

**Guidelines for Designing and  
Implementing Aquatic Effects  
Monitoring Programs for  
Development Projects in the  
Northwest Territories**

*Recommended Procedures for Identifying  
Issues and Concerns Associated with  
Development Projects*

*AEMP Technical Guidance Document  
Volume 1*

Indian and Northern Affairs Canada  
Yellowknife, Northwest Territories

*June 2009 Version*

# **Guidelines for Designing and Implementing Aquatic Effects Monitoring Programs for Development Projects in the Northwest Territories**

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Prepared by:

**D.D. MacDonald<sup>1</sup>, B. Zajdlik<sup>2</sup>, and INAC Water Resources<sup>3</sup>**

**<sup>1</sup>MacDonald Environmental Sciences Ltd.**  
#24 - 4800 Island Highway North  
Nanaimo, British Columbia V9T 1W6

**<sup>2</sup>Zajdlik & Associates Inc.**  
R.R. # 3  
Rockwood, Ontario N0B 2K0

**<sup>3</sup>Water Resources Division**  
**Indian and Northern Affairs Canada**  
P.O. Box 1500  
Yellowknife, Northwest Territories X1A 2R3

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## List of Acronyms

AEMP	-	Aquatic Effects Monitoring Program
CCME	-	Canadian Council of Ministers of the Environment
CEAA	-	Canadian Environmental Assessment Act
DQO	-	data quality objective
EEM	-	Environmental Effects Monitoring
EQG	-	environmental quality guideline
EQO	-	environmental quality objective
FSP	-	field sampling plan
GIS	-	geographic information system
GLWB	-	Gwich'in Land and Water Board
HSP	-	health and safety plan
INAC	-	Indian and Northern Affairs Canada
$K_{oc}$	-	organic carbon partition coefficient
$K_{ow}$	-	octanol water partition coefficient
LWB	-	the Land and Water Board
MRP	-	Management Response Plan
MVEIRB	-	Mackenzie Valley Environmental Impact Review Board
MVLWB	-	Mackenzie Valley Land and Water Board
MVRMA	-	Mackenzie Valley Resource Management Act
NWTWA	-	Northwest Territories Water Act
NWTWB	-	Northwest Territories Water Board
NWT	-	Northwest Territories
QAPP	-	quality assurance project plan
QA/QC	-	quality assurance/quality control
SLWB	-	Sahtu Land and Water Board
TK	-	Traditional Knowledge
USEPA	-	U.S. Environmental Protection Agency
VEC	-	valued ecosystem component
WLWB	-	We'eezhii Land and Water Board
WQG	-	water quality guideline
WQO	-	water quality objective

## **1.0 Introduction**

The first step in the framework for designing and implementing Aquatic Effects Monitoring Programs (AEMPs) involves identification of the issues and concerns associated with a development project (e.g., potential effects of the project on the aquatic ecosystem). The activities that need to be undertaken at this stage of the AEMP development process include:

- Preparation of project description;
- Identification of interested parties, including the potentially-affected Aboriginal governments/organizations, the responsible regulatory board, government agencies/departments, non-governmental organizations, and others;
- Compilation of the available data and information on the affected watershed;
- Dissemination of information on the proposed development project and affected watershed to interested parties;
- Initial consultation with Aboriginal governments/organizations and other interested parties; and,
- Documentation of issues and concerns.

Each of these tasks are described in the following sections of this Technical Guidance Document.

