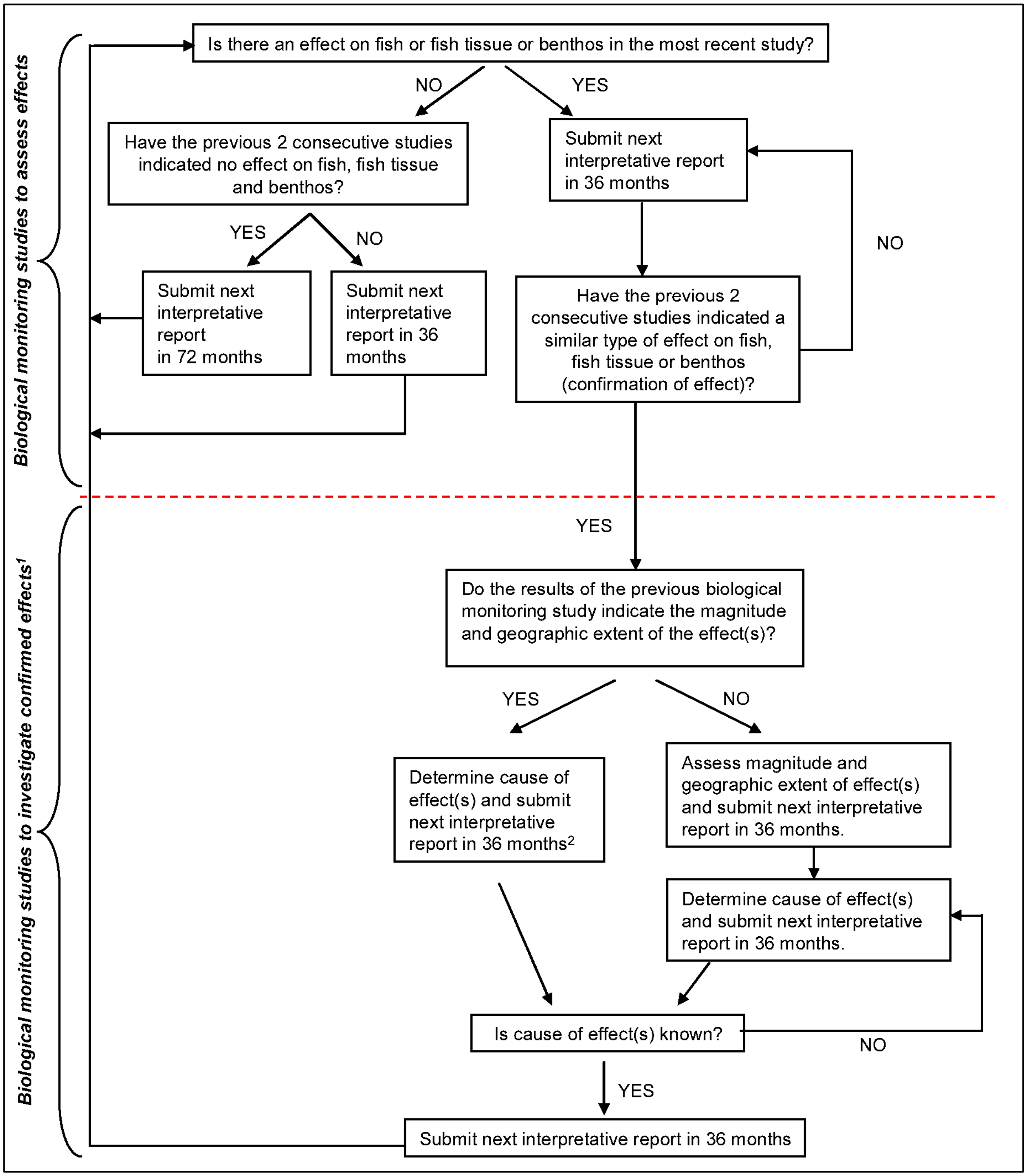

Figure 1. Decision Tree to assist the evaluation of data. From Metal Mining Effluent Guidance for Environmental Effects Monitoring, 2012.

Cultural Data

Discussions with the Yellowknife Dene First Nation has been supplemented with data from the North Slave Metis Association and the Tlicho First Nation. An Archeological Overview study has been completed and this will form the basis for evaluating the cultural baseline data on the property.

Geological Data

The area has been mapped by various company and government geologists. Data includes descriptions of rocks, thin and polished sections, RQD and Rock Mass Data, geochemical analysis as well as metallurgical testing including numerous ABA studies on waste rock, ore, and tailings. This data is presented in a number of maps and section, described in Company reports and will form the basis for evaluating the geology of the property.

Biological Data

The area has been subject to a significant wildfire in 2023 materially changing the surface biology.

Aqueous lifeforms

Plant

The area has been described in several regional reports and will be used to establish a best practice for the collection of this data.

Animal

The area has been described in several regional reports and will be used to establish a best practice for the collection of this data. Specific reports by consultants completed in the area will be relied upon.

Terrestrial lifeforms

Mammal

The area has been described in several regional reports and will be used to establish a best practice for the collection of this data. Specific reports by consultants completed in the area will be relied upon.

Avian

The area has been described in several regional reports and will be used to establish a best practice for the collection of this data. Specific reports by consultants completed in the area will be relied upon.

Amphibian

The area has been described in several regional reports and will be used to establish a best practice for the collection of this data. Specific reports by consultants completed in the area will be relied upon.

Reptilian

The area has been described in several regional reports and will be used to establish a best practice for the collection of this data. Specific reports by consultants completed in the area will be relied upon.

Insect

The area has not been well studied but some reports discuss insects and will be used to establish a best practice for the collection of this data. Specific reports by consultants completed in the area will be relied upon.

Hydrological Data

Surface waters

Surface water have been observed and sampled since 1990 as part of the historic SNP programs on the property. All of these data were submitted to the NWT Land and Water Board and some of these data are available. Sampling since the current Permits and Licenses have provided additional data and can be collected as baseline studies.

Groundwater

There is no report of groundwaters on the property, and there is insufficient temperature measurements to demonstrate permafrost conditions. The surface morphology that is not water covered, exposed bedrock or esker is best described as boreal forest hummocky terrain. Reports by Tews, 2004, Kokelj, S.V., Burn, C.R., and Tarnocai C. 2018 use this as evidence of turbic soils of the cyrosolic order. Thermistors have been installed and will provide continuous temperature measurements

All underground workings are dry and historically since 1990 any waters that enter underground waters freeze and remain frozen until excavated. Thermistors have been installed at the requested SNP stations to confirm temperature conditions. Thermistors will be monitored when activities occur on the property, and each summer regardless. Temperature measurements to confirm subzero temperatures in the ground will be reduced after air temperature are $<-10^{o}$ C.