

**THE CIMP PATHWAYS APPROACH:
Developing a common platform for NWT monitoring.
V-2011-06-23**

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Contact Information:

If you have questions or concerns about this publication, you can contact:

The Cumulative Impact Monitoring Program
Environment & Conservation Division
Aboriginal Affairs and Northern Development Canada
Box 1500, Bellanca Building
Yellowknife, NWT Canada, X1A 2R1
Phone: (867) 669-3886
E-mail: CIMP@inac.gc.ca

CREATING A COMMON PLATFORM: The need for “The Pathways Approach”

It has been noted that monitoring and research efforts in the North are often disjointed, and frequently, the data and results are not utilized in northern decision making. To provide guidance that will encourage collaboration and the development of projects that will contribute to the analysis of cumulative impacts, CIMP proposes the “Pathway Approach” as a common platform for developing monitoring and research programs in the NWT. The approach will provide a framework for partnerships, bring consistency and focus to a diversity of projects and ensure that efforts yield relevant and accessible information. The Pathway Approach will define the steps for developing a good, northern relevant monitoring and research program, and it will ultimately provide a framework for the development of guidance documents on how to accomplish each step.

This document describes the Pathway Approach by outlining the basic steps and principles required to develop cumulative impact monitoring and research projects (Figure 1; Phase 1 and 2). This paper also provides the framework to focus and organize input from a diversity of northern monitoring partners (Phase 3). This information will be organized in the form of Pathways guidance documents describing how to: a) develop monitoring and research projects which utilize science and TK; b) maximize partnerships and community involvement and answer relevant questions; and c) contribute to the monitoring and analysis of cumulative impacts.

Therefore, the current document represents culmination of Phase 1 and 2 in the work plan shown in Figure 1. Phase 3 will involve obtaining input from partners on how to accomplish and implement the steps defined in the Pathway Approach. Phase 4 will organize these inputs into the Pathway Approach to produce guidance documents that will help:

- A) communities grow as partners and leaders of monitoring and research that addresses their concerns and influences decision makers;
- B) academic and government researchers understand how to effectively involve northerners and how to develop monitoring and research programs that meet the needs of northerners; and
- C) decision makers to influence the development of an information base (data/reports) that can be used as evidence when making decisions on resource management (e.g.: Renewable Resource Boards, Land Use Planning Boards), to assess impacts of development (e.g.: Land and Water Boards) and to plan and design developments (e.g.: proponents).

