

NICOLA
Water Use
Management
Plan



PHASE 2 – PLAN DEVELOPMENT

Interim Report

Prepared by:

Nicola Watershed Community Round Table
Box 400
Merritt, BC V1K 1B8
Telephone: (250) 378-4087
E-mail: esalomon@mail.ocis.net

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Table of Contents

	PAGE
1.0 Introduction	1
2.0 Overview of Phase 2	2
3.0 Roadmap	2
4.0 Accomplishments and Completed Projects to Date	9
4.1 Multi-Stakeholder Committee Meetings	9
4.2 Public Meetings	10
4.3 Steering Committee (formerly Planning Team) Meetings	10
4.4 Web Site	12
4.5 Present and Future Water Demand Study	14
4.6 Additional Water Storage Sites Study - Phase 1	23
4.7 Governance - Phase 1	25
4.8 The droplet	26
5.0 Works in Progress	27
5.1 Instream Fish Flow Study	27
5.2 Water Management Tools	28
5.3 Surface and Groundwater Supply and Interaction Study	29
5.4 Water Management in the Guichon Pilot Project	32
6.0 Structure for the Planning Process	34
7.0 Reports, Papers, Articles, Bulletins, Etc. on File	35
APPENDIX A – Copies of <i>the droplet</i> (Issues 1 through 11)	47

1.0 Introduction

This report summarizes the results of *Phase 2 – Plan Development of the Nicola WUMP¹ planning process*, as of July 2007. The following pages describe the key accomplishments and the ongoing work that has taken place over the past two years. The community-driven planning process was initiated in the fall of 2004 following a workshop entitled *Charting Our Water Future*. The workshop concluded with a strong endorsement of the need for a water use management plan for the Nicola basin.

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The planning process consists of four phases:

PLAN INITIATION

PLAN DEVELOPMENT

PLAN EVALUATION AND APPROVAL

PLAN IMPLEMENTATION

Phase 1 or PLAN INITIATION was completed in June 2005 with the following having been accomplished:

To avoid having to change a multitude of documents, this report continues to use the words to mean either one of the four stages of the planning process or one or more portions of studies.

- a) terms of reference for the process and all committees
- b) a vision statement
- c) a mission statement
- d) an organization structure
- e) funding for Phase 1
- f) a communication strategy for the process and to build awareness about WUMP
- g) a strategy to promote wise water conservation including the implementation of a number of suggested action items
- h) an outline for a drought strategy
- i) an outline (table of contents) for the Nicola water use management plan document
- j) identification of key knowledge gaps and estimated costs to fill those gaps
- k) increased awareness and knowledge about current community issues
- l) socio-economic and environmental goals for the plan
- m) a better understanding of groundwater
- n) a feasibility study for completing the Nicola Dam was begun with an October 2005 completion date
- o) a timeline for completion of project (water use management plan)
- p) a preliminary long-term budget (Phase 2 through completion of plan)
- q) a work plan for *Phase II – Issue Identification and Information Gathering*

The work and accomplishments of Phase 1 were summarized in a report entitled: *Report on Phase 1 of the Process Leading to a Nicola Water Use Management Plan*, September 2005.

¹ WUMP is the acronym for water use management plan and refers to both the planning process and the plan itself.

2.0 Overview of Phase 2

In a commonly-used (template) planning model, Phase 2, also known as PLAN DEVELOPMENT, confirms the issues to be addressed in the plan, develops planning scenarios (i.e. solutions) to resolve issues and provide management direction, analyzes scenarios, tweaks scenarios to improve results, analyses results and prepares a draft plan.

At the outset of Phase 2, the work plan for this phase of the Nicola WUMP planning process included the following:

- confirming the key knowledge gaps and proceeding to fill them;
- an examination and confirmation of the water issues identified at the *Charting Our Water Future* workshop;
- investigating water management models, tools and options;
- conducting trade-off and cost-benefit analyses of various options;
- investigating decision-making tools; and
- creating a draft plan document.

Phase 2 has been underway for two years. As noted above, this report documents in summary form the work done in this period.

The main sections of the report are as follows:

- 1) roadmap
- 2) accomplishments and completed projects to date
- 3) works in progress
- 4) structure for the planning process
- 5) reports, articles papers, etc. on file
- 6) copies of the droplet

The report is intended only as a reference document. For more detailed information on any of the topics discussed below, the reader is referred to the original documents, e.g. meeting minutes, study and other reports, web site, newsletters, etc.

