GUIDE FOR DEVELOPING WATER MONITORING PLANS AT METAL MINES IN NOVA SCOTIA

2025

NOVA SCOTIA

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Definitions

AMBIENT: the conditions in the surrounding environment, which may include non-point source anthropogenic conditions as well as naturally occurring conditions.

BACKGROUND: naturally occurring conditions in the environment, without any influence from human activity or pollution.

BASELINE: a reference point or starting point used for comparison. A standard or benchmark against which other measurements or values can be evaluated.

BASELINE STUDY: information about relevant, pre-existing environmental, economic, social, heritage, and/or health conditions at the site of, or in the area surrounding, a proposed project to enable a determination of actual project effects through comparisons before and after development.

CONCEPTUAL SITE MODEL: a written or pictorial representation of an environmental system and the biological, physical, and chemical processes that determine the transport of contaminants of concern from sources through environmental media to environmental receptors within the system.

CONTAMINANTS OF CONCERN: a contaminant that has been selected for evaluation, monitoring, and/or regulation in an Industrial Approval. This includes substances that may be introduced to the environment by the mining or milling processes or naturally occurring substances that may be increased by mining activities.

EFFLUENT: liquid waste discharged into the environment.

HYDROGEOLOGIC UNIT: geological formations with distinct hydraulic properties that influence the storage and movement of groundwater.

QUALIFIED PROFESSIONAL: an individual with relevant training and work experience and is a current member in good standing with either Engineers Nova Scotia or Geoscientists Nova Scotia. Relevant training and experience may include water resource assessment, hydrogeology, and contaminant hydrogeology, preferably in the mining sector.

TOXICITY MODIFYING FACTORS: variables that can influence the toxicity of pollutants in surface water. These factors can alter the bioavailability, transport, and fate of contaminants, affecting their impact on aquatic organisms. Common toxicity modifying factors include pH, hardness, dissolved organic carbon; however, others also may be relevant, such as temperature, turbidity, and salinity. The concentration of these parameters must be known to calculate limits for select pollutants in surface water.

1. Introduction

A water monitoring plan is a structured program that outlines how water quality and quantity will be systematically observed, tested, and recorded over time. The purpose of this Guide is to assist applicants when preparing water monitoring plans.

The Guide outlines a best practice approach for monitoring groundwater, surface water, and effluent discharge. It is applicable to all phases of a mining project, including construction, operation, and reclamation. While providing clear guidance, the Guide is designed to be flexible to accommodate variability between projects and site-specific conditions.

Applicants should consult with Nova Scotia Environment and Climate Change (the Department) at key stages of the process, as noted in the Guide. Connecting with the Department early and regularly can help make the process smooth and efficient.

1.1 Why is a Water Monitoring Plan Important?

Effective water monitoring plans support sustainable mining practices and environmental protection. Properly conducted water monitoring provides valuable data that informs decision making throughout the life of the mine. Water monitoring data can identify unexpected risks to the environment and help determine mitigative measures to reduce such risks.

1.2 Who Should Prepare a Water Monitoring Plan?

A qualified professional, as defined in this Guide, should lead the development of the water monitoring plan. Developing a water monitoring plan for a metal mine requires specialized knowledge in hydrogeology, hydrology, and geochemistry with relevant experience in water quality monitoring, contaminant hydrogeology, and mine water management. It is sometimes beneficial to involve a team of professionals with expertise in all related fields. An individual licensed to practice by Engineers Nova Scotia or Geoscientists Nova Scotia is required to sign-off on the final documents.

1.3 What Should Be Included in a Water Monitoring Plan?

The water monitoring plan will differ for each mining project, based on the unique characteristics of the site and the specific details of the project. An effective water monitoring plan includes the following components, each of which are described in detail in the Guide:

- Conceptual Site Model
- Detailed Site Plan
- Baseline Water Study
- Surface Water Monitoring Plan
- Groundwater Monitoring Plan
- Sampling Methods

2. Conceptual Site Model and Site Plan

2.1 Conceptual Site Model

A conceptual site model is an important aspect of a mining project that can support the development of an effective water monitoring plan. A conceptual site model provides a visual and/or narrative description of the project and site conditions, including details of the natural environment, project components and potential sources of contamination, how contaminants may move through the environment, and receptors, such as aquatic habitat and drinking water supplies. The conceptual site model is based on site-specific information, including but not limited to geology, hydrogeology, groundwater levels and groundwater quality, surface water flow rate, lake volume, and surface water quality. The conceptual site model should account for all phases of the project, i.e., construction, operation, and reclamation, to ensure that effective monitoring and mitigation measures are implemented throughout the life of the mine.