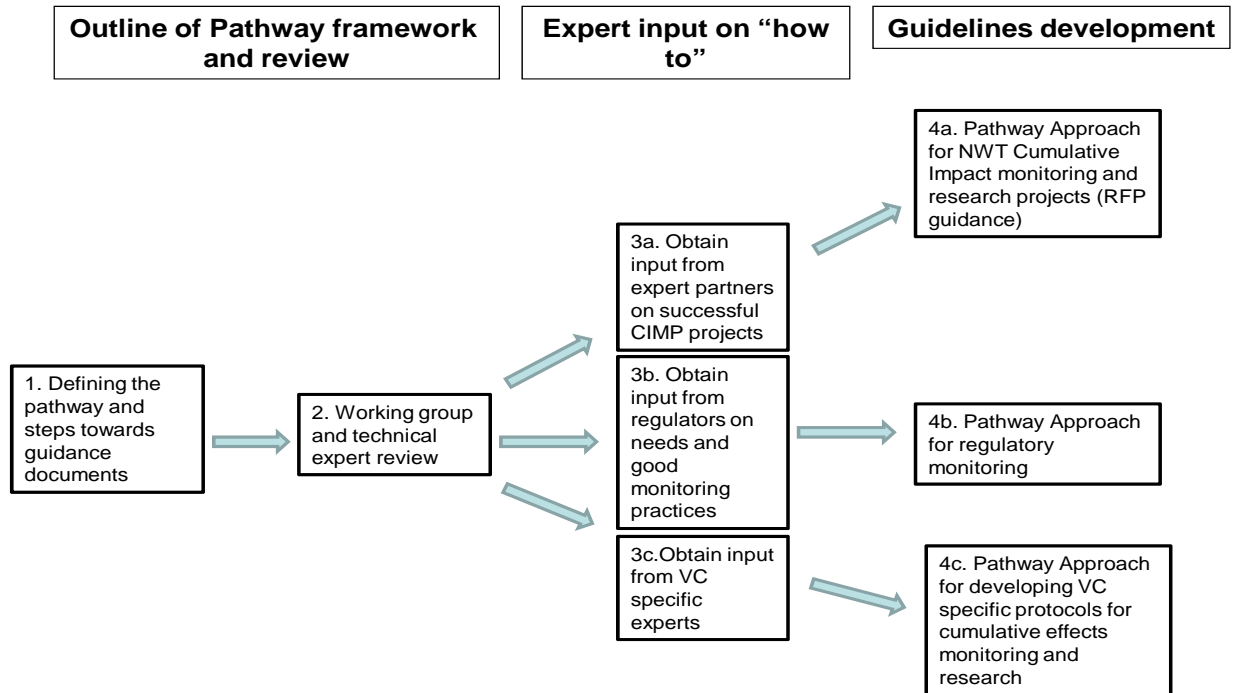


Figure 1. Proposed CIMP “Pathways approach” workplan. This document is the output of Phase 1 and 2.

This document is the outline of the Pathway framework “THE CIMP PATHWAYS APPROACH: Developing a common platform for NWT monitoring. V-2011-06-23”. This consultative framework will yield several versions of the Pathways Document tailored to various types of cumulative impact monitoring and research (see Figure 1; Guidelines development 4a, b, c).

BACKGROUND ON THE CUMULATIVE IMPACT MONITORING PROGRAM (CIMP):

CIMP is an NWT-wide initiative that is focused on integrated monitoring and research on a range of Valued Components (VCs) including their indicators. CIMP aims to guide and support monitoring & research on the state of the NWT environment and on the cumulative environmental impacts of multiple stressors. Variation in the environment from place to place and over time, and the factors that cause those changes must be understood to help ensure that northern development can be properly planned and assessed and so that potential impacts can be determined and managed. The intent is that the monitoring and research information will be accessible to and used by communities and decision makers.

The CIMP **mission** is “To watch and understand the land and to use it respectfully forever”. “To watch the land” refers to monitoring and research which is conducted using Science and Traditional Knowledge. “Understanding the land” requires that the information collected is managed, analysed and interpreted so that the state of the environment can be described and the drivers of environmental change can be identified. “Using the land respectfully” requires that the knowledge developed from monitoring and analysis is useful and can be accessed by decision-makers. In the context of NWT CIMP, a decision maker includes anyone who requires information on the NWT environment to make informed choices to ensure that responsible economic developments occur within a sound environmental management framework. NWT decision makers can include communities, regulators, co-management boards, planners and proponents.

The broad **goals** of CIMP include developing and strengthening a culture of environmental monitoring and research in the NWT. Supporting a culture of knowledge generation about the NWT environment will help inform northerners and ensure that management decisions are based on rigorous, relevant and comprehensive information. One CIMP priority is to promote collaboration by enhancing partnerships amongst groups and individuals, such as academics, agencies, and community-based organizations that are carrying out or have interests in research and monitoring activities in the North. Monitoring and research partnerships require northern capacity to ensure tangible engagement in project activities and an understanding of results.

Flowing from these broad goals, the specific **objectives** of the CIMP are to:

1. Establish a common platform for cumulative impact monitoring and research;
2. Promote monitoring and research partnerships;
3. Improve access to monitoring information;

4. Analyse cumulative effects in a systematic way using science and traditional knowledge;
5. Generate a knowledge base that will inform decision making.

The program has a strong mandate to engage northerners, and be responsive to evolving environmental priorities in northern communities. CIMP must also provide guidance to regulators, industry and other groups involved in monitoring and research in the North.

“THE PATHWAYS APPROACH”

The Pathway Approach articulates the common steps required to develop effective cumulative impact monitoring and research programs in the NWT. This document outlines the steps in this approach with the aim of providing a consultative framework to collect input on the development, implementation and maintenance of effective cumulative impact monitoring and research programs in the NWT. This document defines the basic principles and approaches for determining monitoring needs, assessing options, and then taking steps to implement monitoring and research activities that will generate information relevant to northern communities and decision makers.

The CIMP Pathways Approach requires that the partners work together to identify: 1. Project goals and questions; 2. appropriate monitoring indicators and study design; 3. methods for data collection and management; and 4) plans for analysis and reporting techniques.

The following are the steps along the Pathway:

- Step 1) Defining the purpose: Why are we monitoring?
- Step 2) Developing the conceptual model: How does the world work and what do we need to look at?
- Step 3) Conducting a review: What is already known?
- Step 4) Developing the hypothesis: What are the questions that need to be answered?
- Step 5) Designing the study: How will we find the answers?
- Step 6) Data collection: Gathering the information
- Step 7) Data management and analysis: Turning data into knowledge
- Step 8) Reporting and publication: Telling the story
- Step 9) Adapting: What has changed? Are we still asking the right questions?