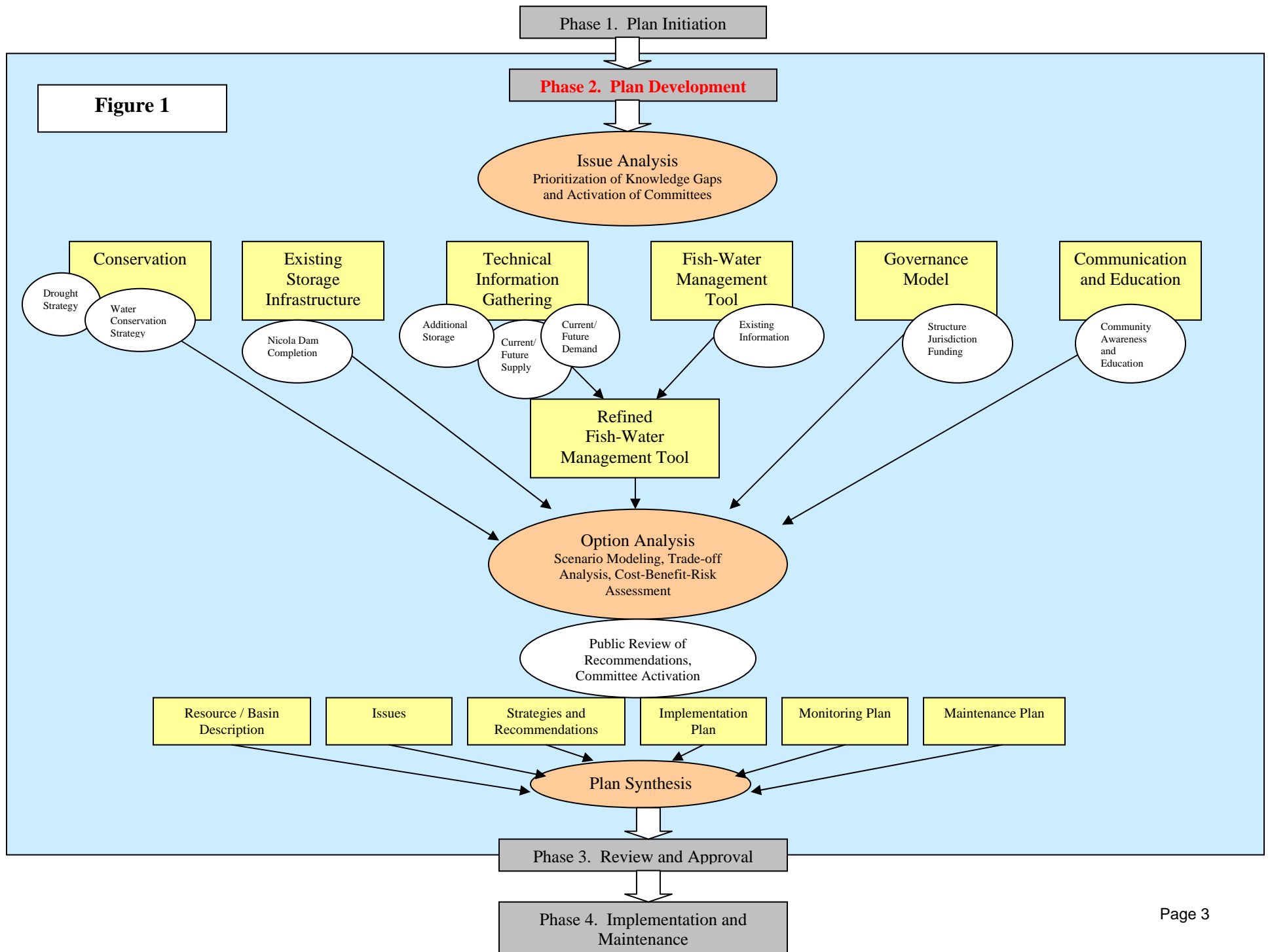
3.0 Roadmap

One of the most-often asked questions throughout the first year of Phase 2 was how to present and describe the planning process in a manner that provided a clear picture of the planning process and its relationship to the ultimate goal – a water use management plan. This question can be answered in a number of ways. For some, a diagram provides the explanation of the components of the planning process that will lead to a water use management plan for the Nicola watershed. Several diagrams have been produced over the past two years.

At the outset of Phase 2, Figure 1, below, was created by Katherine Gizikoff to show how all the components would eventually lead to a water use management plan.

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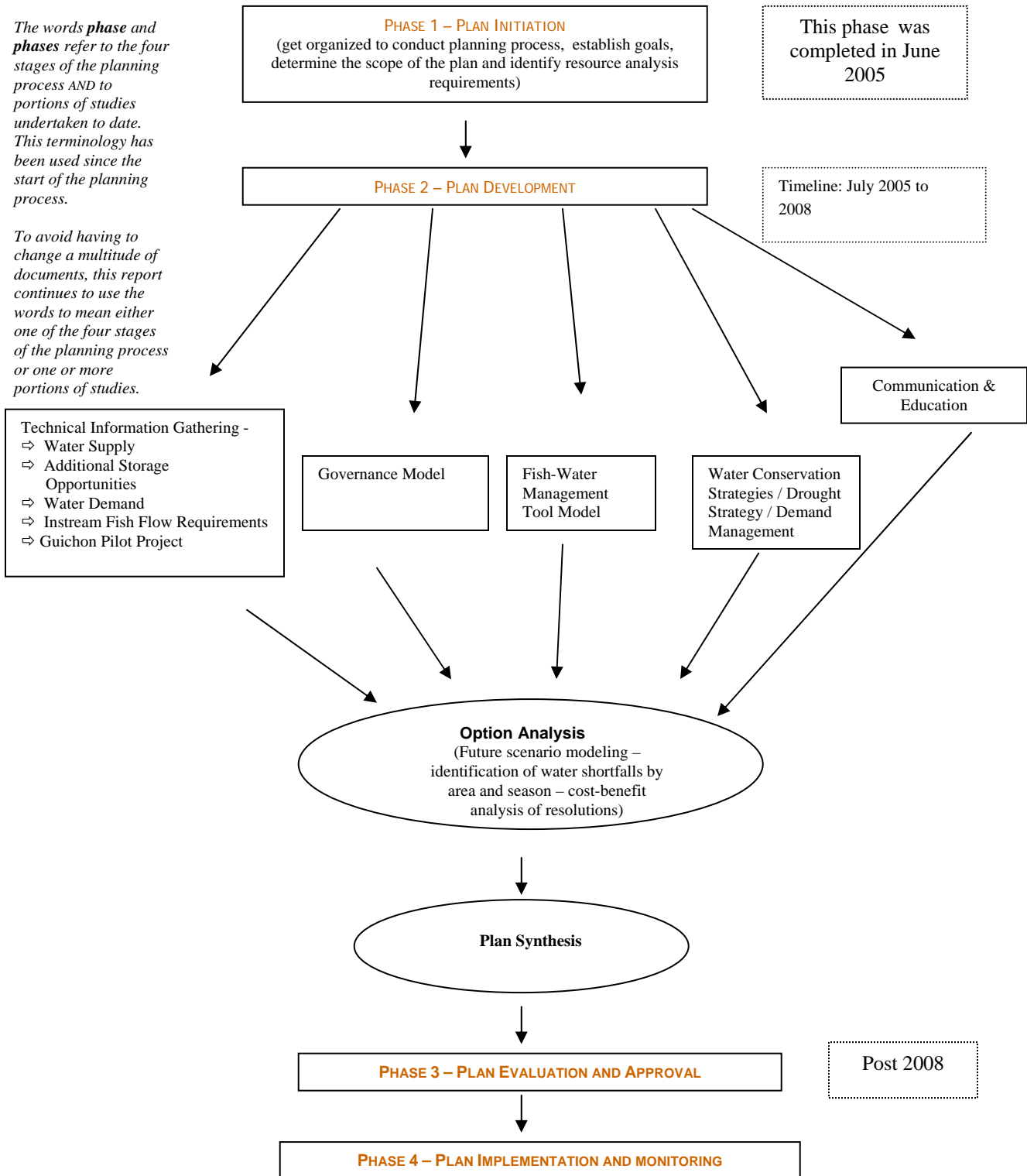