The conceptual site model should be developed early in the project planning phase and updated regularly as the project progresses and as additional information becomes available. Changes to the conceptual site model should be tracked, along with rationale for the refinement. Although updates to the conceptual site model are expected, it is recommended that the initial conceptual site model reflect the final facility design as accurately as possible. This will help to ensure the surface water and groundwater monitoring networks and baseline studies are designed to adequately accommodate the final project design. Any significant changes to the project design may result in the need for additional monitoring stations and baseline data collection.

The conceptual site model should include the following information:

- ☐ Project description and infrastructure design, including but not limited to extraction pits, tailings management facilities, waste rock storage areas, roads, ditching, and settling ponds, proposed depth of extraction pits relative to the annual high water table elevation, plans for pit dewatering, and on-site water supply wells.
- ☐ Location, extent, and characteristics of known, suspected and potential sources of contamination, including but not limited to naturally occurring contaminants, areas impacted by past land use, and potential future sources of contamination associated with the proposed project.
- ☐ Proposed mitigation measures for the protection of surface water and groundwater resources.
- ☐ Potential for acid rock drainage and metal leaching, which may impact water quality on site and downstream. If there is potential for acid rock drainage and metal leaching, include proposed mitigation measures, which demonstrate how geochemical stability of a project site will be achieved during construction, operation, and reclamation.
- ☐ Contaminants of concern associated with the construction and operation of the proposed project.
- ☐ The mechanisms of mobilization, reaction and transport of contaminants of concern from source(s) to receptor(s). Include the contaminants of concern that may be introduced to surface water and/or groundwater from the proposed project and potential changes in surface water and/or groundwater quality that may mobilize naturally occurring parameters.
- ☐ Geologic setting of both surface and subsurface geology that is relevant to site operations, including bedrock and soil types, depositional environments, such as glacial, fluvial, marine, mineralogy of ore occurrence, and subsequent relevant metamorphic features.
- ☐ Characteristics of geologic properties affecting groundwater flow in the project area including both primary porosities (in sedimentary aquifers) and secondary porosities (such as fractures, faulting).
- ☐ Hydrogeologic setting, the known or inferred extent and continuity of aquifers and aquitards and related hydrogeologic units.

- ☐ Groundwater elevations, equipotential contours, groundwater flow direction, groundwater flow velocities and horizontal and vertical hydraulic gradients within and between relevant permeable geologic units that are factors used to determine location and degree of contaminants of concern transport.
- ☐ Physical and hydrogeologic boundaries that define groundwater flow systems, including recharge and discharge areas, pumping wells, hydraulic and physical groundwater divides, surface water features and other relevant conditions.
- ☐ Role of groundwater as a pathway for transporting known and potential contaminants of concern. Consider groundwater migration from source areas and the potential for subsequent groundwater discharge to surface receptors, such as plants, aquatic life, animals and humans, as well as to groundwater well supplies.
- ☐ Location and description of all surface water resources, including type, size, flow direction, and secondary watersheds.
- ☐ Location of all known or planned points of discharge, such as effluent discharge and stormwater runoff.
- ☐ Current land uses, including water supply wells, within a 2 km radius of the outer boundary of the project area.
- ☐ All known and potential human and environmental receptors, within a 1 km radius of the outer boundary of the project area, which may be affected by site activities, this includes on-site drinking water supplies.
- ☐ Analysis and discussion of the potential effects of the project on surface water, groundwater, and wetlands for the duration of the project.

For submission to the Department: a conceptual site model that includes the information listed above. Identify all sources of information, limitations and assumptions, as well as the planned process for updating the conceptual site model and sharing updates with the Department.

2.2 Site Plan

A detailed site plan is an important component of an effective monitoring plan, as it provides a clear and accurate representation of the project's physical layout and key environmental features, and support effective planning, assessment, decision-making, and regulatory review.