## **2.0 Preparation of the Project Description**

The first step in the issues and concerns identification process involves preparation of the project description. While it is understood that the project is likely to be refined throughout the planning process, the project description that is initially developed should be as detailed as possible to enable reviewers to understand the nature and scope of the development. In this way, reviewers will be provided with

the information needed to identify their issues and concerns in a way that will enable the project proponent to address them in a timely manner (i.e., in the environmental assessment and regulatory phases). The key types of information that should be provided at this stage of the AEMP development process include:

- Project overview;
- Description of the proposed development schedule;
- Description of the site location and footprint;
- Description of the approaches that will be used in the development project (e.g., for mines, the type of mining methods that will be used);
- Description of the waste materials that will be generated at the site and the procedures that will be used to manage waste materials (e.g., waste rock, drilling muds, solid waste);
- Description of the sources of water that will need to be managed at the site and the procedures that will be used to manage water and wastewater (e.g., mine water, site runoff, effluent, sewage);
- Description of the site support facilities (e.g., camp, camp services, quarries, rock crushing facilities, power generation) and the storage facilities (e.g., fuel storage, explosives storage, cement storage, rock storage, laydown areas, parking);
- Description of transportation methods and corridors (i.e., location of airstrips and associated facilities, site roads, access roads, transportation methods, mobile equipment);
- Description of mine operations, including mine management, policies and plans, environmental management system); and,
- Description of closure and reclamation and closure methods (i.e., by mine component).

Again, it is understood that the preliminary project descriptions may not have all of the detailed information needed to fully support the identification of issues and

concerns by Aboriginal governments/organizations and other interested parties. Nevertheless, the preliminary project description should be sufficiently detailed to permit the identification of key issues and concerns. Refinement of the project description during the environmental assessment (as required) and regulatory phase will provide reviewers with the additional information needed to refine and clearly articulate their issues and concerns.

### **3.0 Identification of Interested Parties**

It is important to identify the parties that have a legitimate interest in a development project early in the AEMP development process. These parties are likely to include affected Aboriginal governments/organizations and communities, the responsible regulatory boards, government agencies/departments (e.g., Indian and Northern Affairs Canada, Fisheries and Oceans Canada, Environment Canada, Government of the Northwest Territories), and others. These organizations are likely to be participants in the environmental assessment process and the subsequent regulatory process (i.e., water licencing and land use permitting), so it is important to effectively identify them to facilitate effective communications related to the project and development of the AEMP. It is recommended that the key representatives of these interested parties be invited to participate on an AEMP Working Group that will provide a proponent with timely input throughout the AEMP development and implementation process (see the AEMP Guidelines Overview Report for more information on the recommended use of an AEMP Working Group). Resources to support the activities of an AEMP Working Group would generally be provided by the project proponent.

#### **3.1 Dissemination of Information to Interested Parties**

Timely dissemination of data and information on the project is essential for keeping participants (for example, an AEMP Working Group) engaged in the process and building the trust needed to support efficient development, approval, and

implementation of the AEMP. Some of the information that reviewers will need at the outset of the AEMP development process include the project description, a watershed backgrounder document on the receiving water body under consideration (i.e., that compiles and summarizes the available information on the watershed), and a preliminary AEMP consultation schedule. This information will enable reviewers to identify their preliminary issues and concerns regarding the proposed development. Importantly, timely dissemination of this information will engage participants in the process of determining traditional knowledge (TK) and other relevant information requirements to support the project. Experience with various diamond mining projects in the NWT indicates that the importance of developing good working relationships early in the process cannot be overemphasized.

## **3.2 Initial Consultation with Interested Parties**

Consultation with Aboriginal governments/organizations and other interested parties is of fundamental importance relative to the development of an AEMP that can be approved by the responsible regulatory board in a timely manner. Effective consultation contributes to the AEMP development process by improving coordination of participants involved in the process, enhancing access to data and information on the study area, including TK, building trust and a sense of common purpose among participants, and facilitating better communication and participation. To be effective, however, consultation should be conducted in a systematic manner and adhere to the following principles:

- *Make consultation timely:* Consultation needs to be conducted while participants still have an opportunity to influence outcomes (i.e., before decisions are made);
- *Consultation should be inclusive:* Aboriginal governments/organizations and other interested parties should be contacted and asked to identify participants who can represent their interests and needs. The process for selecting participants should not be open to manipulation. In addition, barriers to participation should be explicitly identified and addressed;