The drawing on the previous page was amended about a year later as a result of progress with the planning process (See Figure 2). Both these figures have been used in funding applications and in presentations about Nicola WUMP. The most recent version of this figure is shown below.

Figure 2

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Another way to describe how the end goal will be reached is by using a roadmap. A roadmap can be likened to a project schedule in that it lists in sequential order, with timelines, key tasks or main steps that need to be accomplished. The timelines show when a task or project will start and end.

The first roadmap was prepared and presented to the Multi-Stakeholder Committee for discussion and adoption in January 2006.

A portion from that first roadmap is provided below.

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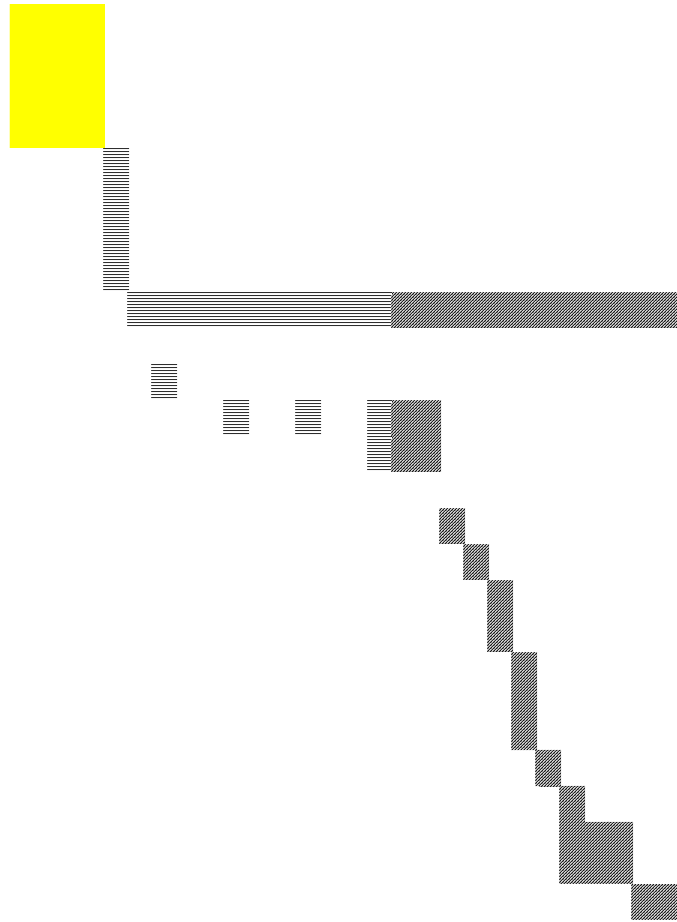


PHASE 1- Plan Initiation



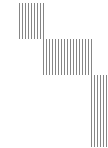
PHASE 2 - Plan Development

- Review issues
- Public meeting - Nicola Dam study
- Prioritize knowledge gaps
- Develop Roadmap for Plan Completion
- Establish Committees, identify tasks/schedule (see below)
- Apply for Phase II funding for High Priorities
 - Funding for Developing Terms of Reference
 - Funding for Studies
- Committee work (see below)
- Initiate Development of Fish-Water Management Modelling Tool (FWMT)
- Compile Technical Information into FMMT
- Evaluate Need for Remaining Topics (Lower Priorities)**
- Develop List of Options, including GOVERNANCE MODELS, and Alternative Actions from Committee and Consultant Projects
- Conduct Trade-Off Analysis, Cost-Benefit Analysis
- Present Options and Recommendations to Community
- Plan Synthesis
 - Apply for Funding
 - Strike Committees for Implementation, Monitoring, Maintenance Plans
 - Draft recommendations to MSC for review
 - Final recommendations
 - Prepare Draft Water Use Management Plan with Recommendations
 - MSC Review of Draft Plan



PHASE 3 - Plan Evaluation and Approval

- public and First Nations review
- review by government agencies
- prepare final plan document
- submit to government for legislative/regulatory amendment



PHASE 4 - Plan Implementation

- establish governance model
- changes to regulations
- infrastructure construction/installation
- implement action plans
- review performance and adapt, based on monitoring results
- assess/evaluate governance model



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Since then, the roadmap has been periodically revised and as of the end of June 2007, the tasks completed and remaining were as follows. This latest draft does not show timelines.