A detailed site plan should cover the Environmental Assessment boundary as provided in the Environmental Assessment Registration Document, and should include the following information:

- ☐ Project infrastructure
- ☐ Known and potential sources of contamination
- ☐ Historic mine features
- ☐ Topography
- ☐ Location, name (if known), and flow direction of watercourses
- ☐ Wetlands
- ☐ Proposed effluent discharge locations
- ☐ Groundwater elevation and contours
- ☐ Groundwater flow direction
- ☐ Surface water monitoring locations
- ☐ Groundwater monitoring locations
- ☐ Water supply wells
- ☐ Receptors

For submission to the Department: a scaled site plan showing the details listed above. The site plan should be updated, as necessary, to include any new information, such as new or proposed surface water or groundwater monitoring locations.

3. Baseline Water Study

Baseline water studies are an important component of all mining projects. Data collected prior to the start of mine construction is considered as acceptable baseline data. This includes baseline data collected in support of the Environmental Assessment.

The purpose of the baseline water study is to:

- Characterize baseline surface water quality in all watercourses potentially impacted by the proposed project, i.e., flowing watercourses, lakes, and wetlands, including seasonal and annual variability, at recommended frequencies.
- Characterize baseline groundwater quality, groundwater levels, hydrogeological characteristics, and groundwater flow direction in all aquifers present at the site, including seasonal and annual variability.
- Delineate baseline groundwater flow paths and identify possible changes that may result from the proposed mine development.
- Characterize background water quality for both surface water and groundwater.
- Identify the location and nature of area(s) impacted by historic land use.
- Allow the comparison of baseline and background data with operational and post-closure data to identify whether surface water or groundwater have been impacted by mine-related activities.
- Supply water quality and quantity data to support further work, such as water quality models, mixing zone studies[1], surface water management plans[2], and water withdrawal approvals[3], where applicable.
- Provide information to inform project design and mitigation measures for the protection of surface water and groundwater.

Baseline data collection should begin as early as possible to ensure you have sufficient samples to inform baseline water quality, including seasonal and annual variability. It is recommended Applicants discuss their proposed baseline study plan with the Department prior to implementation.

[1] Refer to CCME Technical Supplement 3, Section 5.3.

[2] Refer to the Department's Guide to Developing Surface Water Management Plans.

[3] Refer to the Department's Guide to Surface Water Withdrawal Approval and Guide to Groundwater Withdrawal Approvals

3.1 Baseline Monitoring Locations

3.1.1 Surface Water

The number and location of surface water monitoring stations will be site-specific, depending on several factors such as project design and site conditions. A complete baseline surface water study includes the following monitoring locations:

- Downstream of all areas potentially affected by the proposed construction, operation, and reclamation phases of the mine, including, but not limited to:
  - proposed discharge locations
  - project infrastructure, including, but not limited to waste rock stockpiles, tailings management facility, wastewater treatment facilities, diversion ditches, sedimentation ponds, mill plant, and chemical and fuel storage areas
  - future land disturbances
  - known or suspected areas of historical contamination
  - areas with potential acid rock drainage/metal leaching due to naturally exposed bedrock
- Upstream locations that reflect naturally occurring conditions in the environment, free of contamination from human activities, to characterize background conditions. In some cases it may be necessary to collect samples beyond the project area to collect data that is representative of background conditions.
- Immediately upstream of all planned or potential effluent discharge points.
- Proposed effluent receiving water or locations that are representative of the proposed effluent receiving water quality, i.e., similar geological, biological, physical, and chemical characteristics.

