Report on Cumulative Effects Management in Alberta For the Bow River Phosphorus Management Plan

Final Project Report

March 2014

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1. Introduction

When the cumulative effects management system was formally launched by the Government of Alberta in 2007, it included an expectation that pilots would occur in "various parts of the province at different scales", with an intent to:

- "Address real and pressing cumulative effects issues;
- Test the approach in the real world to learn from experience and adapt;
- Demonstrate to the public and stakeholders what a results-based system is and how it can work."

(Alberta Environment, 2007:20)

At a sub-regional scale, several pilots or prototypes have since commenced, one of which was the management of phosphorus inputs to the Bow River.

The development of a Bow River Phosphorus Management Plan was initiated in mid-2011 and a draft plan is expected to be finalized in the coming months of 2014. To receive feedback on the process, a lessons learned study was carried out partway through the development of the plan in early 2013[1]. Since then, an additional year of preparations has occurred. Alberta Environment and Sustainable Resource Development (ESRD) has now sought further review of the prototype and other research for the preparation of an internal guide to assist similar processes in the future.

This report presents an overview of cumulative effects management in Alberta to date with a focus on sub-regional activities, along with a detailed description of the Bow River Phosphorus Management Plan prototype and lessons that may be applicable to future, similar processes. A suggested process is outlined that builds on experience to date, and a compendium of tools and other elements is presented to assist sub-regional plan development and implementation.

This report is structured as follows:

- Section 2 describes the policy context for cumulative effects management in Alberta, including examples of regional and sub-regional planning.

[1] Refer to project report by Elinam Consulting, "Bow River Phosphorus Management Plan: Lessons from the process of plan development", project ref. AESRD-OPSSOU-130325.

- Section 3 describes the Bow River Phosphorus Management Plan as a process case study and prototype of sub-regional cumulative effects management, with identification of key steps and what was learned during the process.
- Section 4 offers elements that may assist future processes for cumulative effects management, including decision support tools, process examples, and concepts.
- Section 5 provides a suggested outline for the preparation of a guidebook to support future sub-regional planning initiatives.
- A list of those participating in this study and the interview template used to elicit the most recent lessons learned are provided in the Appendix.

1.1 Acknowledgements

The author wishes to thank the interview participants and others who offered advice (listed in Appendix A) for their perspectives that contributed to the contents of this report.

This project, *Bow River Phosphorus Management Plan – Cumulative Effects Implementation: Research and Resources*[2], was undertaken by Elinam Consulting (Amy Mannix[3]) with the oversight of Louella Cronkhite (ESRD). The project was conducted from January to March 2014.

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2. Environmental cumulative effects management in Alberta

2.1 Progression of a system to manage cumulative effects

The development of a cumulative effects management system (CEMS) was launched in 2007 as a policy direction in the public discussion paper, "Towards environmental sustainability: Proposed regulatory framework for managing environmental cumulative effects" (Alberta Environment, 2007). The need for cumulative effects management was considered from a holistic perspective that takes into consideration factors such as the environment, human health, economics and social values, including the risks related to maintaining a "social licence" so that economic activity and new investment could continue with certainty. It was recognized that the approach overlaps with other initiatives, including the Land-use Framework and the Water for Life strategy.

The approach is described as results-based, by setting environmental objectives (i.e., target outcomes) at the outset based on environmental risks and socio-economic values, then developing systems to manage results to within the set objectives. The setting of an environmental objective is defined as a trade-off decision that is a matter of social choice. In addition to current approaches, cumulative effects management would enable "a full toolbox of non-regulatory and policy tools, including economic incentives, education and voluntary action" to achieve objectives (Alberta Environment, 2007:6). Generic, site-based environmental authorisations would eventually be replaced with conditions that consider the effects on regional objectives.

The proposed design elements of the system were:

- Clear objectives, defined for the present state and into the future (i.e., forward-looking) with recognition of the social, economic and environmental implications of meeting the objectives.
- Place-specific objectives, at different spatial scales (provincial, regional and sub-regional).
- Adaptive, in response to performance, risk and changes in circumstances.
- Shared stewardship, via collaborative development of objectives and implementation.
- Knowledge based, involving information of existing and future projected states.

Two fundamental components of the system are the setting of objectives and strategies. An objective is a quantitative and measurable ambient environmental indicator, while strategies refer to adaptive measures that may include policies, programs, and regulatory and non-regulatory actions to achieve objectives and may include performance indicators, and monitoring, evaluation and reporting. In terms of the roles of various actors, it was foreseen that stakeholders and other governments would advise and recommend to the Government of Alberta the appropriate objectives and strategies to achieve those objectives, and to be involved in implementing strategies and monitoring results (Alberta Environment, 2007:10). The role of the Government of Alberta would then be to ensure that the defined objectives are achieved. Two options considered for developing objectives and strategies were delegation to multi-stakeholder organisations, or the establishment of government-appointed advisory committees.

A list of the basic features of environmental cumulative effects management in Alberta is provided in Table 2–1.

Table 2–1 Proposed direction for managing environmental cumulative effects in Alberta*

Management Aspect	**Proposed**
Environmental media	Air, land, water, and biodiversity together (as opposed to single, one-by-one approach to controls)
Spatial context	Management may occur over a variety of scales, that may eventually result in nested plans and a hierarchy of objectives
Scope	Regulated and unregulated activities
Outcome	Defined results (as opposed to mitigated impacts)
System organisation	Connected
Responsibility / participation	Collective action
Performance measurement	Essential (rather than “as required”), comprehensive

*Source: adapted from Alberta Environment (2007:9).

A departmental handbook, “Walking the Cumulative Effects Talk: A Case Study Approach”, was released in the following year (Alberta Environment, 2008). The handbook provides step-by-step guidance on the recommended process to prepare plans to manage environmental

cumulative effects by identifying and explaining nine separate process elements required to implement the approach from an operational or internal perspective (Figure 2–1). The handbook demonstrates examples of the implementation of selected steps using descriptions of the following case studies:

- East Central Alberta Cumulative Effects Project
- Industrial Heartland Project
- Bow River Basin Water Management Plan.

Figure 2–1 Operational process elements of a cumulative effects management system (Alberta Environment, 2008)

Following internal research and communications, a system for implementation of cumulative effects management was further described in the May 2010 report, "AENV Functional Design: CEMS Transformation". The report outlines the core functions and sub-functions necessary to implement cumulative effects management in practice. While the report was written with a broader purpose to inform the restructuring of environmental management functions within government to assist in implementation, it remains a highly useful resource for describing the system requirements. The process was simplified into four broad functions, each with stated principles, enabling conditions, and capability requirements of project staff. The functions, sub-functions and tasks were outlined as follows:

1. Set the strategic direction
    a. Acquire strategic intelligence
        i. Gather information
        ii. Extract intelligence
    b. Confirm strategic intent
        i. Determine strategic intent
        ii. Ensure clarity of strategic intent
        iii. Evaluate and report progress
    c. Strategic planning
        i. Analysis
        ii. Identify collaborative opportunities
        iii. Identify relationship-building opportunities
        iv. Manage reputation
        v. Develop options
    d. Operational planning
2. Develop and refine outcomes and strategies
    a. Identify issue, value and opportunities
        i. Scanning
        ii. Define coarse issue, value and opportunities
        iii. Coarse screening and priorities assessment
    b. Assessment, research and analysis
        i. Build the policy development proposal
        ii. Refine issue definition
        iii. Reach conceptual agreement on policy outcomes and objectives
    c. Develop outcomes and policy options
        i. Identify and develop outcomes and options
        ii. Evaluate options and outcomes
    d. Decision making
        i. Develop appropriate policy and outcome decision-making model(s)
        ii. Document decision

    e. Transition to implementation
        i. Develop an implementation and management plan
    f. Measure and evaluate performance
    g. Engagement
3. Deliver
    a. Issue authorisations and approvals
        i. Assess environmental cumulative effects
        ii. Consider authorisation options, including performance-based, outcomes-based, and risk-based
        iii. Consider Water Act approval options
    b. Consider "non-regulatory" approaches
        i. Determine tool suitability and adaptability
        ii. Consider collaborative options for choice of tool and implementation
        iii. Choices include market-based instruments, and proactive tools such as management frameworks, approved water management plans, and other regulatory tools as may be made available with legislative change
    c. Assure compliance
        i. Choices include education, preventative approaches, and enforcement
4. Evaluate and report performance

The knowledge and performance management requirements in transforming to cumulative effects management were also outlined, based on the following sub-functions and tasks:

1. Inform the development of outcomes and select indicators
    a. Analyse current state and trends
    b. Determine public preferences and priorities
    c. Analyse scenarios
2. Inform the design and delivery of strategies
    a. Plan
    b. Prioritize
    c. Monitor delivery

    d. Quality assurance / quality control
3. Measure environmental and corporate performance
    a. Evaluate environmental condition and pressure indicators
    b. Evaluate response indicators
    c. Report
4. Manage knowledge
    a. Foster effective relationships
    b. Capture knowledge
    c. Mobilize knowledge
    d. Measure knowledge

In 2011, an internal document was produced by the Strategy Development and Foresight division titled: "Enabling Cumulative Effects Management" (Alberta Environment, 2011). The document reaffirms the purpose of cumulative effects management within the evolving context of land-use planning, and proposes new and enhanced tools and mechanisms to implement cumulative effects management, including environmental management frameworks, proposed cumulative effects directives, outcomes-based authorisations, and compliance assurance tools.