- *Consultation should be community focussed:* Ask participants what they consider is appropriate for the community as a whole, rather than for individuals in the community;
- *Consultation should be interactive and deliberative:* Allow participants to engage in meaningful discussions that can influence decision making;
- *Consultation should be effective:* Be clear on how decisions will be made and emphasize that consensus (i.e., general agreement), rather than complete agreement, is the goal of the process;
- *Consultation should matter:* It is important that there is a strong likelihood that the recommendations that are developed during the process will be adopted;
- *Consultation should be well facilitated:* Utilize an independent, skilled, and flexible facilitator with no vested interest in the outcome of the consultation process;
- *Consultation should be open, fair, and subject to evaluation:* Measures of success and associated evaluation questions should be formulated in advance and provided to participants following the process. The results of the evaluation should be provided to participants;
- *Consultation should be cost-effective:* Aboriginal governments/organizations and other interested parties should be appropriately identified in advance and appropriate resources should be dedicated to consulting with those parties; and,
- *Consultation should be flexible:* Consultation techniques should be selected to be appropriate for the target group and include both qualitative and quantitative methods.

These principles for effective community consultation should be applied throughout the consultation process. They provide a framework for making consultation effective and meaningful. Adherence to these principles will help project proponents optimize the potential for success of the consultation process.

## **4.0 Compilation of Background Data and Information**

The identification of issues and concerns associated with a development project requires detailed information on the study area under investigation. More specifically, information is needed on:

- Characteristics of the receiving water body (including climate, water quality, hydrological and ecological information);
- Regional land and water use patterns; and,
- The characteristics of effluent and stormwater discharges in the vicinity of the site, if any exist.

Integration of information on the project and on the watershed provides an informed basis for identifying issues and concerns in the study area, as they relate to the developmental activity that is being proposed by a proponent and the water body that may be affected by the project. Such background information should be compiled in a watershed background report that will ultimately be distributed to interested parties. Both TK and western scientific information need to be compiled to ensure that the watershed background report reflects our current understanding of conditions in the study area.

Information on the affected watershed provides an understanding of key ecosystem attributes and, hence, a basis for developing a common vision for the future (which is articulated in terms of ecosystem goals and ecosystem health objectives). In addition to supporting the development of ecosystem goals and objectives, collation of the existing knowledge base is essential for identifying the issues and concerns that need to be addressed in broader water management processes within the study area. Such processes need to be linked to regional cumulative effects assessments to ensure that the long-term goals for the aquatic ecosystem can be met when multiple development projects are pursued within the study area.

## **4.1 Characteristics of the Receiving Water Body**

The effects of developmental activities on aquatic ecosystems depend not only on the nature and scope of the activity, but also on the characteristics of the receiving water body. For example, salmonid fishes (trout) tend to be more sensitive to the effects of many chemicals of potential concern than are cyprinids (minnows) or catostomids (suckers). Similarly, many metals are more toxic in soft waters (i.e., those with low water hardness) than they are in hard waters. Accordingly, it is important to obtain, evaluate, and compile data and information on the physical, chemical, and biological characteristics of the water body under consideration early in the AEMP development process.

The NWT is characterized by a plethora of aquatic ecosystems, including thousands of lakes, rivers, and streams. Many of the water bodies located nearby population centres and major development projects have been subjected to in-depth investigation and, hence, a substantial amount of data exists on the physical, chemical, and biological characteristics of these systems. However, much less information is available on the characteristics of the majority of the water bodies that are spatially removed from population centres or resource development sites. The data that are available on the characteristics of lakes, river, and streams in the NWT can be obtained from a variety of sources, including Aboriginal governments/organizations, government departments, monitoring agencies, various planning and assessment bodies, industry, and other non-governmental organizations. The followings types of information should be sought during this stage of the AEMP development process:

- Climate data;
- Surface water quantity (i.e., hydrological conditions);
- Surface water chemistry;
- Sediment chemistry;
- Fish and invertebrate tissue chemistry; and,
- Structure of aquatic plant and animal communities.