3.1.2 Groundwater

A permanent groundwater monitoring well network is necessary to facilitate baseline and long-term groundwater monitoring. The number, location, and construction of groundwater monitoring stations will be site-specific, depending on several factors, such as project design and site characteristics. A complete baseline groundwater study includes the following locations:

- Groundwater monitoring locations within each hydrogeologic unit downgradient of all areas potentially affected by the proposed construction and operation of the mine, including, but not limited to:
  - project infrastructure, including, but not limited to waste rock storage area(s), tailings management facility, diversion ditches, organic material, overburden, sedimentation ponds, mill plant, and chemical and fuel storage.
  - future land disturbances.
  - known or suspected areas of historical contamination.
  - areas with potential acid rock drainage/metal leaching due to naturally exposed bedrock.
- Monitoring wells in each hydrogeologic unit upgradient of the proposed mine to characterize background groundwater conditions. These samples are to reflect naturally occurring conditions in the environment, free of contamination caused by human activity. In some cases, it may be necessary to collect samples beyond the project area to collect data that is representative of background conditions.
- Multi-level monitoring wells to establish vertical hydraulic gradients and to sample groundwater at different depths.
- Groundwater monitoring in mineralized zones, e.g.., the orebody. Mineralized zones should be characterized separately from non-mineralized zones due to their often-distinct geochemistry and groundwater quality.
- Groundwater monitoring wells to identify and describe the location and nature of groundwater impacts associated with historical contamination.
- A baseline well survey of private water supply wells within 1 km of the outer boundary of the project area is recommended.

3.2. Baseline Monitoring Frequency, Duration, and Parameters

Baseline monitoring frequency should be sufficient to characterize site-specific groundwater and surface water quality, accounting for seasonal variability. To capture the full range of hydrologic conditions, data collection should include periods of both high and low water levels. A typical baseline water monitoring program includes monthly surface water sampling, quarterly groundwater sampling, and continuous groundwater level monitoring.

The duration of baseline monitoring must be long enough to capture temporal trends and establish a statistically reliable data set. Larger sample sizes improve the accuracy and precision of statistical analyses, enhancing confidence in the results. The duration of baseline monitoring should reflect the level of risk associated with the proposed activity.

Parameters typically associated with metal mining projects are listed in Appendix A. The parameter list may be modified depending on the contaminants of concern identified in the conceptual site model. Include the baseline data in an unlocked spreadsheet along with electronic laboratory reports. It is also recommended that hydraulic conductivity testing be completed for all individual monitoring wells. Hydraulic conductivity testing is necessary to fully understand the physical properties that govern the movement of groundwater on the site, inform future groundwater models, as applicable, and to assess potential impact on groundwater associated with the construction and operation of the mine.

For submission to the Department: a report summarizing the results of the baseline surface water and groundwater study that includes the information presented in this Guide and rationale for modification(s) to the recommended baseline monitoring plan. Include a description of the surface water and groundwater monitoring locations, monitoring well and borehole logs, elevation of the top of the monitoring well casing, geographical UTM coordinates, and photographs, and methodology used to collect the water samples, including QA/QC protocols. Include all baseline data in an unlocked spreadsheet and laboratory certificates of analysis.

4. Water Monitoring Plan

Water monitoring plans are an important part of all mining operations. The purpose of a monitoring plan is to detect impacts to groundwater and surface water associated with mine activities so that operators can take prompt corrective actions to prevent environmental impacts and maintain water quality for downstream and surrounding users. This additional data can also support calibration of water models to support ongoing planning, evaluate the effectiveness of the proposed mitigation measures, and inform necessary adjustments to the project design, and water and waste management practices.

It is expected that monitoring plans will evolve throughout the life of the mine. It may be necessary to add or remove monitoring locations based on current conditions and operations, such as changes to project components or groundwater flow paths because of mine construction and/or operations. Additional monitoring locations may need to be added to support assessment(s) and remediation measures.

4.1 Surface Water Monitoring Plan

Surface water monitoring plans for a mine operation typically consider the following components:

1. Effluent and discharge monitoring, e.g., mine discharge effluent, seepage locations, discharge locations from underground dewatering activities.
2. Mine site water monitoring, e.g., water and waste storage locations within the proposed permitted mine area, such as tailings management facilities, surface collection ponds, waste rock storage area stockpiles.
3. Environmental (ambient) monitoring for the protection of water resources.