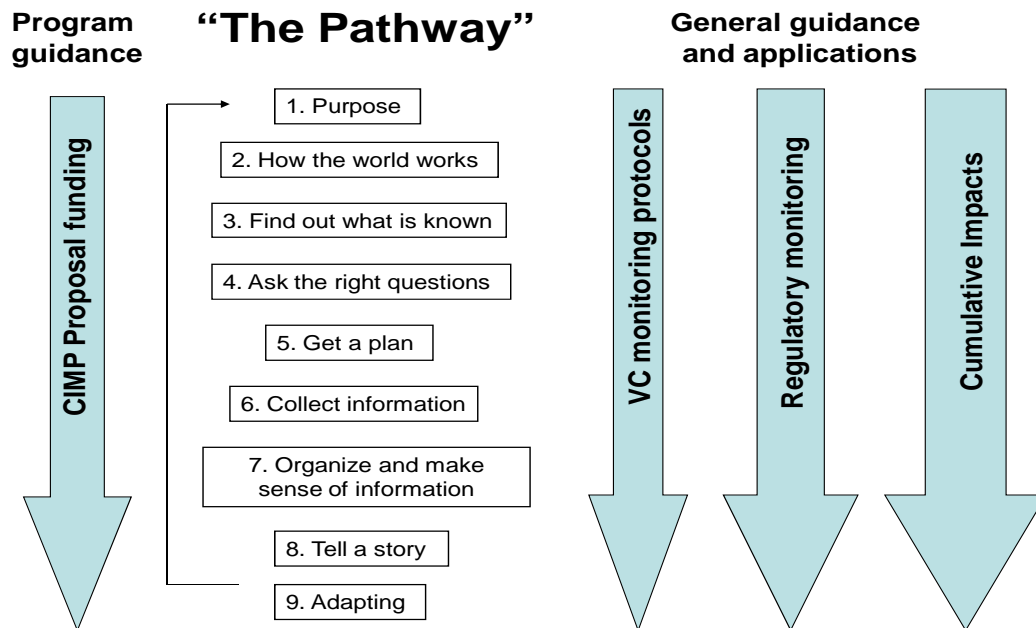


Figure 2. The 9 step pathway provides broad guidance in the steps, approaches and principles involved with initiating and implementing cumulative impact monitoring and research activities that engages northerners and generates information relevant to decision makers.

Step 1) Defining the Purpose: Why are we monitoring?

What and why. The first step in developing a CIMP monitoring or research project is to identify issues and concerns and to describe how these relate to the assessment of cumulative impacts. This will help to define the purpose of the monitoring. The purpose may be broad (Is the water quality changing?) or specific (Is seismic activity significantly impacting Woodland Caribou habitat?). Defining a clear purpose is the critical first step along the Pathway, and the step upon which all others depend. Clear expression of purpose will help to define the project scope, identify appropriate monitoring indicators, and guide the development of study design, data collection methods, data management, analysis and reporting techniques. At this initial stage it is important to assess the potential contributions of Traditional Knowledge and science. It is also important for researchers to understand that they have a responsibility to ensure that their research is relevant to the north and northerners.

Who. Step 1 requires that partners work together to identify the purpose of the proposed monitoring project. Close collaboration between scientific researchers, community members and other agencies (in the case of regulatory monitoring) is required at this stage.

How: It is important that proponents of monitoring and research projects understand that partnerships and collaborations should be developed concurrently with developing and refining the purpose. It is important that partners understand and agree on the general purpose of the intended monitoring or research activities. This requires a plan, resources and commitment to communicate effectively. Northern meetings or workshops can provide a venue where stakeholders can discuss critical issues and define the purpose of the monitoring or research.

Step 2) Developing the conceptual model: How does the world work and what do we need to look at?

What and why: Once the purpose of the project is defined, project partners must work collaboratively to identify the most relevant valued environmental components (VCs) to be tracked in order to meet the monitoring and research objectives. This process should focus on describing relationships amongst the environmental component(s) of concern, their indicators and possible stressors (Figure 3). For example, in a particular region, declining populations of Dolly Varden Trout may be an issue of concern. Discussions amongst communities, scientists and other stakeholders may identify that population health is related to the quality and accessibility of spawning habitat. Developing a systems model, based on inputs from various partners, including communities, may determine that relevant indicators to track are those which impact fish habitat, including water quality, water quantity, landscape change or development activities.