It is clarified that outcomes "may be described through objectives, including limits and targets", where targets represent desired outcomes, and limits define the point at which risks become unacceptable (Alberta Environment, 2011:9). In terms of who should participate in cumulative effects management, "everyone, whether currently regulated or not, who contribute[s] to cumulative environmental effects will be responsible" in limiting or reducing their impacts (Alberta Environment, 2011:10).

Table 2–2 Responsibilities within a cumulative effects management system*

Environment and Sustainable Resource Development	**Contributing parties to environmental impact**
Active and/or assurance role in the collection, monitoring and reporting of data[1].	Participate in good faith in the development of limits, triggers and targets
Modelling of environmental conditions, assessment and evaluation	Participate in the collection of data, monitoring and reporting

Coordinating management responses and developing policy	Respond with appropriate management actions according to defined strategies to address environmental risk
Administering the system to provide for transparency and certainty	Sustain a commitment to continual improvement and best management practices regardless of environmental risks and
Anticipating and strategically assessing potentially contributing but currently unregulated activities	

*Source: adapted from Alberta Environment (2011:13-14).

1. Note: the roles and responsibilities regarding data is under transition.

2.2 Scale and links to regional land-use planning

The scale of an environmental issue affects the management form and process to be adopted for cumulative effects management; for example:

- Provincial scale issues may require a custom process e.g., aquatic invasive species, water protection and conservation.
- Regional scale issues may be addressed by regional land-use plans, including the designation of regional environmental management frameworks.
- Sub-regional scale issues apply to particular environmental issues of concern within a defined area. These concerns may be identified under the operation of an environmental management framework, e.g., identification of a trend that is forecast to exceed acceptable limits.

Cumulative effects management may be implemented with or without land-use plans in place. Where regional land-use plans exist, clear links can be drawn to sub-regional cumulative effects management plans (Figure 2–2). These links should be emphasized to assist implementation.

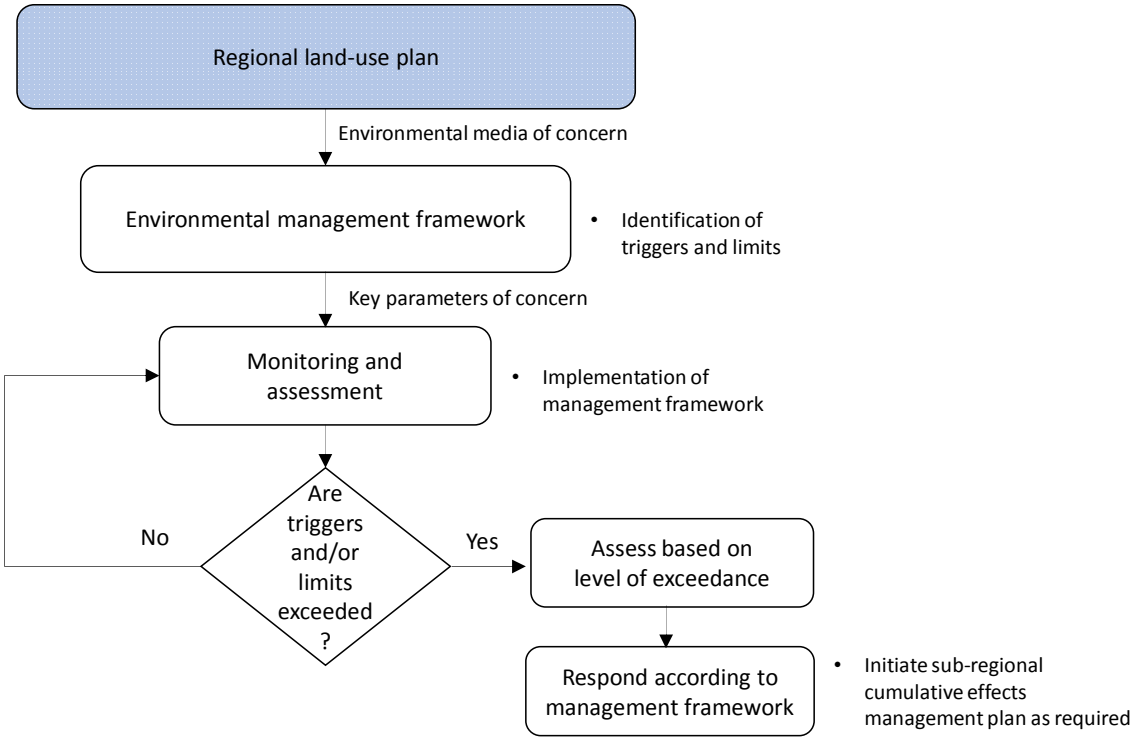

Figure 2–2 Conceptual relationship between regional land-use plan and initiation of sub-regional cumulative effects management plan

In the case of cumulative effects management plans of the Industrial Heartland and Capital Region, frameworks have been specified at the sub-regional level. The relationship between the air quality management framework and management planning is reproduced in Figure 2–3.

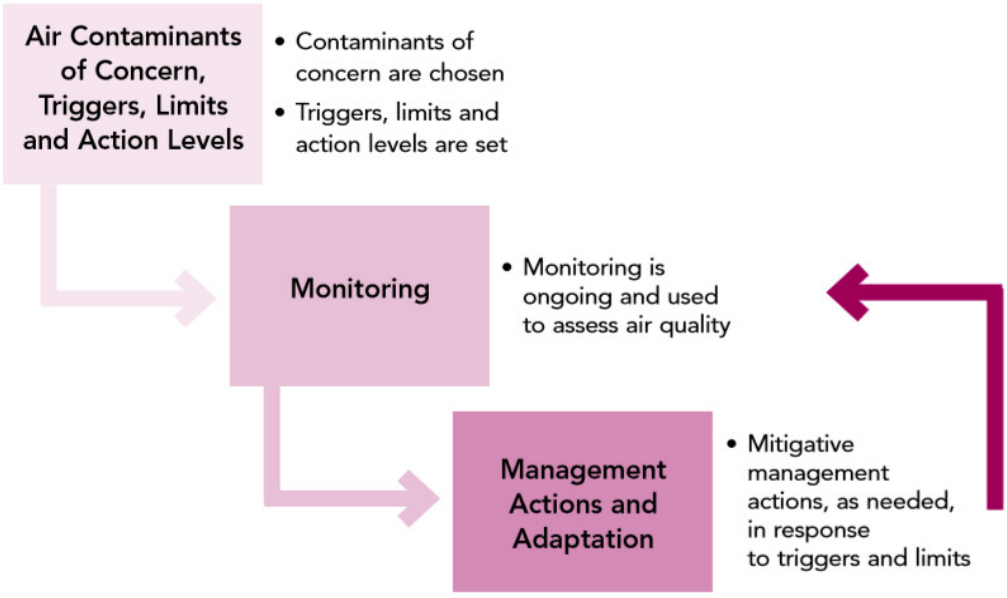

Figure 2–3 Management response steps of Air Quality Management Framework for the Capital Region (Alberta Environment and Sustainable Resource Development, 2012:4)

The Surface Water Quality Management Framework for the Lower Athabasca River provides a more detailed depiction of the progression between monitoring under the framework and the initiation, implementation and review of management actions under a sub-regional cumulative effects management plan (or similar), reproduced in Figure 2–4.