4.1.1 Surface Water Monitoring Locations

The proposed surface water monitoring plan should include the following locations:

- All effluent and discharge locations.
- Mine site water, e.g., tailings management facilities, collection ponds, pond discharge, waste rock storage areas, and any seepage locations.
- Upstream surface water sampling locations to capture background surface water quality.
- Downstream of all known and potential sources of contamination, including, but not limited to:
    - effluent and stormwater discharge locations.
    - project infrastructure, including, but not limited to waste rock storage areas, tailings management facility, chemical and fuel storage, seepage collection and diversion ditches, and storage ponds, such as stormwater and contact water.
    - known or suspected areas of historical contamination.
    - areas with potential acid rock drainage/metal leaching due to exposed bedrock.
- Receiving environment within and downstream of any mixing zones.
- Downstream within any watercourses that are within the project area.

All proposed surface water monitoring locations should be included in the Site Plan identified in Section 2.2. The Site Plan should be updated, as necessary, to incorporate any new or previously unidentified monitoring locations.

4.1.2 Surface Water Monitoring Frequency and Parameters

Monitoring is generally conducted monthly. However, a higher frequency may be required in certain situations, such as for compliance or performance monitoring, or during specific project phases. For example, more frequent monitoring may be necessary during the early stages of the project to detect potential changes in surface water quality related to site construction activities.

For mining operations, parameters typically include those listed in Appendix A. The parameter list may be amended based on site conditions, project details, and contaminants of concern, as determined by the baseline surface water study and conceptual site model.

Surface water quantity, including water levels and flow, may also be included, as required, to support other project components such as a surface water management plan or water withdrawal approval, or to validate a mixing zone study.

For submission to the Department: a proposed surface water monitoring plan that includes the location, frequency, and parameters outlined in this Guide. If proposing alternative plans, include rationale.

4.2 Groundwater Monitoring Plan

An effective groundwater monitoring plan requires a network of groundwater monitoring wells strategically placed throughout the project area to monitor changes in groundwater quality and water levels associated with the construction, operation, and reclamation of the mine. The number and location of monitoring wells will vary between projects, based on site-specific conditions, including, but not limited to geology, hydrogeology, surface water, receptors, project components, sources of contamination, contaminants of concerns, and risks to the environment.

4.2.1 Groundwater Monitoring Locations

The proposed groundwater monitoring plan should include the following locations:

- Upgradient monitoring well locations in each hydrogeologic unit to adequately capture background groundwater conditions.
- Downgradient of all known and potential sources of contamination, including, but not limited to
    - project infrastructure, including, but not limited to waste rock stockpiles, tailings management facility, chemical and fuel storage, diversion ditches, organic material, overburden, and waste rock stockpiles, sedimentation ponds, and mill plant.
    - known or suspected areas of historical contamination, due to previous site activities.
    - areas with potential acid rock drainage/metal leaching due to exposed bedrock.
- Locations necessary to monitor the project design and effectiveness of mitigation measures.

It is important to have several multi-level monitoring well nests to capture groundwater quality at different depths and within different formations and to monitor vertical hydraulic gradients.

All proposed groundwater monitoring locations should be included in the Site Plan identified in Section 2.2. The Site Plan should be updated, as necessary, to incorporate any new or previously unidentified monitoring locations.

4.2.2 Groundwater Monitoring Frequency and Parameters

Groundwater monitoring, which includes water quality sampling and water level measurements, is typically conducted quarterly, i.e., every three months. However, more frequent monitoring may be required at certain locations for compliance or performance monitoring, or during specific project phases. For example, increased monitoring frequency may be necessary in the early stages of the project to detect potential changes in groundwater quality or levels due to site construction, dewatering, or other activities.

At mining operations, groundwater monitoring typically includes the parameters listed in Appendix A. This list may be adjusted based on site conditions, project specifics, and the Conceptual Site Model, as determined by the baseline groundwater study.

For submission to the Department: a proposed groundwater monitoring plan that includes the location, frequency, and parameters outlined in this Guide. If proposing alternative plans, include rationale.

5 . Sampling Methodology

To ensure the integrity of the data being collected and consistency between sampling events, it is critical that all surface water, effluent, and groundwater monitoring follow consistent standardized procedures. This is applicable to all phases of the monitoring plans, including baseline, operational, and post-closure monitoring. Field methods and QA/QC protocols should be documented for all sampling events. Additionally, samples should be analysed at an accredited laboratory.