## **4.2 Regional Land and Water Use Patterns**

Evaluation of issues and concerns relative to the quality and quantity of aquatic resources requires information on regional land and water use patterns. More specifically, information is needed on the types of industries and businesses that operate or have operated in the watershed and the region, on the location of wastewater treatment plants, on land use patterns in upland areas and/or applicable land use plans, on stormwater drainage systems, on residential developments, on other historic, ongoing, and potential activities within the area, and on the uses of water resources. For new or proposed developmental activities, it is important to prepare a detailed description of the project, including all of the related activities that will likely need to be undertaken to implement and support the project.

The nature of the activities conducted within the study area determines which substances may have been released, are currently being released, and/or could be released into the environment. Activities that have a relatively high potential for releasing hazardous substances into the environment or other stressors in the NWT include mining, oil and gas development, hydro development, power installations, municipal development, and contaminated sites. For example, releases of metals into aquatic ecosystems are commonly associated with mining, milling, and related activities. Oil and natural gas drilling, production, processing, retailing, and distribution can result in the release of a variety of petroleum hydrocarbons and related substances into aquatic ecosystems. Hydroelectric power developments can alter hydrologic conditions, including the magnitude and timing of high and low flow events.

Information on regional land uses also provides a basis for identifying non-contaminant stressors in the watershed (e.g., presence of commercial fishing operations, etc.). The types of information needed to assess land use patterns can be obtained from a variety of sources, including Aboriginal governments/organizations, federal, territorial, and municipal government departments/agencies, various regulatory bodies, monitoring agencies, environmental impact review boards,

regulatory boards, land use planning boards, industry, and other non-governmental organizations.

Information on land use patterns within the study area provides a basis for identifying potential sources of chemical substances and other stressors to aquatic ecosystems. In turn, information on potential sources provides a basis for identifying the substances that may have been released into aquatic ecosystems and the other stressors that could affect aquatic organisms and/or their uses. These chemical substances can then be included on the preliminary list of stressors of potential concern for the study area. Physical (e.g., changes in hydrological conditions) and biological (e.g., presence of invasive species) stressors should also be identified at this time. Physical, chemical, and biological stressors associated with a project are collectively termed stressors of potential concern.

### **4.3 Characteristics of Effluent and Stormwater Discharges**

Information on the location, volumes, and chemical characteristics of effluent stormwater, and other (e.g., groundwater, seepage) discharges within the study area provides important data for validating and refining the preliminary list of stressors of potential concerns. It is important to remember that the available data may not provide comprehensive information on the characteristics of effluents that are discharged into receiving water systems. For this reason, other information on the types of substances that are typically released into the environment in association with specific land use activities should also be used to identify stressors of potential concerns at the site (BCE 1997; Thomson *et al.* 2007).

For new developments, site-specific data on the composition of effluent streams, runoff, and other discharges will not be available. For this reason, it is essential to access information from other sites where similar development activities have occurred. In addition, it is important to fully review the project description to determine the types of activities that will be conducted on-site and in other areas to support construction and operation of the facility.

## 5.0 Identification of Preliminary Stressors of Potential Concern

When used together, the information on regional land and water use patterns and data on the likely characteristics of effluent, stormwater, and other discharges from the project provide a basis for identifying the preliminary chemicals of potential concern and other stressors of potential concern. However, further refinement of this list requires data on the physical/chemical properties of each of the chemical substances. More specifically, information should be compiled on the transport and fate of these chemicals of potential concern when released into aquatic ecosystems. Information on octanol-water partition coefficients ( $K_{ow}$ ), organic carbon partition coefficients ( $K_{oc}$ ), and solubilities of the preliminary chemicals of potential concern is useful for predicting their fate in the aquatic environment. For example, substances with low  $\log K_{ow}$  or  $\log K_{oc}$  values (i.e.,  $< 3.5$ ) and/or those that are soluble in water are the most likely to occur in surface water and groundwater. The preliminary chemicals of potential concern that have a high potential for occurring in water should be identified as the water-borne chemicals of potential concern at the site. Those substances with higher  $\log K_{ow}$  or  $\log K_{oc}$  values (i.e.,  $> 3.5$ ) and/or those that are not soluble in water are the most likely to occur in sediment and/or biological tissues (i.e., sediment-associated chemicals of potential concern and bioaccumulative chemicals of potential concern).