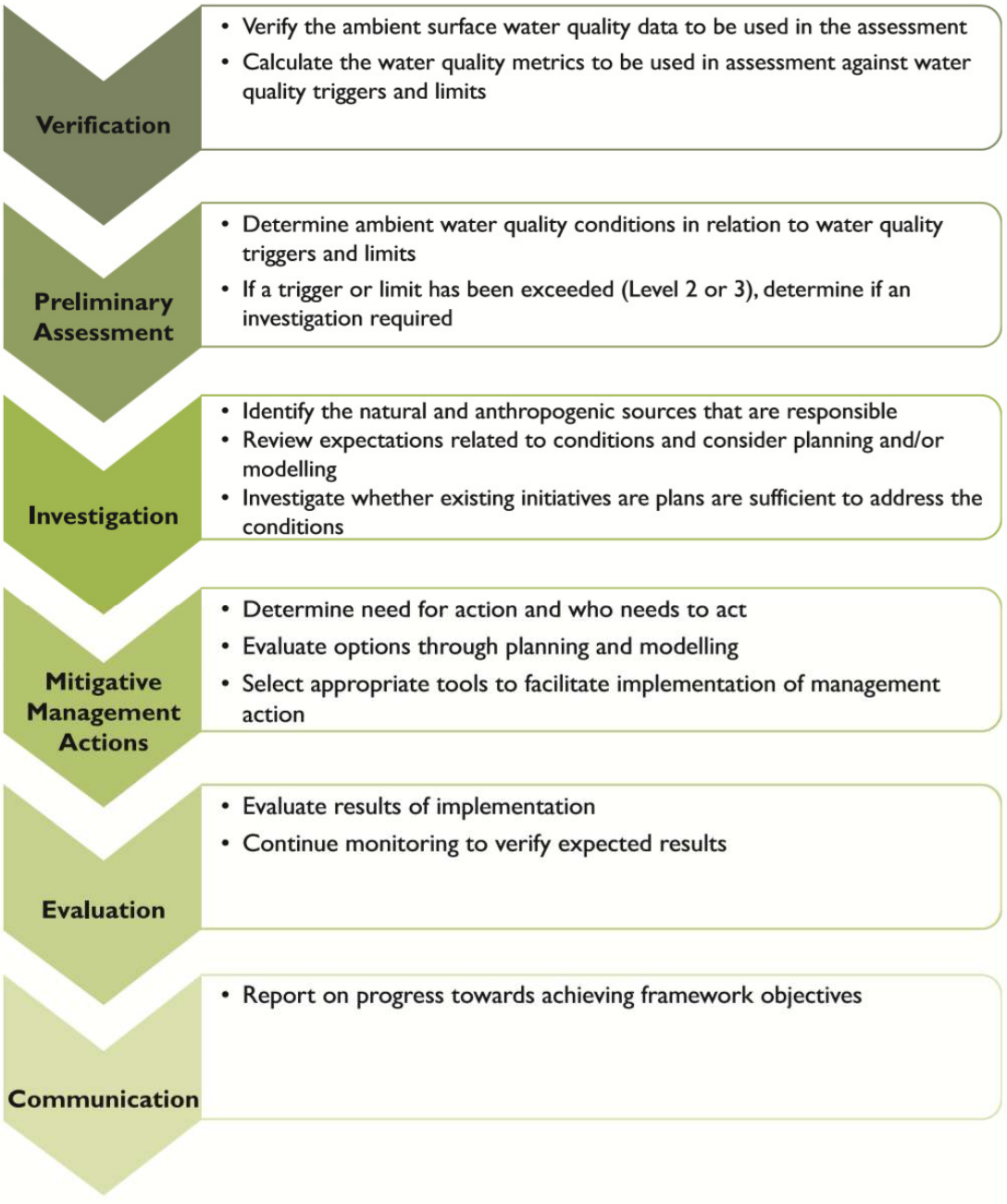

Figure 2–4 Management response steps of the Surface Water Quality Management Framework for the Lower Athabasca River (Government of Alberta, 2012:31)

2.3 Management examples

Since the cumulative effects management system was proposed in 2007, several pilot or prototypes have been underway. Cumulative effects management as a concept is not new, and other examples exist prior to the launch of the system that involve elements of the system as envisaged. Summaries of selected regional and sub-regional plans that align with the management of cumulative environmental effects are outlined in the tables below in chronological order. In addition to these examples, an early discontinued example was the East Central Alberta Cumulative Effects Project (June 2008 to March 2009).

Table 2–3 Water Management Plan for the South Saskatchewan River Basin

Status	Approved in 2006, certain controls in effect from May 1, 2005
Environmental media	Water
Spatial context	South Saskatchewan River basin. This includes the Red Deer, Bow, Oldman and South Saskatchewan River sub-basins.
Scope	Regulated water extractions under the Water Act.
Target outcomes	Target outcomes are in the form of mitigated impacts rather than being explicitly defined. Bow, Oldman and South Saskatchewan sub-basins: ▪ Provide first steps toward restoration of aquatic environment. Red Deer River sub-basin: ▪ Permit water diversion while limiting negative impacts on the environment.
Objectives	Bow, Oldman and South Saskatchewan sub-basins: Water conservation objective of 45% of the natural rate of flow, or the existing instream objective plus 10% - whichever is greater – at any point in time. Red Deer river sub-basin: water conservation objective set according to licence issue period, location, and time of year of diversions (refer to plan for quantitative limits).

Key strategies	Applications for new water allocations suspended in certain sub-basins. In the remaining sub-basin (Red Deer River), a review will occur when annual licensed water use reaches 550 000 cubic decametres. Existing and new water licences are subject to water conservation objectives that limit diversions according to in-stream conditions. Water transfers subject to discretionary 10% reduction in volume for conservation purposes.
Responsibility / participation	Primarily regulated entities under the Water Act. Though not the focus of the plan, unregulated activities are broadly mentioned. These include encouragement of voluntary water conservation, and management planning by Watershed Planning and Advisory Councils.
Performance measurement	Performance monitoring of a range of subjects is mentioned along with assigned responsibilities. The form and frequency for reporting performance measures is not specified.
References	Refer to Alberta Environment (2006). http://environment.alberta.ca/01235.html
Other notes	Early seminal example of cumulative effects management.

Table 2–4 Water Management Framework for the Lower Athabasca River

Status	Phase 1 released in 2007, Phase 2 under development since mid-2007.
Environmental media	Water quantity, linked to aquatic ecosystem habitat.
Spatial context	Lower Athabasca River from downstream of Fort McMurray to upstream of the confluence of the Firebag River (area of industrial development).
Scope	Regulated activities.
Target outcomes	Protect the ecological integrity of the lower Athabasca River during oil sands development.
Objectives	Provide a high level of environmental protection, while ensuring water use restrictions are realistic and the framework can be implemented efficiently.
Key strategies	Maximum limits on instantaneous water withdrawals set based on in-stream flow conditions, with consideration of habitat area and flow variability when compared to historic conditions. Green-yellow-red threshold approach that applies increasingly stringent limits on water use during times of ecological sensitivity and low flow periods. Monitoring and research to refine the framework in Phase 2.
Responsibility / participation	Industry, as regulated surface-water users in the region, are to collectively define their annual plan to manage instantaneous water withdrawals in the case that the set limits are reached. The multi-stakeholder organization, the Cumulative Environmental Management Association, was originally tasked to make an in-stream flow recommendation in 2003 but did not do so within the allowable time period. The water management framework was then prepared by Alberta Environment and the federal department of Fisheries and Oceans Canada.
Performance measurement	Unspecified, though not required at this stage (water withdrawals significantly less than set limits under framework).
References	Alberta Environment and Fisheries and Oceans Canada (2007). http://environment.alberta.ca/documents/Athabasca_RWMF_Technical.pdf
Other notes	Phase 2 of the framework has been delayed well beyond the original timeframe.

Table 2–5 Water Management Framework for the Industrial Heartland and Capital Region

Status	First released 2007, 5-year review completed (2007-2012).
Environmental media	Water quantity and quality.
Spatial context	North Saskatchewan River from Devon to Pakan
Scope	Regulated activities. Unregulated impacts acknowledged though not explicitly incorporated.
Target outcomes	"World leader" in water and water reclamation technology. Minimise impacts via water conservation and quality improvements. Maintain aquatic life and support current and proposed industrial development.
Objectives	Improve in-stream water quality from "fair" to "good". No further deterioration of water quality. Keep water clean based on no more than a 20% increase in contaminants from Devon to Pakan.
Key strategies	Implementation plan to be created by an Implementation Committee. Explore opportunities for reclaimed water treatment and use. No new physical intakes of water along the river (unless there are no other options). Use of reclaimed wastewater where feasible. Use of Best Available Technology that is Economically Achievable ("BATEA"). Define science-based environmental outcomes. Establish thresholds to depict water quality for each parameter as part of a Water Management Framework (green-yellow-red designation). Thresholds are tied to management actions. Management options are to be explored when "yellow" conditions occur. Management plan to be implemented when "red" conditions occur e.g., surface water quality guidelines exceeded. Develop maximum allowable loads for contaminants of concern. Consider governance of regional wastewater treatment systems.
Responsibility / participation	Implementation Steering Committee comprised of industry, municipal government, Government of Alberta and a Watershed Planning and Advisory Council.

Performance measurement	Plan to evaluate environmental benefit of major policy and investment decisions, as well as technical and economic assessment.
References	Alberta Environment (2007b) http://www.municipalaffairs.gov.ab.ca/documents/7864.pdf 5 year review: Alberta Environment and Sustainable Resource Development (2013) http://environment.gov.ab.ca/info/library/7864.pdf
Other notes	Three-phase implementation plan: 1. 2007-2009 enable current development via issuing of approvals and mobilization of process 2. 2009-2012 regulation of new industry and detailed engineering design phase (“foundation building”) 3. 2012-2041 implementation (“sustainability”).