	COMPLETED	STILL TO BE COMPLETED
PHASE 1 - Plan Initiation	✓	
PHASE 2 - Plan Development		
- Review Issues	✓	
- Public meeting - Nicola Dam study	✓	
- Prioritize knowledge gaps	✓	
- Develop Roadmap for Plan Completion (1 st version)	✓	
- Establish Committees, identify tasks/schedule	✓	
- Apply for Phase 2 Funding for High Priorities	✓	
Funding for Developing Terms of Reference for Studies	✓	
Funding for Studies/Pilot Project	✓	
Funding for Planning Process (Phase 2, Cont'd)	✓	
- Present and Future Water Demand Study	✓	
- Surface and Groundwater Supply Study - Phase 1		✓
- Additional Storage Sites Study - Phase 1		✓
- Governance - Part 1	✓	
- Governance - Part 2		✓
- Apply for Funding to Continue Studies/Projects		
- Surface and Groundwater Supply Study - Phase 2		may be a recommendation in the PLAN
- Additional Storage Sites Study - Phase 2		✓
- Instream Fish Flow Requirements Study (3 year project)		completed in 2008
- Pilot Projects		
Water Management in the Guichon - Phases 1 and 2		✓
Pilot Project #2		If a project can be identified by the fall, it may be able to go ahead if funds are found.
- Water Management Tools		✓
- Plan Synthesis		✓
Apply for Funding		✓
Review progress and prepare a first draft of outline of plan		✓
Draft recommendations to MSC for review		✓
Finalize recommendations		✓
Prepare Draft Water Use Management Plan with Recommendations		✓
MSC Review of Draft Plan		✓
		POST 2008
PHASE 3 - Plan Evaluation and Approval		✓
- public and First Nations review		✓
- review by government agencies		✓
- prepare final plan document		✓
- submit to government for legislative/regulatory amendment		✓

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	COMPLETED	STILL TO BE COMPLETED
		POST 2008
PHASE 4 - Plan Implementation		✓
- conduct trade-off analysis, cost-benefit analysis		✓
- water demand management strategy		✓
- strike committees for Implementation, Monitoring and Maintenance Plans		✓
- establish governance model		✓
- changes to regulations		✓
- infrastructure construction/installation		✓
- implement action plans		✓
- review performance and adapt, based on monitoring results		✓
- assess/evaluate governance model		✓

4.0 Accomplishments and Completed Projects to Date

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4.1 Multi-Stakeholder Committee Meetings

As the decision-making body with respect to the recommendations that will be included in the Water Use Management Plan document, the Multi-Stakeholder Committee plays a key role. This role was formulated early in Phase 1 of the planning process and was revisited and confirmed in the spring of 2007. The main functions of this committee whose membership includes all levels of government, First Nations, interest groups and individuals, are as follows:

- 1) to review, adopt by consensus and if agreed to, implement recommendations of sub-committees and the Steering Committee (formerly the Planning Team);
- 2) to provide direction to the Steering Committee (formerly Planning Team) and sub-committees;
- 3) to receive the reports on studies and projects, assess them and either adopt the reports as submitted/presented or adopt them conditionally;
- 4) to assess the suitability of the planning process to address the needs and confirm the desire of the members of the Multi Stakeholder Committee to engage in the process;
- 5) to refine and/or expand the issues identified by the Steering Committee (formerly the Planning Team);
- 6) to work through trade-off analyses and decide on what will be in the Plan document.

Between July 2005 and June 2007, the Multi-Stakeholder Committee met fourteen (14) times. Attendance at these meetings ranged from 20 to 49 individuals resulting in an average of 33.7 persons per meeting. Only in recent months has attendance dropped off with the June 2007 meeting recording the lowest attendance (20) to date.

The Multi-Stakeholder Committee discussed, learned about and tackled a broad range of topics over the past 24 months. They included:

- a review and confirmation of water and water related issues (October 2005);
- the process for approving developments at the regional and municipal government levels (October 2005);
- the roadmap for developing a water use management plan and selection of priority knowledge gaps to be filled (November 2005);
- the engineering options for completing the Nicola dam (November 2005);
- roadmap for Nicola WUMP and discussion of terms of reference for new sub-committees (January 2006);
- review of draft terms of reference for studies and projects (January 2006);
- water issues of the Coldwater Indian Band (March 2006);
- decision-making models – guest speaker, Jon O’Riordan (April 2006);
- introduction to governance models (September 2006);
- update on projects, studies and governance (January 2007);
- operation of the Nicola dam – guest speaker: Ted Fuller, Ministry of Environment; and change to structure of planning process (March 2007);
- presentation on the Present and Future Water Demand Study findings (May 2007);
- groundwater and salmon – guest speaker, Tanis Douglas (May 2007);
- Nicola WUMP’s response to the final report on the Present and Future Water Demand Study (June 2007).

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Minutes of all Multi-Stakeholder Committee meetings are archived by the Nicola Watershed Community Round Table and are also available through the web site at www.nicolawump.ca.

4.2 Public Meetings

There was one public meeting over the past 24 months. It was held on May 16, 2006 on the topic of groundwater. The guest speaker was Thierry Carriou (BC Groundwater Consulting Services Ltd.), a hydrogeologist who has done extensive work on groundwater in and around Merritt. His presentation included an introduction to groundwater, watershed-scale summary of groundwater resources, review of aquifer and well distribution by sub-basin, surface water and groundwater interaction - the process, examples of local monitoring results, surface water depletion, groundwater under direct influence - and conclusions.

Public meetings are advertised in the local newspapers while meetings of the Multi-Stakeholder Committee are not. The main reason is cost. With a distribution list of over 125 names, information about dates and times of Multi-Stakeholder Committee meetings reach a broad audience.

4.3 Steering Committee (formerly Planning Team) Meetings

In the spring of 2007, the decision was made to expand the membership of the Planning Team and to rename it the Steering Committee. This was done for two reasons:

- a) to satisfy current and potential funders that the planning process is indeed concerned about addressing all water issues and that a narrow self interest is not guiding or directing the process;

- b) to incorporate other voices and perspectives in decisions that are made to move the planning process forward and in areas that are operational and administrative in nature – e.g. looking for funding.