This step can help the monitoring team to recognize overlap or duplication with other initiatives, and identify potential synergies and partnerships. This step will normally involve background knowledge, either from local sources or contemporary science. This step provides the foundation to support and focus the design of the monitoring or research program.

Factors affecting fish population

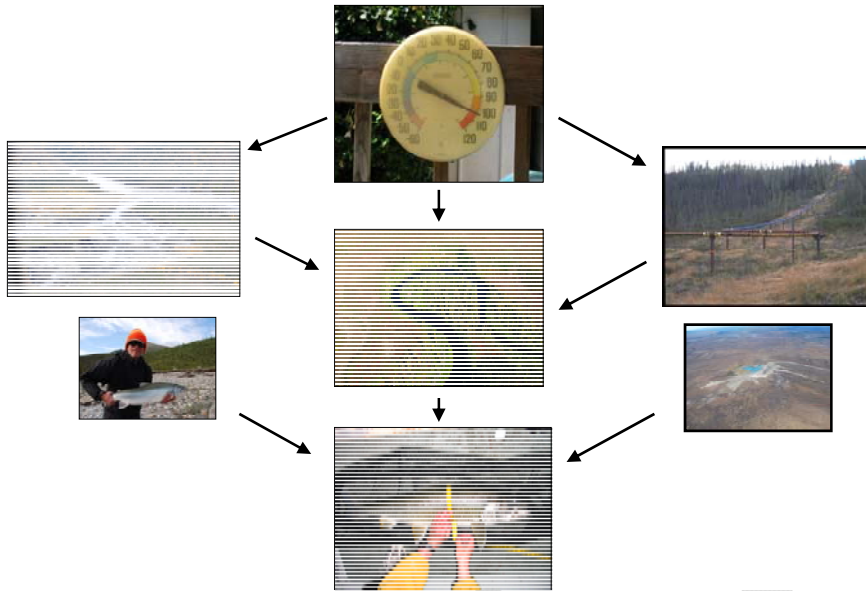


Figure 3. Simplified schematic showing stressors on spawning Char.

Who: This stage requires that project partners share knowledge on the environment that is relevant to the monitoring or research goals.

How: Workshop settings can be an effective venue in which to share knowledge. Conceptual or systems models are a useful tool that can help partners develop a common understanding of the environment and communicate complex system-level relationships and interactions among VCs and stressors.

Step 3) Conducting a Review: What is already known?

What and why: Prior to implementing a monitoring or research project, a review must be undertaken to compile and integrate existing information on the selected VC(s), the region and the environmental indicator to be monitored. This review should consider both scientific and Traditional Knowledge. Information collected can help set the context for the proposed monitoring by reviewing the state of knowledge on the issue or phenomenon of interest and identifying existing complementary projects and relevant datasets. This step can also identify appropriate field and analytical methods. It is important that the knowledge acquired during this step is shared with the partners because it will inform further development of the monitoring or research program. This

step may contribute new information to the conceptual model described in the previous step. Flexibility to refine and adapt the conceptual model in step 2 can improve the quality and focus of the monitoring program.

Who: This step is typically led by the group responsible for implementing the monitoring program. It is important that roles and responsibilities be agreed upon and defined early in the monitoring and research program. Partners can contribute important information at this stage and should be involved through consultation. CIMP guidance documents could assist researchers in identifying appropriate organizations to contact.

How: The review of relevant literature typically takes the form of a desk study, but may also involve targeted consultation with knowledgeable local experts. It is likely that partner engagement in steps 1 and 2 will also provide important background information. It is important that information shared during the process of Steps 1 and 2 is effectively captured and included as an output of Step 3.

Step 4) Developing the hypothesis: What are the questions that need to be answered?

What and why: Developing research questions and specific hypotheses guide the collection and analysis of monitoring data. Asking the right questions is critical as it will focus the monitoring and research and ensure that the results are useful. Engaging decision makers and communities in the development of research questions will increase the likelihood that results will be of use in decision making. The broad questions to be answered by monitoring are dictated by the scope and context defined in Step 1. Specific questions will be refined as the partners identify key indicators and relations between indicators and stressors (Step 2).