Table 2–6 Bow Basin Watershed Management Plan

Status	Phase 1 released in 2008, Phase 2 released 2012. Future phases are planned as part of ongoing management.
Environmental media	Water quality (Phase 1). Land use, riparian lands, wetlands, headwaters and water quality (Phase 2). Surface and groundwater quantity (Phase 3, anticipated).
Spatial context	Bow River watershed, including specific reaches of the river and its tributaries.
Scope	Plan prepared by a Watershed Planning and Advisory Council in collaboration with stakeholders. Plan is advisory in nature, providing guidance and recommendations that may be voluntarily implemented.
Target outcomes	General goal (Phase 1) to maintain or improve current water quality conditions in all reaches, considering site-specific natural features and user needs. Basin-wide target outcomes (Phase 2, paraphrased): ▪ A healthy, resilient watershed for people and wildlife. ▪ Responsible tourism and recreation. ▪ Recognition of: - Links between economy and environment. - Variability of natural occurrences, including droughts, wet periods and flood events. - Capacity of watershed to accommodate population growth, higher-intensity agriculture, and expanded recreation, tourism, oil and gas activity, and forestry activities. ▪ Stakeholder understanding of: - Value, importance and functions of the watershed. - Ecosystem services and their value. - Water, land, air, and biodiversity interactions. Target outcomes by environmental media (too numerous to list) are separated into the following categories: general, groundwater, water quality, water quantity, land use, riparian lands, wetlands, and headwaters.

Objectives	Meet reach-specific water quality outcomes (Phase 1). Range of targets listed for each of the four major areas of land use, wetlands, riparian lands and headwaters (Phase 2).
Key strategies	In Phase 1, key strategies were to create reach-specific water quality objectives and targets, then recommend monitoring and evaluation, and management actions (61 in total) to achieve water quality objectives. Total of 66 strategies and actions identified in Phase 2, separated into four major areas of land use, wetlands, riparian lands and headwaters.
Responsibility / participation	Strategies and actions assigned to the Bow River Basin Council, municipalities, Cows and Fish, Government of Alberta, Parks Canada, Watershed Stewardship Groups and research institutions. Participation and implementation is voluntary only.
Performance measurement	Numerous “measurable objectives” and indicators are listed. The form and frequency of performance reporting against all measures is not clearly defined; may instead be defined under a separate implementation planning process. State of the Watershed reports will measure some aspects of performance. Future phases of the watershed management plan will include review of previous phases.
References	Bow River Basin Council (2008, 2012) http://www.brbc.ab.ca/index.php/about-us/core-activities/bbwmp-2012
Other notes	The plans were produced by the Watershed Planning and Advisory Council rather than the Government of Alberta. Both phases to date have produced complex plans, with lengthy, detailed lists of indicators and management actions along with assigned priorities. Question of whether this level of detail has a realistic potential for implementation given its voluntary nature.

Table 2–7 Airborne particulate matter and ozone management plans (various)

Status	Management plans for the Capital, Parkland and Calgary regions completed in 2008.
Environmental media	Air: fine particulate matter (smaller than 2.5 micrometres) and ozone.
Spatial context	Various. Canada-wide standards addressed by provincial-wide management framework and strategy, in turn addressed by management plans for the Capital, Parkland and Calgary regional airsheds.
Scope	Regulated and unregulated activities.
Target outcomes	Achieve Canada-wide standards for $PM_{2.5}$ and ozone, and prevent future exceedances given population growth, industrial activity and air quality trends.
Objectives	Canada-wide standards: $PM_{2.5}$: 30 micrograms per cubic metre, averaged over 24 hours. Achievement to be based on 98^{th} percentile, averaged over three consecutive years. Ozone: 65 parts per billion, eight-hour average. Achievement to be based on fourth-highest reading averaged over three consecutive years.
Key strategies	Monitor and assess against three action triggers and four action levels as defined under a province-wide management framework. Management actions are more stringent as higher levels of pollution are recorded.
Responsibility / participation	A provincial-wide implementation plan is outlined in the Clean Air Strategic Alliance Particulate and Ozone Management Framework. Management plans developed under the framework are collaborative and designed to facilitate multi-stakeholder responsibility.
Performance measurement	Annual reports on performance in achieving national targets at a provincial level.

References	Capital Region Ozone Management Plan (Capital Airshed Partnership, 2008). Parkland Airshed Management Zone (Stantec Consulting, 2008) Ozone Management Plan. Calgary Region Airshed Zone (Stantec Consulting, 2008a) Particulate Matter and Ozone Management Plan.
Other notes	Example of integration from national standards to regional management plans.

Table 2–8 Capital Region Air Quality Management Framework

Status	Released in 2012. Presently in Phase 1 (of 3): taking action on priority issues and building the management framework
Environmental media	Air quality - specifically nitrogen dioxide, sulphur dioxide, fine particulate matter and ozone.
Spatial context	Area covered by the Edmonton Capital Region Board. Includes Parkland County, Sturgeon County, Leduc County, Strathcona County and Lamont County.
Scope	Primarily regulated, point-source activities. The opportunity for non-point source inclusion is mentioned.
Target outcomes	Compliance with Alberta Ambient Air Quality Objectives. These objectives are set using a multi-stakeholder approach, considering environment, social and economic factors.
Objectives	Annual and hourly air quality monitoring results are described according to four, tiered levels. In the case of annual monitoring, results defined as "level 4" are above the specified limit of the Alberta Ambient Air Quality Objective.
Key strategies	Strategies are set according to the assessed level of the monitoring results and contaminant of concern. Level 2 monitoring results will trigger heightened surveillance above baseline monitoring. Level 3 monitoring results for nitrogen dioxide and sulphur dioxide require the identification of pressures and implementation of management actions to prevent Alberta Ambient Air Quality Objectives being reached. Level 4 results (excludes hourly results) will require mandatory emission reductions.
Responsibility / participation	Defined responsibilities for ESRD, municipal governments, monitoring organisations and regulated entities. Collaboration with non-governmental organisations.
Performance measurement	Detailed reporting plan that outlines format and frequency. Includes annual State of the Environment reporting process.
References	Alberta Environment and Sustainable Resource Development (2012). http://environment.gov.ab.ca/info/library/8593.pdf
Other notes	Management framework is being developed over three phases: 2012-2015, 2015-2020, and 2020-2041

Table 2–9 Surface Water Quality Management Framework for the Lower Athabasca River

Status	Released August 2012, in effect from September 1, 2012
Environmental media	Water quality. The framework was released as part of the Lower Athabasca Regional Plan (plan also includes detailed consideration of air quality and groundwater quality and quantity). Framework includes an intent to develop links across media for an integrated approach.
Spatial context	Lower Athabasca River from downstream of the Grand Rapids to the Athabasca River Delta
Scope	Applies to all regulated water users or parties releasing substances to the Lower Athabasca River
Target outcomes	Water quality is managed so current and future water uses are protected, where water uses include protection of aquatic life, drinking water, recreation and aesthetics, agricultural and industrial.
Objectives	Water quality triggers and limits set for 38 indicators at one monitoring station located downstream of industrial development (Old Fort).
Key strategies	If mean and peak water quality conditions are at or better than historical conditions, then apply standard approaches (regulatory and non-regulatory) to manage water quality. Where triggers are exceeded, management intent is to proactively maintain water quality to below limits, and improve knowledge and understanding of trends. Where limits are exceeded, management intent will be to improve ambient water quality to below limits.
Responsibility / participation	To be defined as required if/when triggers and limits are exceeded. In general, ESRD and regulated parties have primary responsibilities.
Performance measurement	Annual review and assessment by ESRD. Report format is not specified.
References	Government of Alberta (2012). http://environment.alberta.ca/03423.html
Other notes	Target outcome is in the form of a broad results statement.

Table 2–10 Bow River Phosphorus Management Plan

Status	A draft plan expected to be released in early to mid 2014.
Environmental media	Water quality, specifically in relation to phosphorus. Includes phosphorus inputs from land-based activities.
Spatial context	Bow River between Bearspaw Dam and Bassano Dam
Scope	Regulated and unregulated contributors of phosphorus releases to catchments along the designated river reach.
Target outcomes	Phosphorus inputs to the Bow River are managed to provide a healthy aquatic ecosystem while meeting the needs of those who rely on fresh water.
Objectives	Preserve the current water quality conditions in the Bow River through the management of phosphorus inputs.
Key strategies	Under development. Strategies were developed via separate consideration of urban point sources, urban non-point sources, and rural non-point sources.
Responsibility / participation	Implementation is expected to involve a wide variety of groups, including participants of the plan development phase.
Performance measurement	Under development.
References	Not applicable.
Other notes	Sub-regional plan that involves significant input from unregulated as well as regulated contributors to the environmental issue.

2.4 Review of implementation to date

There are a number of similarities in the approaches used to manage environmental cumulative effects and issues encountered in preparing management plans. These include:

- **Prioritisation** of the most pressing environmental issues.

  In general, management plans have been developed across the province in the order of priority; that is, cases where public concern is greatest and/or where environmental thresholds are at a heightened risk of being exceeded have been addressed first.

- Planning has taken a **large amount of time and resources**.

  Most of the plans developed have been multi-year processes requiring the input of many stakeholders and department staff. Implementation and monitoring is ongoing, including the ongoing update of sophisticated models (where utilized). Resources and budget implications will need to be actively managed for the successful implementation of existing plans.

  Decisions regarding the feasibility of new planning ventures should consider realistic estimates of time and resources, both for government staff and participants in the process. Planning timelines of less than one year may only be feasible in practice where there is greater capacity e.g., stakeholder relationships are established, and required information is readily available.