In addition to information on the sources and fate of chemical substances, historical water, sediment, and tissue chemistry data provide a basis for identifying and/or confirming the water-borne, sediment-associated, and tissue-associated chemicals of potential concern. However, evaluating the relevance and quality of historic data before using it in this application is important. For example, historical data sets may include only a limited suite of chemical analytes, which restricts their use for identifying chemicals of potential concern. In addition, the applicability of the chemistry data may be further restricted by high analytical detection limits. Furthermore, spatial coverage of the study area may not include the areas that are most likely to be contaminated. Due to these potential limitations, historical data sets

should be used with caution for eliminating substances from the list of chemicals of potential concern for a site. However, substances that have been measured at concentrations in excess of background concentrations and/or environmental quality guidelines (EQGs) should be identified as chemicals of potential concern. In addition, those substances that are predicted to occur at concentrations in excess of background concentrations and/or EQGs during construction, operation, or closure of a new project should be identified as chemicals of potential concern.

In addition to chemicals of potential concern, it is important to identify the physical and biological stressors that may be associated with the project at this stage of the process (collectively termed stressors of potential concern). Because the effects of two or more projects within an area can be cumulative, it is also important to evaluate the physical, chemical, and biological stressors associated with other projects in the study area. Such information will be useful during the problem formulation process, in which the potential effects of the project alone and in conjunction with other human activities are assessed. In turn, this information will contribute to the identification of assessment endpoints, risk questions, cumulative effects hypotheses, and the measurement endpoints that need to be included in the AEMP to assess project-related effects and cumulative effects.

## **6.0 Identification of Areas of Potential Concern**

The information that was assembled to support the identification of stressors of potential concern also provides a relevant basis for identifying areas of potential concern within a study area. More specifically, information on the historic and current uses of the site, on regional land and water use patterns, on the locations of effluent, stormwater, and other discharges provides a basis for identifying the areas of potential concern at the site (i.e., areas that may have contaminated surface water, groundwater, sediment, and/or biota). In addition, information on local hydrological conditions should be considered when evaluating the potential for contamination at a site and the distribution of any contaminants that may have been released or may be released in the future.

Historical water, sediment, and tissue chemistry data can also be used to identify areas of potential concern relative to contamination. However, the application of such data for this purpose can be limited for a number of reasons. Therefore, such historical chemistry and related data should be used with care for identifying areas of potential concern. Nevertheless, examination of such data from existing facilities of similar nature can provide a basis for estimating the nature, magnitude, and extent of contamination in the vicinity of a new project.

## **7.0 Documentation of Issues and Concerns**

Consultation early in the AEMP development process is intended to help proponents identify the issues and concerns associated with their project, to assist in the identification of relevant data and information on the study area, and to promote team building and mutual respect with Aboriginal governments/organizations and other interested parties. To achieve these objectives, it is recommended that project proponents listen carefully to the input provided during consultations and accurately reflect this input in summary reports that are produced after each consultation session. Participants should be provided with an opportunity to review and provide comments on these documents to assure their accuracy and completeness. Importantly, the project proponent should also describe how the results of consultation have been used to identify issues and concerns related to the project, to develop an accurate conceptual site model, to refine the project to address these issues and concerns, and to support the design of an AEMP that will provide the information to demonstrate that these issues and concerns have been effectively addressed. Each of these topics are discussed in subsequent Technical Guidance Documents.

## 8.0 References Cited

- BCE (British Columbia Environment). 1997. Waste Management Act: Contaminated Sites Regulation. B.C. Reg. 375/96. Schedule 2. Victoria, British Columbia.
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