The goal of this step (Step 4) is to develop hypotheses that can be used to test the conceptual model developed in Step 2. Several explanations may be proposed, and part of the monitoring or research program's objectives will be to determine which explanation is the most accurate. A hypothesis serves as the starting point for further investigation. They are framed as statements that can be tested and then supported or rejected based on the analysis of appropriately collected data or information. CIMP can support monitoring projects that test hypotheses (or questions) relevant to the assessment of cumulative impacts. It should also be recognized, that testing a hypothesis is a scientific idea, but TK projects can also be organized around research objectives or questions.

Who: The lead scientists or technical advisors involved in the project may take primary responsibility for Step 4, and should explain the hypotheses to the satisfaction of all

partners. Hypotheses should be formulated on the basis of partner inputs gathered in Steps 1-3.

How. Steps 1-3 provide the foundation for defining research questions and developing hypotheses. Development of the conceptual model in Step 2 allows the research partners to identify the key factors that are believed to impact the VC or indicator of interest. The hypotheses should be developed with consideration of this information.

Step 5) Designing the study: How will we find the answers?

What and why. Step 5 involves developing a plan that will guide field and analysis activities to support the project objectives. The project team must work together to determine how, where and when the information will be collected. This step also involves determining the appropriate ways to analyze this data in order to test the hypothesis.

Once a study design has been agreed to, the research partners must plan logistics for data collection and storage of the results. Logistics planning involves solving issues of data management, field safety, budgeting resources and in some cases, planning for contingencies in sensitive areas due to ecology or traditional uses.

It is important that field and analytical methods be developed and refined concurrently. This will avoid the risk of collecting insufficient or inappropriate data, which may hinder the development of substantive conclusions. In some cases, consultation with a professional statistician is a good way to ensure that resources are utilized optimally. The roles and responsibilities of individual participants should be identified and the schedule and locations for data collection must be determined. It is important that the partners engage in discussions related to logistics, and this should take place prior to final decisions on field and analytical approaches. Early agreement on logistics will ensure that the implementation of the project (data collection and analysis) goes smoothly.

Who. Methods employed in CIMP projects should be balanced by best practices for data collection and available methods, available capacity and resources to implement the monitoring or research, and logistical and safety considerations. Consequently, the development of field methods and study design will benefit tremendously from discussion amongst the project partners and external expert review. It is also critical to engage local field staff, who can be trained to implement the field program, and to collaborate with local land users who understand the landscape and environmental logistical constraints.

How. Rationalizing and developing an effective study design depends on the completion of Steps 1-4. Creating a study design that will support hypothesis testing requires effective communication amongst scientific and technical staff, land managers and land

users. This is achieved when communities help to identify priorities, by sharing their concerns, recent observations and understanding of the environment while scientists provide leadership in developing appropriate field and analytical methods, and then meet face to face with their partners to discuss details of the study design. The team must ensure that the necessary partnerships are in place, and that adequate funds are allocated in order to effectively carry out the fieldwork.

To ensure the effectiveness of monitoring and research in the NWT and to facilitate the development and implementation of a project specific study design CIMP supports:

- a) Training and capacity building: Employing local field workers helps to ensure that the project is well anchored in communities. Rigorous training is critical to safeguard data collection quality and to ensure that necessary safety procedures are followed. CIMP encourages monitoring and community agencies to train community members and support the integration of standard field methodologies into the curricula of secondary and post-secondary education.
- b) Field data collection protocols: CIMP VC experts will be supported to identify and develop appropriate methods for data collection and reporting. These findings will be integrated with evolving documentation of VC-specific monitoring guidelines as they become available.

Step 6) Data collection: Gathering the information

What and why: In the NWT, data collection is typically the most costly and complex step in project implementation. The high cost of fieldwork and the importance of quality data make it vital that field methods are clearly defined. Procedures must be well understood and followed by a trained field team. It is also critical that the field team is trained in safety procedures.

Who: It is critical that a field program leader be identified to ensure coordination of data collection and field safety. Following identification of the leader, trained field staff (scientists, technicians, and community members) must collaborate in data collection. Wildlife and environmental monitors should be engaged as per licensing requirements. The ease of implementation, degree of collaboration and understanding of the results increases immensely if there exists northern monitoring and science capacity.

How: Collection of northern environmental data may involve fieldwork, interviews and/or analysis of remotely sensed information including aerial photographs or satellite imagery. Procedures for collection of field samples and recording of field data should conform to data management protocols (see Step 7). In the context of community-based monitoring programs, collaboration between scientists and local community members is

critical to knowledge exchange, capacity building, and monitoring efficiency. This approach will also help to build a shared understanding of environmental issues.