- Plans have been developed using **advanced information**.

  Advanced modelling, data analysis and detailed data collection have been utilized for the production of plans. This has benefits in terms of the knowledge and education of stakeholders, that may in turn lead to indirect environmental benefits.

  Given the end format and scope of plans, in some cases research may have occurred beyond what was strictly necessary for the production of such plans.

- Implementation to date has largely been **limited to voluntary actions** and reaffirmation of existing regulatory instruments and conditions.

  These approaches may not be sufficient to result in lasting environmental benefits that ensure that target outcomes and objectives are met.

  Though responsibilities for reducing impacts beyond licensed conditions are envisaged for cumulative effects management, in practice such responsibilities are yet to be formally assigned.

  The common approach of seeking consensus-based negotiations among contributors to set and/or implement objectives may not result in actions beyond what would have occurred under existing regulations (e.g., implementation of the lower Athabasca Water Management Framework). Multi-stakeholder negotiations have been generally unable to achieve consensus beyond voluntary approaches that tend to be limited in scope and longevity.

A regulatory backstop may be necessary for successful implementation, including to address contributors unable or unwilling to participate by other means.

- Most of the focus to date has been on **regulated stakeholders**.

  The Bow River Phosphorus Management Plan appears to be the first plan that will reach completion that has actively sought to engage unregulated (non-point source) stakeholders beyond single representatives.

- Expectations of **leadership by government** and reluctance of stakeholders to be representatives for decision-making.

  Several of the examples show an unwillingness or inability of stakeholders to represent their counterparts in a decision-making capacity. For example:

  - Phase 1 of the lower Athabasca Water Management Framework was eventually set by government, and Phase 2 has been delayed many years after consensus was unable to be reached on the base objective for conservation.

  - Stakeholders involved in two of the Industrial Heartland and Capital Region processes opted to alter their form of involvement from a Steering Committee to an Advisory Committee, as regulatory decisions were perceived to be strictly the role of government (pers. comm., L. Avis, 10 Feb. 2014). In one case, ESRD organized the inputs from different departments of the same organization in order to facilitate their active involvement, since the designated representative was unable to do so (pers. comm., W. Qiu, 10 Feb. 2014).

  A background factor that limits participation by industry is the proprietary nature of corporate information.

- Plans may have inadvertently led to **increased uncertainty** that has implications for economic development.

  Because implementation is not clear in many cases, particularly over the longer term investment horizon that applies to large industrial and municipal projects, cumulative effects management is yet to achieve its original goal with respect to greater regulatory certainty. This may create additional costs to stakeholders and/or reduced investment than otherwise.

- **Staged planning** has been adopted in several cases.

  Separate phases are specified in several plans that allow for implementation planning and plan refinement at later stages. In practice, the phases have not been completed within the timelines originally envisaged. Later phases have overlapped in the case of the water management framework for the Industrial Heartland and Capital Region (Alberta Environment and Sustainable Resource Development, 2013).

- **Common formats and terms** are becoming standardised.

  Triggers, limits, objectives, targets, framework, levels etc. all have specific and emerging definitions and format expectations in the context of cumulative effects management in Alberta.

- Importance of **clear target outcomes** and initial project intent from the outset.

  The discontinued East Central Alberta Cumulative Effects Project was perceived by some to be lacking in the clarity of its intent and its links to other planning initiatives (Abells Henry Public Affairs, 2009), which may have been a factor in its early cancellation.

3. Case study: Bow River Phosphorus Management Plan

3.1 Rationale for plan development

Heightened nutrient levels along the Bow River downstream of Calgary have long been a concern. In the past these levels were managed using the traditional approach of regulating point-source discharges in the form of maximum concentration limits. The decision to allow treated wastewater from Strathmore to be discharged via a pipeline to the Bow River was a turning point. The environmental approval for the activity was successfully appealed to the Environmental Appeals Board (2007), who in their ruling emphasized that such decisions ought to be managed in light of their cumulative environmental impacts, especially since water quality guidelines were being exceeded.

An interim policy on effluent limits was released in the following year (2008) that pertained to discharges from Calgary, Heritage Pointe and Strathmore. This policy required that a regional nutrient load reduction plan be developed for reaches at risk of exceeding water quality guidelines. As the format of the nutrient load reduction plan was uncertain, an internal water quality modelling project was initiated to understand the risks to water quality from a regulatory perspective. It was found that if the regulated entities discharged phosphorus at their approved limits then the water quality guidelines for phosphorus would be frequently exceeded. The results further showed that in the spring and summer months, the phosphorus discharge from other sources (including non-point) would be similar in magnitude to the approved limit from the City of Calgary. In this case, the parameter considered the most likely to exceed guidelines (phosphorus) is not toxic in itself, though its ongoing release at excessive levels can lead to adverse water quality outcomes.

Given the findings of the modelling project, combined with the departmental direction to implement cumulative effects management, a planned approach to manage phosphorus inputs from multiple sources was considered appropriate. Stakeholders were gathered in mid-2011 to communicate these findings and to form such a plan.

3.2 Process adopted

The Bow River Phosphorus Management Plan was launched as a prototype for sub-regional cumulative effects management in June 2011.

The process set out to reach a broad contingent of those who may impact phosphorus levels. In practice this was found to be a challenge due to the great number of potential point and non-point source contributors of phosphorus.

ESRD acted as the process facilitator by initiating and inviting stakeholders to the process, and then by providing facilitation and administrative support of subsequent meetings.

A workplan was developed early in the process, though its formulation was found to be challenging. A logic model was considered to map out the steps in the process.

A terms of reference document was produced and refined during the process.

A Steering Committee was formed of 20 stakeholders, with others kept informed via a 150-member Stakeholder Advisory Committee.

The process initially started with an early focus on informative presentations. Task teams were later formed to gather and analyse information among those with a mix of expertise. The teams were chaired by stakeholders and included:

- A data task team, to address monitoring data collection and analysis gaps
- Three additional task teams to determine strategies by contribution type
    - Urban point source task team
    - Urban non-point source task team, and
    - Rural non-point source task team.

The following tools were utilized to assist the formulation of strategies:

- A risk analysis approach, "Bowtie", that identifies individual risks and risk mitigation measures.
- An investment prioritization tool, "Investment Framework for Environmental Resources" (INFFER), used to sift through the large number of potential strategies identified and assist in selecting those with the greatest merit for implementation.

Separate to the work to develop the management plan, a two-phase analysis of social networks was conducted with an aim to support the development of a strategic engagement plan. In addition, selected participants were interviewed during and toward the end of the process to reflect and identify lessons that may be learned to assist future, similar processes.

A draft plan is expected to be completed in early to mid 2014. In all, the stakeholder-led process has taken almost three years.

The elements of the process and an indicative timeline is illustrated in Figure 3–1.