As of July 2007, the membership of the Steering Committee consisted of Bruce Beech (forestry), Jeff Guerin (Fisheries and Oceans Canada), Judy Guichon-Mailloux (ranching and agriculture), Bob Hamaguchi (Highland Valley Copper), Laurie Kingston (Spences Bridge Steelhead Advocate Association), David Laird, (Mayor, City of Merritt), Jack Madryga (resident, City of Merritt), Ian McGregor (Ministry of Environment), Stuart Murray (ranching and agriculture), Katharine Shewchuk (resident, City of Merritt) and Neil Todd (Nicola Watershed Stewardship and Fisheries Authority). John Anderson who was on the Planning Team will continue to chair the meetings in a consulting capacity. Katherine Gizikoff also stepped down from the Planning Team.² Dave Coutlee who represented the Nicola Tribal Association and sat on the Planning Team has taken a leave of absence. The Thompson-Nicola Regional District was represented on the Planning Team but is not represented on the Steering Committee.

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The Steering Committee/Planning Team (SC/PT) met 25 times over the past two years. Meetings on average lasted about 3.5 hours.

The role of the SC/PT has not changed significantly from the first terms of reference that were developed at the start of the planning process. The SC/PT's main function is to provide support to the Multi-Stakeholder Committee and the water use management plan planning process. Since July 2005, the SC/PT's workload has risen significantly. In that time, the SC/PT's activities included the following:

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- 1) planning Multi-Stakeholder Committee and Public meetings including
 - communications,
 - logistics,
 - agenda,
 - speakers,
 - facilitation and chairing of these meetings.
- 2) co-ordinating information flow, the work of all sub-committees and activities in a fair and objective manner;
- 3) liaising with the Nicola Watershed Community Round Table;
- 4) providing progress reports on the planning process to the Multi-Stakeholder Committee, the public, government, funders, etc.;
- 5) media relations and communications;
- 6) investigating possible funding sources;
- 7) initiating proposals and requests for funding - approving final draft;

² Katherine Gizikoff (GGEM Consulting Ltd.) has been projects manager for the studies and projects. As of September 2007, she will no longer be available to continue in that capacity.

- 8) evaluating progress with planning process and recommending changes in strategy to Multi-Stakeholder Committee;
- 9) updating roadmap;
- 10) reviewing written reports that may be brought to the attention of Nicola WUMP for input, addition to web site, etc. and recommending a course of action;
- 11) receiving new information and oral reports that could affect the planning process, assessing them and deciding on a course of action;
- 12) assigning work to the Nicola Watershed Community Round Table and the projects manager;
- 13) preparing letters of support in response to requests;
- 14) drafting work plans/cash flows (tied to funding applications) for adoption by the Multi-Stakeholder Committee;
- 15) drafting Memoranda of Understanding;
- 16) reviewing and evaluating/assessing opportunities for comment on terms of reference for economic impact assessments and recommending/deciding on a course of action;
- 17) other duties and tasks as assigned by Multi-Stakeholder Committee.

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4.4 Web Site

In early 2006, the Communications Sub-committee of the Multi-Stakeholder Committee began developing the content for a web site. The design of the web site was contracted out to *UBQ Communications and Design* of Kelowna. The web site was on line by April 2006 with the following address: www.nicolawump.ca.

In addition to the HOME page there were links to 12 sub-pages:

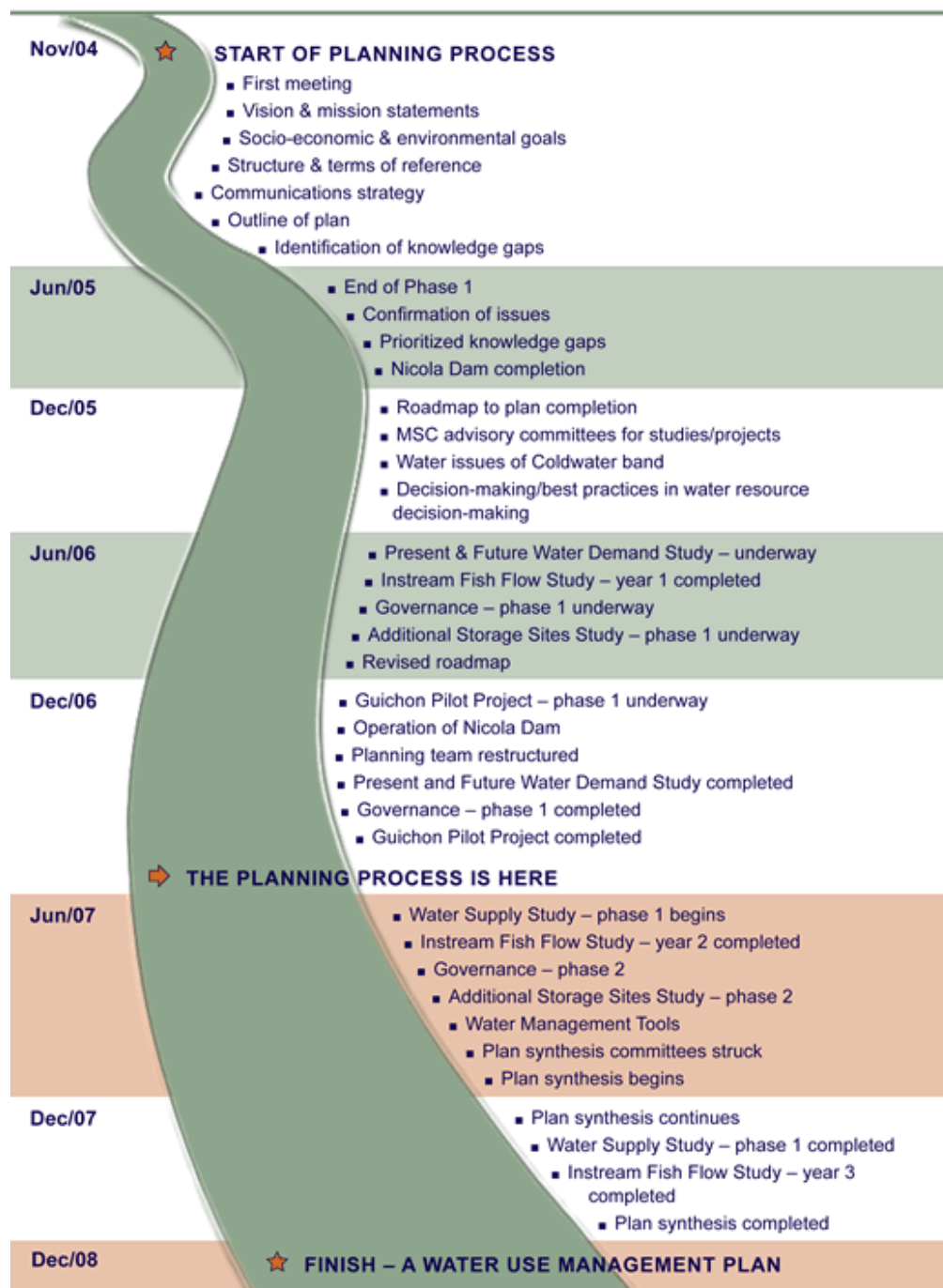
ABOUT US	WATERSHED MAP	WATER ISSUES
FAQ	THE DROPLET	MEETING MINUTES
REPORTS	WATER USE TIPS	GLOSSARY
DONORS/SPONSORS	LINKS	CONTACT US.