5.1. Surface Water Sampling Methodology

For water quality monitoring sites located in rivers and streams, standard procedure is to collect samples from areas that are turbulent/well-mixed. Where feasible and safe to do so, samples should be collected at the centre of the stream, at 60% depth. For lakes, standard procedure is to collect samples at points of effluent discharge, where flowing watercourses enter the lake, outlets from the lake, and at the deepest location of the lake.

It is standard practice to analyse surface water samples for total concentrations, unless specified otherwise in Appendix A. Applicants may choose to analyze samples for both total and dissolved metals, to help understand site conditions.

All surface water monitoring locations should include a location description, be geo-referenced, mapped and photographed, with photographs facing both upstream and downstream of the sample location.

5.2. Groundwater Sampling and Monitoring Well Installation Methodology

Standard practices for groundwater sampling include field filtering and preservation for metals analysis. It is important that monitoring wells are designed, installed, developed, purged and sampled in accordance with accepted industry standard practice. Include all borehole and monitoring well logs and all groundwater monitoring wells georeferenced, mapped, photographed, and surveyed for geodetic elevation, specifically with reference to ground and/or top of casing elevation.

Appendix A
Monitoring Parameters for Metal Mines in Nova Scotia

COLUMN 1 SURFACE WATER AND EFFLUENT	COLUMN 2 GROUNDWATER <10M TO SURFACE WATER	COLUMN 3 GROUNDWATER >/=10 M TO SURFACE WATER
GENERAL CHEMISTRY (major ion, physical and calculated parameters)		
Dissolved Chloride	Chloride	Chloride
Fluoride	Fluoride	Fluoride
Dissolved Sulphate	Dissolved Sulphate	Dissolved Sulphate
Nitrite(N)	Nitrite(N)	Nitrite(N)
Nitrate (N)	Nitrate (N)	Nitrate (N)
Ammonia (N)	Ammonia (N)	Ammonia (N)
Total Alkalinity	Total Alkalinity	Total Alkalinity
Hardness	Hardness	Hardness
pH	pH	pH
Reactive Silica	Reactive Silica	Reactive Silica
Colour	Colour	Colour
Turbidity	Turbidity	Turbidity
Conductivity	Conductivity	Conductivity
Total Dissolved Solids	Total Dissolved Solids	Total Dissolved Solids
Total Suspended Solids (TSS)	Total Suspended Solids (TSS)	Total Suspended Solids (TSS)
Total Organic Carbon	Total Organic Carbon	Total Organic Carbon
Ion Balance	Ion Balance	Ion Balance
METALS		
Total Aluminum (Al)	Dissolved Aluminum (Al)	Dissolved Aluminum (Al)
Total Antimony (Sb)	Dissolved Antimony (Sb)	Dissolved Antimony (Sb)
Total Arsenic (As)	Dissolved Arsenic (As)	Dissolved Arsenic (As)
Total Barium (Ba)	Dissolved Barium (Ba)	Dissolved Barium (Ba)
Total Beryllium (Be)	Dissolved Beryllium (Be)	Dissolved Beryllium (Be)