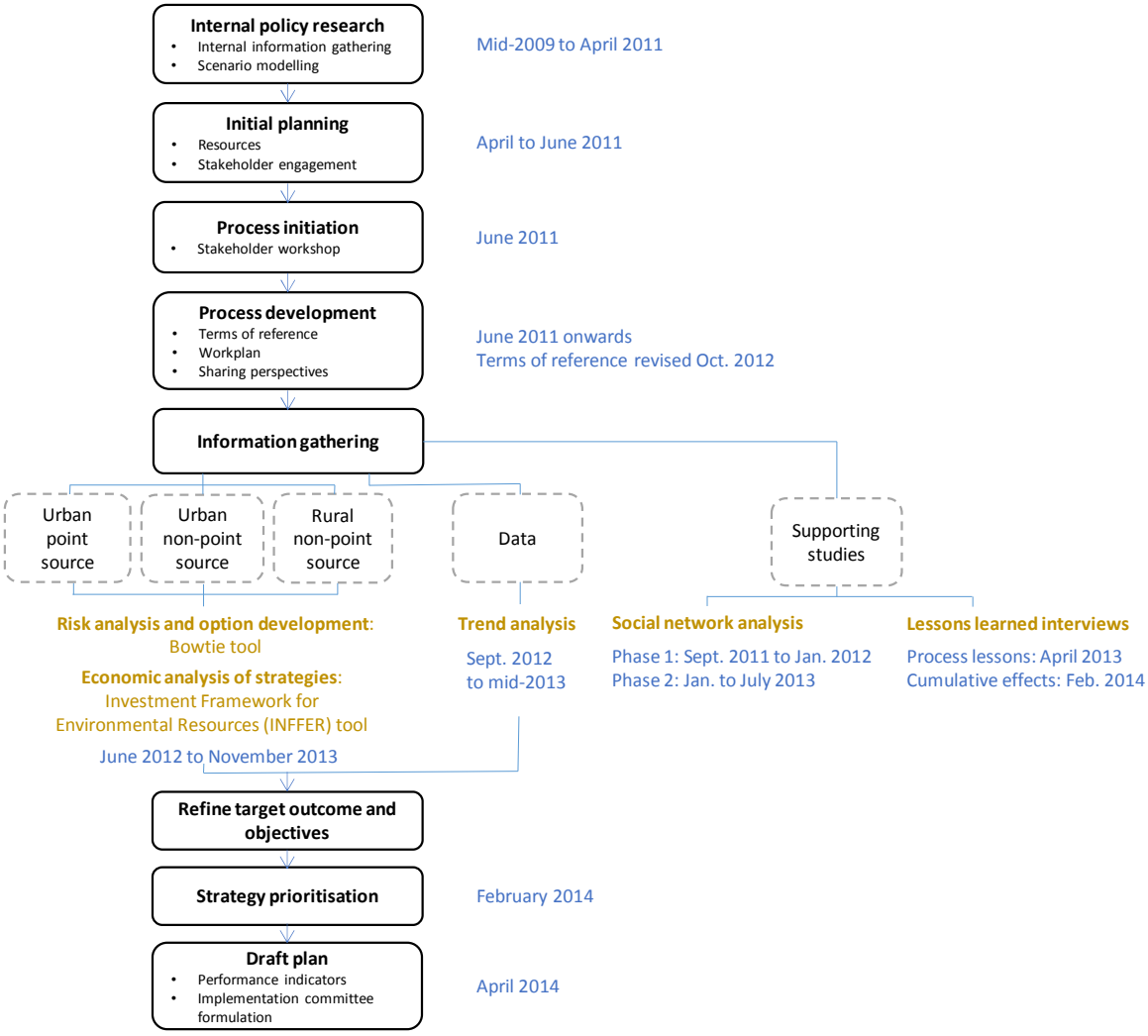

Figure 3–1 Timeline of the development of the draft Bow River Phosphorus Management Plan, 2011 to 2014

3.3 Key lessons for future plan development

Interviews conducted during and toward the end of the process suggest that the Bow River Phosphorus Management Plan prototype has merit, and that the development of sub-regional cumulative effects management plans in general is well-supported. It is recognized that much has been learned over the course of the process that would assist future, similar processes.

A key benefit of the process has been its ability to educate participants via discussion, and the uncovering and sharing of information and perspectives. Some comments suggested that this feature of the process has had indirect benefits of increased understanding and trust among and across various groups and with government departments that may in turn lead to additional environmental management and/or awareness than otherwise. The original vision of cumulative effects management that "other participating governments and non-government decision-makers would be encouraged to use objectives and strategies to guide their decisions" (Alberta Environment, 2007:14) as a result of participating in developing plans was confirmed by several stakeholders.

Key lessons identified during the Bow River Phosphorus Management Plan process for the benefit of developing future sub-regional plans include:

- Planning
    - The process should be well-defined up front, requiring rigour and expertise in the various disciplines and design aspects of a project.
    - Robust conceptualisation of the plan is important to ensure a logical progression of the process that has direct links to the target outcomes.
    - A document that communicates the project context, including the environmental issue, the plan purpose and task outline should be released early in the process.
- Timeliness
    - The timeline for the total length of the external process should be kept to within one year, for continuity of participants, timely response to applicable triggers/limits, and political cycles for implementation. Additional time allowances for internal preparations will be required depending on the suitability of available data.

- Active management of scope, and avoiding the late entry of participants (where possible) for smooth group functioning and dynamics, will assist in generating an efficient process.

- The time duration and commitment expectations should be communicated to participants up-front.

- Leadership

  - ESRD is considered the legitimate leading department for plan development, and greater leadership from ESRD is sought by stakeholders. Part of this leadership role is a need to actively manage expectations regarding the form and depth of the final plan, and to provide guidance on how the elements of the process relate to one another and (eventually) the final plan.

  - Change management, discussion facilitation, strategic project management, awareness of group dynamics, and other broad leadership skills among the ESRD support team will assist the process.

- Strategic engagement

  - Regulated and non-regulated contributors have differing needs and expectations, suggesting a benefit in separate approaches to engagement, and recognition of potential differences in the applicability of management options.

  - The approach of stakeholder empowerment was appreciated by participating stakeholders, provided there is active leadership by ESRD in guiding the process and ensuring an emphasis on the target outcome. This model of public participation may require a longer time duration than other approaches.

- Collaboration

  - Information sharing and discussion among participants played a key role in the education and indirect benefits of the process.

  - From a departmental standpoint, a successful process includes one that achieves collaboration to the extent that the key contributors are engaged in the process, there is an appreciation and acceptance of the environmental issue, each understands their contribution to the issue, and participants work together to find solutions.

- One participant noted that “collaboration” on the part of government would be to be forthcoming with regulatory instruments to address contributors of phosphorus who appear to be unwilling to be engaged in other formats.

- Information

  - A key impetus for encouraging action among contributors is knowledge of the extent of the problem and the contribution from each of the various sources. Stakeholders expect ESRD to gather this supporting information prior to launching a process to develop a plan.

  - There is a need for balance in gathering information during the process. It was found that greater information than necessary was gathered to support the level of detail within the final plan. This resulted in extra meetings and time delays that frustrated participants. Facilitation and foresight is necessary to manage and obtain the degree of detail required.

- Expertise

  - Project management and subject-matter expertise among the project team will assist in generating a successful process. This includes prior familiarity with the tools to be used during the process (information needs, purpose, applicability of results) and a good understanding of the biophysical problem and potential strategies that may be successful.

- Reducing uncertainty

  - Reducing regulatory uncertainty for contributors is a key tenet of cumulative effects management (Alberta Environment, 2007). This was not realized in practice – that is, uncertainty was increased by the process adopted. Policy development in relation to load allocation would assist to address this issue.

4. Elements to assist cumulative effects management

4.1 Decision support tools

The process of making decisions on preferred strategies to achieve target outcomes is a key step in the development of a management plan. Table 4–1 provides a summary of the range of tools available to assist in supporting and navigating this step. Each tool category has different information requirements and may require the input of specialists. Only some of the categories are recommended for direct involvement by stakeholders in the analysis; instead the role of stakeholders may be limited to provision of data inputs and the review of findings that in turn may lead to recommendations on preferred strategies. Examples and references for each of the tool categories are listed in Table 4–2.

Table 4–1 Decision support tool categories

Type	Purpose	Examples	Benefits	Limitations
Information	Presentation of supporting information in helpful ways; provoke informed discussions.	▪ Ecosystem services assessment ▪ Systems diagram ▪ Historic simulation and scenario modelling ▪ Thresholds and sensitivities analysis (e.g. geosimulation modelling) ▪ Probability of exceedance charts ▪ Consideration of triple-bottom-line indicators	Promotes education; brings to light less obvious findings via presentation in new and enlightening formats.	Information only. No clear decision process when used in isolation (though information as presented may point toward solutions).
Risk	Analyse potential future hazards and scenarios. Assess likelihood and consequence that hazardous events will occur. Devise responses to reduce individual risks, prioritised by risk exposure.	▪ Risk assessment matrix with green-yellow-red prioritization of risks ▪ Bowtie risk and response table.	Tends to favour thorough technical analysis (technique is commonly used by engineers). Explicit consideration of range of factors that may cause future impacts.	Costs of responses not directly considered; leads to solution caveats such as Best Available Technology Economically Achievable, As Low As Reasonably Practicable etc. Minimise harm approach rather than maximize outcomes.

Decision process	Outline steps in process and potential pathways based on the findings at each step.	▪ Logic model diagram	Clear presentation of process. Formulation will assist in identifying process uncertainties.	May not be followed in practice if process flexibility is required to obtain and respond to stakeholder input.
Economic	Assess options and identify preferred options on the basis of maximizing outcomes per unit of expenditure.	▪ Benefit-cost analysis (may include non-market valuation of environmental and other factors) ▪ Net present value assessment ▪ Investment Framework for Environmental Resources (INFFER)	Rational approach with clear links to decision recommendations. Aim to maximize outcomes per unit of expenditure. Can be used to promote a clear focus on achieving the environmental goal with minimum effort and/or funds.	Utilitarian philosophy (e.g., proceed if benefits are greater than costs) may not align with stakeholder and/or government approach. Requires consideration of bounds of analysis and context e.g., assessment of all options across stakeholders/sectors may not be relevant if no pooled (cost-sharing) or flexible funding mechanism is available, and there remains a requirement for individual responsibility in addressing cumulative impacts.
Multi-criteria	Consider a range of factors to assess options and identify preferred options.	▪ Multi-criteria assessment	Rational approach with clear links to decision recommendations. Able to accommodate a range of measures considered important to decision makers.	Weighting of criteria may be subjective (though can easily illustrate sensitivities). Design of a transparent process requires separation between setting criteria weights and assessment of options.

Discussion facilitation	Reach consensus on the assessment of options and/or preferred option(s).	▪ Deliberation by expert panel ▪ Citizen's jury ▪ Stakeholder negotiations	Flexible. Discussions can be informed by any of the above tools.	Requires consideration of the political context and whether outcomes will be considered legitimate. Transparency of process in reaching decision. Potential issues of group dynamics (e.g. "group think") and political influence.