The web site was made possible with funding received from Fisheries and Oceans Canada. The out-of-pocket expenses included the web site designer, domain name registration, one-year server fees, training of volunteers in how to make changes to the web site and software (Contribute 3) to update the web site. The content (text) of the web site was developed by volunteers.

The web site is updated regularly. Minutes of the Multi-Stakeholder Committee are posted after every meeting in PDF format. The latest issue of *the droplet*, Nicola WUMP's newsletter, is uploaded as it becomes available. Reports are also added from time to time.

In the spring of 2007, the web site was updated with the addition of a new page called PROGRESS, some new photographs, and information about the date, time and place of the next Multi-Stakeholder Committee meeting at the top of the HOME page.

The PROGRESS page (see below) shows where the planning process sits in relation to the start of the process in November 2004 and end goal. This page will also be updated on a regular basis.



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*This diagram was current as of June 2007. It has since been updated and the updated version can be downloaded from the web site: www.nicolawump.ca.
NWCRT – October 2007*

4.5 Present and Future Water Demand Study

The Present and Future Water Demand study was the first of the key knowledge gaps to be filled. The terms of reference for the study were as follows: *(The present tense is used in the paragraphs below because that was the tense used in the terms of reference document.)*

Scope

The goal of this study is to determine as accurately as possible current and future demand³ for water in the Nicola watershed. As current demand may not be the same as use, the study will encompass allocated surface water use amended by records of actual use of surface water where data is available, and actual use of groundwater where records are kept plus estimated use of groundwater determined from airphoto interpretation and ground-truthing. Current surface water shortfalls for arable land and currently proposed groundwater extractions for development will be estimated and added to current demand in order to provide a baseline from which future demand scenarios can be predicted.

The scope of the study excludes the demand for water by the fisheries resource and that required for maintaining or enhancing existing ecological systems. However, the study will require compiling data on licensed water allocation for fisheries and conservation.

The study is to not only determine total demand and usage but also demand and usage on a monthly basis and, for August and September, on a weekly basis by sector, geographic area (sub basins) and source (surface water or groundwater).

The geographic area for the study is the Nicola watershed including the incorporated municipalities of Logan Lake and Merritt, unincorporated areas of Brookmere, Aspen Grove, Nicola, Nicola Lake, Quilchena, Douglas Lake, Stump Lake, inhabited Indian Reserves and the rural areas in between.

Study Objectives

- 1) To quantify and compare current demand, allocated use by sector on a monthly/weekly basis adjusted for actual use where *possible* in the Nicola watershed.
- 2) To identify in which sectors and sub-basins, that have been selected for this study, current demand exceeds current use and allocation.
- 3) To estimate the capacity for improving irrigation water use efficiency in the agricultural sector.
- 4) To estimate future demand by sector and for selected sub-basins, and identify uncertainties related to future demand from climate change, changes in land use, and water conservation (irrigation) practices.

Tasks

- 1) Carry out a literature search as to past studies done on this topic, review material and analyse for knowledge gaps.

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³ DEMAND is defined as currently (2006) allocated surface water use plus estimated groundwater use, also referred to as water extraction. Although they will not contribute to estimates of current demand, existing shortfalls in surface water allocations for arable land, plus currently (2006) proposed groundwater extractions for developments are additional water volumes to be estimated to enable the production of a baseline for future scenario prediction.

2) To help fill the knowledge gaps resulting from the literature review, to identify sources of information and data, and to gain an understanding of water demand in the Nicola watershed, at a minimum, meet/consult with the following:

City of Merritt
District of Logan Lake
Lower Nicola Water Works
Local Bands
Thompson-Nicola Regional District
Representatives of community watersheds
Proposed/Existing Resorts: *Brookmere, Juliet, Peter Hope, Nicola Lake, etc.*
All pertinent provincial ministries (Environment, Forestry, Energy and Mines, Agriculture and Lands)

3) Quantify (cubic metres) **current** demand and, where possible, actual use⁴ in each of the months from October to July and on a weekly basis, for the months of August and September.

a) by sector
agriculture – industry (forestry and mining) – business/
commercial activity – urban domestic by community –
institutional (aquatic centre, city parks, hospital, schools, etc.)
– a recreation/resort development

b) for each of the sub-basins:

Spilus	Coldwater	Quilchena	Upper Nicola
Stump	Moore	Clapperton	Middle Nicola
Guichon	Lower Nicola		

In certain instances withdrawals come from more than one basin so attention must be paid to avoid double counting and thereby inflating the usage numbers.

c) by source:

- what proportion of current demand (in each sector and sub-basin) is from surface water and what proportion from groundwater.

d) present data in a tabular/matrix form summarizing results from a), b) and c) above.