COLUMN 1 SURFACE WATER AND EFFLUENT	COLUMN 2 GROUNDWATER <10M TO SURFACE WATER	COLUMN 3 GROUNDWATER >/=10 M TO SURFACE WATER
Total Bismuth (Bi)	Dissolved Bismuth (Bi) D	issolved Bismuth (Bi)
Total Boron (B)	Dissolved Boron (B)	Dissolved Boron (B)
Total Cadmium (Cd)	Dissolved Cadmium (Cd)	Dissolved Cadmium (Cd)
Total Calcium (Ca)	Dissolved Calcium (Ca)	Dissolved Calcium (Ca)
Chromium (Cr Total)	Dissolved Chromium (Cr Total)	Dissolved Chromium (Cr Total)
Chromium (CR III)	Dissolved Chromium (CR III)	Dissolved Chromium (CR III)
Chromium (CR VI)	Dissolved Chromium (CR VI)	Dissolved Chromium (CR VI)
Total Cobalt (Co)	Dissolved Cobalt (Co)	Dissolved Cobalt (Co)
Total Copper (Cu)	Dissolved Copper (Cu)	Dissolved Copper (Cu)
Total Iron (Fe)	Dissolved Iron (Fe)	Dissolved Iron (Fe)
Total Lead (Pb)	Dissolved Lead (Pb)	Dissolved Lead (Pb)
Total Magnesium (Mg)	Dissolved Magnesium (Mg)	Dissolved Magnesium (Mg)
Total Manganese (Mn)	Dissolved Manganese (Mn)	Dissolved Manganese (Mn)
Mercury (Hg Total)	Dissolved Mercury (Hg)	Dissolved Mercury (Hg)
Methyl Mercury [2]	-	-
Total Molybdenum (Mo)	Dissolved Molybdenum (Mo)	Dissolved Molybdenum (Mo)
Total Nickel (Ni)	Dissolved Nickel (Ni)	Dissolved Nickel (Ni)
Total Phosphorus (Ph)	Dissolved Phosphorus (Ph)	Dissolved Phosphorus (Ph)
Total Potassium (K)	Dissolved Potassium (K)	Dissolved Potassium (K)
Total Selenium (Se)	Dissolved Selenium (Se)	Dissolved Selenium (Se)
Total Silver (Ag)	Dissolved Silver (Ag)	Dissolved Silver (Ag)
Total Sodium (Na)	Dissolved Sodium (Na)	Dissolved Sodium (Na)
Dissolved Strontium (Sr)	Dissolved Strontium (Sr)	Dissolved Strontium (Sr)
Total Thallium (Tl)	Dissolved Thallium (Tl)	Dissolved Thallium (Tl)
Total Tin (Sn)	Dissolved Tin (Sn)	Dissolved Tin (Sn)
Total Uranium (U)	Dissolved Uranium (U)	Dissolved Uranium (U)
Total Vanadium (V)	Dissolved Vanadium (V)	Dissolved Vanadium (V)
Dissolved Zinc (Zn)	Dissolved Zinc (Zn)	Dissolved Zinc (Zn)

COLUMN 1 SURFACE WATER AND EFFLUENT	COLUMN 2 GROUNDWATER <10M TO SURFACE WATER	COLUMN 3 GROUNDWATER >/=10 M TO SURFACE WATER
CYANIDE SPECIES (where required, i.e., gold mines)		
Cyanide (Total)	Cyanide (Total)	Cyanide (Total)
Weak Acid Dissociable (WAD) Cyanide	Weak Acid Dissociable (WAD) Cyanide	Weak Acid Dissociable Cyanide
Free Cyanide (CNF)	Free Cyanide (CNF)	Free Cyanide (CNF)
Cyanate	Cyanate	Cyanate
Thiocyanates (SCN)	Thiocyanates (SCN)	Thiocyanates (SCN)
PETROLEUM HYDROCARBONS (where required, i.e., petroleum storage areas)		
Total Petroleum Hydrocarbons	Total Petroleum Hydrocarbons	Total Petroleum Hydrocarbons
Benzene	Benzene	Benzene
Toluene	Toluene	Toluene
Ethyl Benzene	Ethyl Benzene	Ethyl Benzene
Xylene	Xylene	Xylene
OTHER (only at MDMER stations)		
Radium 226	-	-
Salinity	-	-
TOXICITY MODIFYING FACTORS		
pH	pH	pH
Hardness	Hardness	Hardness
Dissolved Organic Carbon	Dissolved Organic Carbon	-
FIELD PARAMETERS		
temperature, pH, electrical conductivity, dissolved oxygen levels	temperature, pH, electrical conductivity, groundwater levels	temperature, pH, electrical conductivity, groundwater levels
ADDITIONAL PARAMETERS (as determined through the conceptual site model or as requested by the Department)		

NOTES:

1. Groundwater samples collected for dissolved metals analysis are to be field filtered using a 0.45 µm membrane filter as soon as possible after sampling and immediately preserved. 0.45 µm pore size is the default filter pore size, unless otherwise specified in the method for a given parameter.
2. Chromium speciation is required for groundwater and surface water during the baseline water study. Following the baseline water study, chromium speciation is required if chromium exceedances are noted in the baseline data or if total chromium exceeds the reference guideline values in subsequent samples.
3. Methyl mercury is required during the baseline water study for surface water only. Following the baseline water study, methyl mercury is required in surface water if exceedances are noted in the baselined data or if total mercury exceeds the reference guideline value in subsequent samples.


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