Table 4–2 Sample references and examples of decision support tools*

Type	Sample references	Examples used in practice
Information	Ecosystem services: ▪ Guide published by the World Resources Institute (Ranganathan et al., 2008) ▪ Millennium Ecosystem Assessment (2005) Environmental thresholds: ▪ Literature review produced for B.C. Government (Dykstra, 2004) Systems mapping: ▪ Handbook produced for Government of Alberta (Woodward, 2010)	Ecosystem services: ▪ Pilot of ecosystem services approach using wetland in southern Alberta (Government of Alberta, 2011) Environmental thresholds: ▪ Analysis for the development of Phase 2 of the lower Athabasca River water management framework (Phase 2 Framework Committee, 2010)
Risk	3-tier approach to risk assessment, from coarse screening to detailed quantitative analysis, described in the CCME (1996) Ecological Risk Assessment Framework Bowtie: ▪ Industry conference paper by Risktec Solutions on bowtie method and lessons learned (Lewis and Smith, 2010) ▪ Introductory discussion on risk management and bow tie analysis (applied to Canadian aviation): http://www.tc.gc.ca/eng/civilaviation/publications/tp185-3-10-feature-5829.htm#notevii	Example: ▪ Risk assessment by the Department of Fisheries and Oceans (2012) for ocean management in the Pacific region Bowtie: ▪ Used for developing the Bow River Phosphorus Management Plan (contact project team for details)
Decision process	General approach; refer to project management textbooks for further information.	Examples are various and project specific e.g., work breakdown structure for Bow River Phosphorus Management Plan.

Economic	Guides to benefit-cost analysis: ▪ Guide by US Environmental Protection Agency (2010) for environmental analysis ▪ Guide by Treasury Board of Canada Secretariat (2007) for regulatory and general analysis INFFER references: ▪ Journal article by Pannell et al. (2012) ▪ INFFER website: http://www.inffer.com.au/	Examples of benefit-cost analysis applied to environmental projects: ▪ Examples listed on US EPA website: http://www.epa.gov/sustainability/analytics/benefit-cost.htm ▪ Examples applied to water in the US: http://www.usbr.gov/pmts/economics/reports.html ▪ Canadian example: analysis of proposed renewable fuels content in Canada (ÉcoRessources Consultants, 2007) INFFER examples: ▪ Bow River Phosphorus Management Plan (Land Stewardship Centre, 2013) ▪ Nutrient management of Gippsland Lakes, Victoria, Australia (Roberts et al., 2012)
Multi-criteria	Overview of technique: ▪ Hajkowicz et al. (2000)[4]	Refer to journal article by Hajkowicz and Collins (2006) for international applications of multi-criteria assessment for water resource management.

[4] Hajkowicz is a key author. List of references including tools to implement multi-criteria assessments available at: http://www.csiro.au/en/Organisation-Structure/Divisions/Computational-Informatics/StefanHajkowicz/Publishing-History.aspx

Discussion facilitation**	Guides to various levels of public engagement: ▪ US EPA public participation guide: http://www.epa.gov/international/public-participation-guide/index.html ▪ Report available on-line by Sheedy et al. (2008) ▪ IAP2 Public Participation Spectrum table: http://www.iap2.org/associations/4748/files/IAP2%20Spectrum_vertical.pdf ▪ US Bureau of Reclamation guide: http://www.usbr.gov/pmts/economics/reports/Public.pdf Citizens jury guide: ▪ Refer to The Jefferson Center (2004) Consensus decision-making toolkit: ▪ Clean Air Strategic Alliance and Alberta Water Council http://www.casahome.org/DesktopModules/Bring2mind/DMX/Download.aspx?Command=Core_Download&EntryId=670&PortalId=0&TabId=78	Expert panel report example: ▪ Evaluation of environmental impacts of the oil sands industry by Gosselin et al. (2010) Consensus example: ▪ Procedural guidelines of Clean Air Strategic Alliance http://www.casahome.org/DesktopModules/Bring2mind/DMX/Download.aspx?Command=Core_Download&EntryId=668&PortalId=0&TabId=78

* Refer to reference list in Section 6 for web-site links where available.

** Note: the appropriate format and level of participation by external parties depends on social norms and the political context. Common approaches and/or examples adopted from elsewhere may not necessarily be "best practice" from a local and provincial standpoint (e.g., refer to critique of public consultations in Calgary by Manning Foundation [Heinrichs, 2013]). Certain forms of public involvement may preclude the use of economic tools for environmental management (Mannix and Adamowicz, 2011).

4.2 Implementation options for environmental management

Options for implementation of strategies include those collated in the following Government of Alberta compendiums:

- Environmental Tools Guide http://environment.alberta.ca/01779.html
- Land use Framework Conservation and Stewardship Tools https://www.landuse.alberta.ca/ConservationStewardship/ConservationStewardshipTools/Pages/default.aspx

Selected management examples of strategies in action elsewhere include:

- Auctions to purchase ecological goods and services in Manitoba http://www.gov.mb.ca/agriculture/environment/ecological-goods-and-services/print,activities-in-manitoba.html
- Case studies of economic instruments applied to water management in Canada and Australia http://www.sustainableprosperity.ca/article1926
- Feasibility studies of nutrient trading in the U.S.A. and China http://www.wri.org/our-work/project/water-quality-trading#project-tabs

4.3 Example processes to support cumulative effects management

Processes in use elsewhere that may be applicable to sub-regional cumulative effects management include:

- Process outlined in the US EPA Watershed Planning Handbook: http://water.epa.gov/polwaste/nps/handbook_index.cfm#contents
- Decision process guide of the Bureau of Reclamation in the U.S. Department of Interior: http://www.usbr.gov/pmts/economics/guide/index.html

4.4 Other tools, concepts and useful information

Refer to Table 4–3 for other information that may assist practitioners in developing sub-regional cumulative effects management plans.

Table 4–3 Other useful tools, processes and concepts for sub-regional cumulative effects management*

Subject	Application	References/tools
Group dynamics	Understand and recognize common stages in group development to assist in management and facilitation.	Refer to paper by Tuckman (1965)
Social learning	Design process to maximize educational opportunities	Refer to paper by Webler et al. (1995)
Behavioural science	Motivating change via communications and process design.	Refer to report by Scarlett et al. (2013)
Project management	Administration of process.	Microsoft project (& similar) software to develop flow chart of project steps and dependencies. Refer to Project Management Office for standard tools in use by Government of Alberta.
Leadership	Use of change management theory for effective design of process.	Refer to management textbooks and publications.

Previous experience	Build on previous findings to strengthen current approach.	Lessons learned studies in Alberta, including Abells Henry Public Affairs (2009). Lessons learned studies from elsewhere, e.g., British Columbia example http://www.citbc.org/c-proc-recommend-31Dec04.pdf

5. Suggested handbook components to guide sub-regional management planning

5.1 List of topics

Suggested topics to assist practitioners in planning and oversight of a sub-regional cumulative effects management plan are listed in Table 5–1.

Table 5–1 List of potential topics for guidebook on developing sub-regional cumulative effects management plans

Category	Components	Example content
Context	Cumulative effects management in Alberta	Links to key documents on cumulative effects management in Alberta
	Common terms in use in Alberta and example applications	Definitions and examples of triggers, limits, outcomes, levels, framework etc.
	Example regional and sub-regional management plans in Alberta	Refer to tables in Section 2
	Example management plans from elsewhere	To be determined.
Plan content	Discussion paper to guide process	Intent to set the context for the public and participants. Paper to include background information, linkages with other planning initiatives, rationale and purpose for a management plan, format outline of a management plan, process outline for plan development.
	Information gathering and analysis	Guide to purposely define the level of detail required. Types of information (historic, simulation) and analysis (trends, risk, optimisation). Use of base case and scenario modelling for simulation purposes. Factors to consider in model selection. Other information tools.
	Defining target outcome and objectives	Format of outcome and objective statements

	Defining principles	Explanation of use in identifying feasible alternatives. Examples of principle statements.
	Strategy options	Link to ESRD Environmental Tools Guide.
	Deciding strategies: use of decision-support tools	Outline of example tools, including references and/or links.
	Defining strategies	Specific, measurable, assignable, realistic, time-related ("SMART") attributes.
	Implementation, monitoring and reporting	Outline process for implementation
Process steps	Initial planning stage (internal)	Internal research
	Business plan (internal)	Example format of business plan.
	Detailed project plan (internal)	Stakeholder analysis, engagement and communication plan with attention to regulated versus unregulated stakeholders. Define format of a management plan; consider detail, staging (e.g. phased development, treatment of implementation), spatial extent, topic scope, decision process, consideration of potential strategies, level of stakeholder engagement. Logic model of process as envisioned including clear outline of how decisions will occur. Project task breakdown.
	Communication of plan intent	
	Define organisational structure	Assemble stakeholders. Use of organisation diagrams.
	Setting terms of reference	Example format of terms of reference document.
	Plan development	Refer to content components of guide. Example process timeline.
	Plan endorsement and release	Internal steps to organize endorsement. Communication for launch of plan.