4) Confirm BC government's water allocation figures for all water license holders in the Nicola watershed, and, where possible, compare current water allocation to current actual use⁴.

5) Compile licensed water allocation (volume) for fisheries and conservation by sub-basin on a monthly basis and for August and September, on a weekly basis. Please note that there is a study underway to determine in-stream flow needs for fish in the Nicola basin. This study is sponsored by Fisheries and Oceans Canada, Kamloops.

6) Convert all volume-based (acre feet) water allocation to demand on stream flow (cubic metres per second) for each watercourse that has a water license associated with it.

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⁴ For the purpose of this study **actual use** will be estimated from: licensed allocated surface water adjusted for actual use for those where records exist, plus documented groundwater use, plus estimated groundwater use for irrigated parcels without surface water allocations, minus the known non-utilized licensed allocated use. An investigation into actual irrigation use of water relative to allocated surface water use for the agricultural sector if records are not available is not required for this study.

- 7) Utilize existing information to determine geographical water demand shortfalls.
- 8) Carry out a GIS mapping exercise, supported by ground truthing, on the extent of available arable land, actual use⁴ of water on arable land, and calculate irrigation efficiencies.
- 9) Provide an analysis of current irrigation practices including:
 - types of irrigation methods used and their efficiency;
 - number of ranches using each type of method;
 - area irrigated by each method for each sub-basin.
- 10) Provide an analysis with conclusions, of changes in water demand as a result of implementing irrigation efficiencies and water conservation practices.
- 11) Develop future demand scenarios by sector and specified sub-basin using three (3) population and development growth scenarios over two (2) timelines: **2020** and **2050** – six sets of data. A detailed explanation of the assumptions, the rationale and methodology used to come up with this information to be included in draft and final reports.
- 12) Evaluate confidence in water use and demand data compiled and identify approaches for improving the confidence of this data in the future. Compare and contrast the feasibility of each approach, and make recommendations for implementation considering respective contributions to reducing uncertainties referred to under Study objective 4.

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The study began in the summer of 2006 and the final report was received in June 2007. The consultants on this study were Summit Environmental Consultants Ltd.

A fact sheet on this very important piece of the water balance equation was prepared and is reproduced below. It summarizes some of the key findings of the study.



FACT SHEET

PRESENT AND FUTURE WATER DEMAND in the Nicola Watershed

In 2006, as part of the planning process (Nicola WUMP) leading to a water use management plan for the Nicola watershed, a study was undertaken to look at current and future demand for water.

The study was carried out by Summit Environmental Consultants Ltd. (Vernon, BC). The final report⁽¹⁾ is available on the web site — www.nicolawump.ca.

The final report entitled, *Nicola River Watershed Present and Future Water Demand Study*, provides estimates of current water demand and water use by sub-basin and sector and projects demand into the future. Since ACTUAL WATER USE data is not available for most of the regions of the watershed nor the individual sectors, water use figures were estimated for purposes of this study. The study dealt only with water demand. An analysis of water supply will be undertaken in a separate study.

The following are some highlights from the final report:

► Current (2006) estimated annual water use^a in the watershed is **74.2 million cubic metres**.

► Water use in the 10 sub-basins** that make up the watershed is as follows —

	<u>% of All Water Use</u>		<u>% of All Water Use</u>
Upper Nicola	21%	Stump Lake	8%
Guichon	20%	Quilchena	5%
Middle Nicola	18%	Spius	1%
Lower Nicola	16%	Moore	6%
Coldwater	10%	Clapperton	<.1%

► Agriculture accounts for the largest use of water - **81%** of water used in the watershed.

► The industrial sector (mining and forestry) accounts for **9%** of all water used.

► Domestic water use accounts for just over **6%** of water used.

► The institutional sector (government offices and facilities, educational and health services, city and provincial parks and campgrounds, churches, band offices, fish hatchery) accounts for **2%** of water used.

► The business/commercial sector accounts for less than **half a percent** and the recreation/resorts sector for about **2%** of water used presently.

► Water use overlaps between sectors and between sub-basins and a considerable portion of water used is sourced from ground-water.



The Future

Future water demand and use will be affected by growth and development. Depending on how quickly the population of the watershed expands over the next 15 to 45 years and assuming climate change impacts and no change in water usage patterns, water demand could rise by as much as

43% by 2020
124% by 2050 from 2006 levels.

More FACTS on reverse side

Published by:
Nicola Watershed Community Round Table
on behalf of Nicola WUMP
Box 400 Merritt, BC V1K 1B8
Telephone 250-378-4087

July 2007

(1) Copies (printed) of the report are also available by contacting the Nicola Watershed Community Round Table.

* Excludes water required by fish

** Sub-basins are not all equal in size (area). Sub-basins with irrigated land use more water per hectare of area than those with little or no irrigated land. See sub-basin map on reverse side.



FACT SHEET (cont'd)

Irrigation

- ▶ There are 6,049 hectares under irrigation in the Nicola watershed.
- ▶ The breakdown of irrigated areas by sub-basin is as follows:

Upper Nicola	25%
Guichon	14%
Middle Nicola	21%
Lower Nicola	17%
Coldwater	7%
Stump Lake	8%
Quilchena	6%
Spuis	1%
Moore	less than 1%
Clapperton	nil

- ▶ The 6,049 hectares are irrigated by the following methods:
 - 52% is irrigated by handmove or wheelmove sprinklers
 - 30% is irrigated by flooding
 - 10% is irrigated by centre-point sprinkler or spay heads
 - 6% is irrigated by centre-pivot drop tubes
 - 2% is irrigated by travelling or stationary guns.