Step 7) Data management and analysis: Turning data into knowledge

What and why: It is important to recognize that scientific data are converted to “knowledge” through the testing of ideas and hypotheses via analysis. For example, unless data are properly processed and analyzed using appropriate tools (e.g. graphs, statistical tests) it will not be possible to evaluate if a VC or indicator is changing over time, or to determine the rate of change. Consequently, it is vital that the monitoring team has the capacity to collect and process their data using the appropriate tools. The outcome of this step is crucial to the process of clearly answering the monitoring or research questions (validating or refuting the hypothesis).

Where possible, CIMP project teams should make their environmental data accessible to communities, scientists, NGOs, industry and decision makers. Monitoring and research information from multiple initiatives may be integrated to address new questions, and to answer questions at different scales. Effective data management improves opportunities for information sharing which can significantly improve the capacity to detect cumulative effects and allows each monitoring team to adapt their plans based on prior lessons learned.

Who: Data collected by numerous initiatives in the NWT often resides with the data collector, where it may not be readily accessible to others. Once data pertaining to a given VC has been collected - using standard protocols – project technical staff may then add appropriate information (data) to a centralized repository that has been set up for VC-specific information. Analytical and archival activities are typically the responsibility of project technical staff.

How: CIMP will work towards developing information management services for northerners that will allow them to publish and store information and access reports on monitoring and research across the Arctic.

Data management needs for major VCs and their associated indicators must be identified and supported on a priority basis. Existing repositories for information should be identified.

Step 8) Reporting and publication: Telling a story

What and why: Sharing the findings of monitoring and research is a critical step in the Pathways Approach. The results of CIMP monitoring and research projects should be shared with target audiences in appropriate fashion following a planned schedule.

Monitoring and long-term research programs require that results are reported periodically and formally reviewed by partners and decision makers.

Who: The individual or agency conducting the monitoring or research will typically be responsible for developing reports. Thus the nature of reporting should reflect the purpose of the monitoring or research, and the needs of the partners/decision makers.

How: Project results can be reported in a variety of ways, but the most appropriate format will be dictated by the goal of monitoring or research. The nature of reporting, including format, timing, style and intended audience should be defined early in the monitoring process by the project partners. The following are examples of how monitoring results can be reported:

- peer reviewed publications and reports
- plain language reports
- research summaries (Aurora research licence)
- legal documents associated with compliance reporting
- presentations, workshops, conferences
- public meetings
- websites
- guidebooks

Step 9) Adapting: What has changed? Are we still asking the right questions?

What and why: Monitoring and long-term research programs should take an adaptive approach, where activities are adjusted to address stakeholder concerns and improve service to ongoing resource management and decision making. The monitoring and research process itself should be continually evaluated based on the projected information requirements dictated by new management questions, community concerns, as well as any notable departures from baseline measurements observed. Information generated from monitoring and research should be incorporated into the process of developing policy and setting priorities.

Who: Adaptive management is typically a multi-party, multi-disciplinary undertaking that includes community stakeholders, land users, scientists, regulators, NGOs and industry. The contribution of all of these groups is required in order to develop a full appreciation of the results to date, provide input on any possible shortcomings in the data, and identify and plan for the future monitoring priorities.

How: At the end of every project, or after a predefined period of monitoring (2-years), there should be a review of the results to date. There are three possible outcomes of the monitoring or research program review:

(1) *Program should be continued.* The management question remains critical, and maintaining a long-term record is a priority. Continuation may be a priority if there

has been an observed 'drift' from baseline measurements, or a change in the system variability.

(2) *The monitoring or research should be adjusted.* Changes to the frequency or spatial density of the measurement program may be appropriate in response to stable, low variance data (lower frequency/density needed) or to unexpected fluctuations and variability (higher frequency/density needed). In the course of adjusting the monitoring regime it is crucial to keep in mind the initial questions and hypotheses, and be careful not to compromise the study design that was initially developed. If a program is reduced without such consideration, the data may lose their explanatory power.

Other program adjustments might include updating monitoring equipment, incorporating new techniques, corrections, calibrations, or integration with other monitoring activities. All changes should be carefully documented.

(3) *Program should be discontinued.* A cost/benefit analysis may reveal that a monitoring need no longer exists. This may arise following a change in management or community priorities, the observation that measurements show little variation, and/or the discovery of other data sources that can duplicate the results being collected. If new questions have arisen, it may be time to consider a different approach to the monitoring.