Project management and leadership	Administration	Assembling support team and defining roles, information sharing platform (SharePoint, website or other), quality assurance procedures (inc. file naming protocol), project management tools (e.g., Microsoft Project, RACI chart).
	Discussion facilitation	Tips on leading discussions, conflict management, understanding of group dynamics.
	General tips and links for leading process	Miscellaneous tips e.g., ensuring process is enjoyable, maximizing educational opportunities, change management. Process links.
Experiences and issues encountered to date	Detailed case studies	Bow River Phosphorus Management Plan, others as appropriate
	Issues and lessons learned	Refer to Sections 2.4 and 3.3

5.2 Key steps for plan development and implementation

Suggested process diagrams to assist in sub-regional plan initiation and development are offered in Figure 5–1 and Figure 5–2. The plan development process shown in Figure 5–2 may require modification depending on the nature of the tools and decision process selected.

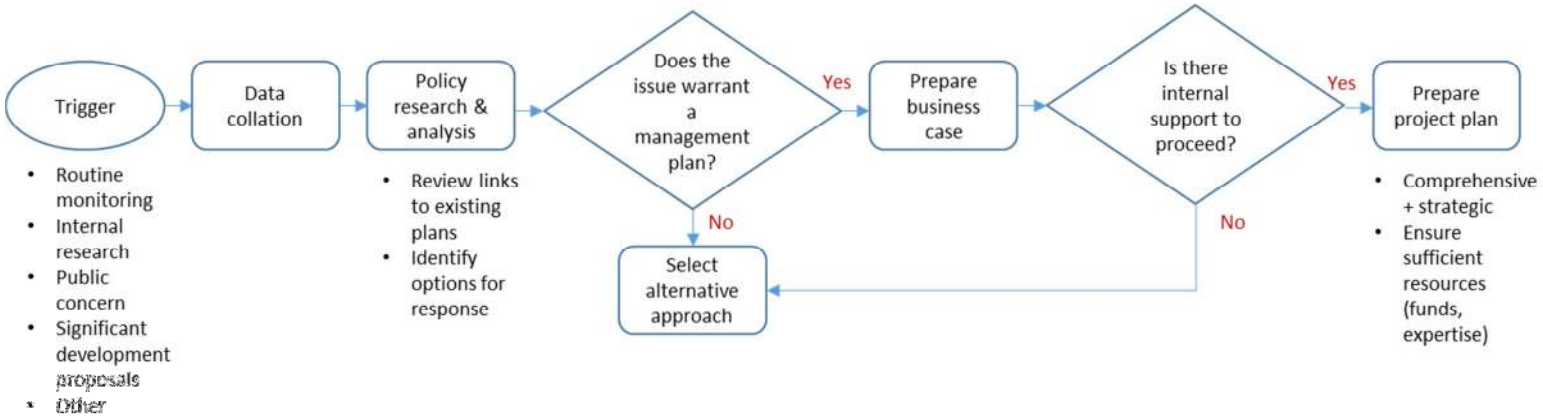

Figure 5–1 Suggested process for internal, initial planning prior to commencement of a management plan to address cumulative environmental effects at a sub-regional scale

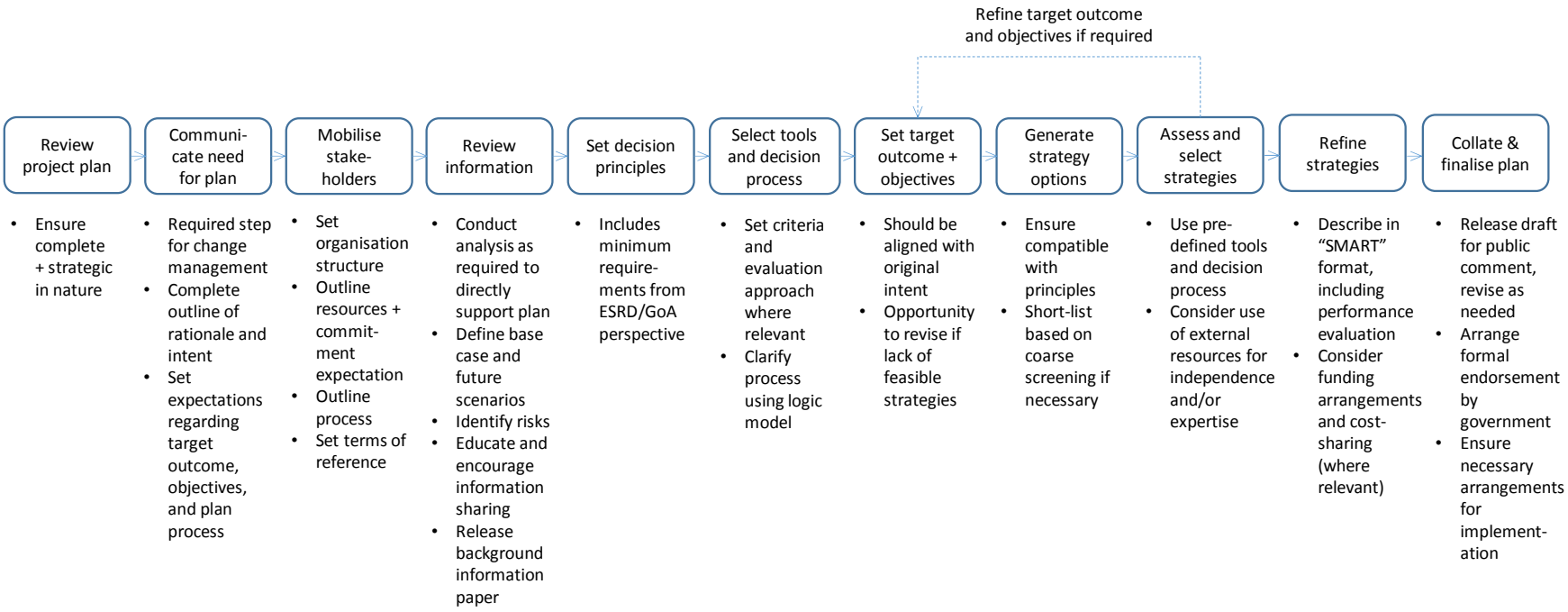

Figure 5–2 Suggested process for development of a management plan to address cumulative environmental effects at a sub-regional scale

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Appendix A Study participants

Seven external participants were surveyed in this study (Table 6–1), two of whom had also participated in an earlier lessons learned study conducted in early 2013.

Table 6–1 Study participants representing external organisations

Name	Organisation
Tim Dietzler	Rocky View County
Margaret Beeston	City of Calgary
Mark Bennett	Bow River Basin Council
Brenda Casella	City of Calgary
Shirley Pickering*	Highwood Management Plan Public Advisory Committee
Ron Axelson*	Intensive Livestock Working Group
Sharon McKinnon	Crop Sector Working Group

* Survey participant also participated in 2013 Lessons Learned study.

Internal staff consulted over the course of this project (via meeting participation or other) include: Louella Cronkhite, Anish Neupane, Dr. Marian Weber (on secondment from Alberta Innovates), Edith Vanderpuye, Courtney Scott, Rob Wolfe, Cecilia Chung, Deanne Newkirk, Nancy Martin, Danielle Wollbaum, Heather Sinton, Monique Dietrich, Kate Vasicek, Martin Foy, Rob Simieritsch, Lisa Avis, Wally Qiu and Darcy McDonald.

Appendix B Lessons learned survey template

The following survey was used to guide discussions with the external participants of this study (listed in Table 6–1):

Bow River Phosphorus Management Plan
Lessons learned for cumulative effects implementation

The Bow River Phosphorus Management Plan is considered a prototype for managing cumulative environmental effects at a sub-regional scale. This interview is to gather views on the process of developing the plan and its secondary impacts.

Responses will be aggregated to assist the Department of Environment and Sustainable Resource Development (ESRD) to improve the process for planning future, similar activities.

1. What are your general impressions of the process used to develop a Bow River Phosphorus Management Plan?

2. Given the opportunity, would you agree to participate in a similar process in the future? Why/why not?

3. Please describe your role in developing the plan.

4. Were the participants who developed the plan, and their level of participation, appropriate for the purpose?

5. How useful were the tools used to develop the plan, such as INFFER?

6. Are you satisfied with the level of time and effort that you and/or your organization have put into developing the plan? How could the efficiency of the process be improved?

7. The process of developing the plan was sought to be collaborative, with the contents of the plan determined by stakeholders. In practise, what were some of the benefits of this approach, and what have been some of the challenges?

8. How has the process affected your understanding of the environmental issue, and that of your organization?

9. Will your organization be undertaking voluntary measures to improve environmental outcomes, and/or increase awareness of the environmental issue, as a result of participating in the development of the plan?

10. Have you noticed changes in cooperation across stakeholder groups and/or government as a result of the process used to develop the plan?

11. Do you trust other groups more, or less, in terms of managing their environmental impacts as a result of the process used to develop the plan?

12. Broadly speaking, what elements in the process worked well for developing the plan, and why? What should be preserved for future, similar processes?

13. If we could start over again, what elements in the process would you change, and why?

14. Is there anything else you'd like to add in terms of lessons learned from this prototype for managing cumulative environmental effects, and encouraging collaborative solutions?