- ▶ Flood irrigation has other benefits beyond providing water for crop production. Flood irrigation provides water for vegetation (trees, bushes, grasses, etc.) and wildlife, brings nutrients to vegetation (e.g. riparian vegetation) and contributes towards plant and animal biodiversity. These are all important values that need to be considered in order to have flourishing communities in a sustainable watershed. In addition, in some areas where flood irrigation is practiced, storing the spring freshet is not economically or environmentally feasible.

- ▶ A significant amount of water extracted from source (river, stream, well, etc.) does not reach its intended use. This applies across all sectors and is referred to as distribution losses.

Management of water demand will become increasingly important in order to facilitate continued economic growth and environmental sustainability.

Groundwater

- ▶ Groundwater is a source of domestic water for approximately 95% of the watershed's population.
- ▶ An estimated 19% of water used by the agricultural sector comes from groundwater.
- ▶ The Business/Commercial, Institutional and Domestic sectors obtain almost all of the water they use from wells.

Domestic Water Use

- ▶ Estimated average (over the course of a year) daily per capita domestic use for the City of Merritt is **770 litres**.
- ▶ In August and September, usage climbs to as high as **1,481 litres**/per person per day.
- ▶ Logan Lake's average daily use per person ranges from a low of **350 litres** in the winter to a high of **1,200 litres** in the summer.



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The Multi-Stakeholder Committee reviewed the study findings in May 2007 and over the next month, prepared an addendum to the final report. The addendum is reproduced below.

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PURPOSE OF THE ADDENDUM

The purpose of the **addendum** is to address comments and answer questions that were raised by the Multi-Stakeholder Committee upon reading the final report and following a presentation on the study findings.

The Present and Future Water Demand Study (PFWDS) and the final report met the terms of reference that were developed for the project. The intention of the **addendum** is to add clarity, highlight a number of statements made in the report, and provide context in order to minimize misinterpretation of the data and comments that are found in the final report, NOT to question the validity of the study findings. The reader is reminded that the study findings, including the projections for future water demand, were based on available data and assumptions made by Summit Environmental Consultants. The findings are useful for general water planning purposes. However, for specific planning within geographic areas, further data should be collected to confirm assumptions and water demand estimates.

No further funding was available to have the Consultant, Summit Environmental Consultants, make further changes to the final report. Therefore, the Multi-Stakeholder Committee (MSC) undertook to prepare an addendum as a separate document.

1) THE DIFFERENCE BETWEEN WATER DEMAND AND ESTIMATED WATER USE

The study estimated that the present *water demand* by all sectors in the Nicola watershed is approximately 53.3 million cubic metres while present estimated *water use* is 74.2 million cubic metres. The difference of about 20 million cubic metres, referred to as distribution loss, represents the volume of water that does not reach its intended use but either returns to the ground (leaky pipes) before reaching its destination or evaporates.

Key to interpreting correctly the study findings on water demand and use is understanding the difference between the phrases *water demand* and *water use*. For purposes of this study and as used in the final report, *water demand* is defined as follows: For all sectors (industrial, business, commercial, domestic, institutional, and resorts and recreation) **except** agriculture, *water demand* is defined as the quantity of water required to optimally maintain their respective activities. To determine the water demand for these sectors, Summit developed a number of assumptions and calculations. These are explained in the final report on pages 31 through 41.

For the agricultural sector, *water demand*, with or without the word ‘crop’ preceding the phrase, refers to the amount of water a crop needs to grow in the field and achieve maximum yield under ideal conditions. Pages 21 to 41 of the report discuss Summit’s assumptions and methodology for determining *water demand* by the agricultural sector.

Water demand by the agricultural sector DOES NOT refer to the water withdrawn either from surface water or groundwater. The water withdrawn is called estimated *water use*, an estimated figure based on *water demand* and irrigation efficiency. See 4) below for a definition of irrigation efficiency.

Water use for all sectors, agriculture included, reflects the quantity of water withdrawn from the source, be it surface or groundwater, and includes losses through the distribution system and potential consumption of water in excess of what is actually needed.

These terms are further discussed on Pages 3 and 4 of the report.

Tables 5.1 and 5.2 (pages 114 and 115 of the report, respectively) present *water demand* and estimated *water use* by sub-basin and sector, respectively.

2) FUTURE PROJECTIONS FOR WATER DEMAND BASED ON CROP DEMAND, NOT WATER USE

Projections for water demand in agriculture are based on 2006 crop water demand figures, not on estimated water use. In other words, the calculations to estimate **future water demand** were based on *water demand*, which refers to the amount of water that a crop needs to grow in the field to achieve maximum yield under ideal conditions. Ideal conditions mean 100% irrigation efficiency, that is, no water loss due to evaporation, leaks and over-watering, and no wind.

Because of the volume of distribution losses (see 1) above), forecasts based on estimated current use rather than current water demand should be considered when planning for sustainable agriculture in the Nicola basin. For example, in Table 8.2, summarizing future agricultural water requirements in the watershed, scenarios predict figures of 40.5 to 48.3 million cubic metres based on crop water demand. In reality, water extracted from the source to deliver these quantities to the fields (actual water use) will be roughly 48% higher to account for distribution losses. These distribution losses are inherent to irrigation and can only be improved by a maximum of between 7% and 10% in the basin by improving irrigation efficiency. Therefore, in planning for as sustainable agriculture in the watershed, water use requirements of between 59.9 and 71.5 million cubic metres by 2050 should be considered rather than the projections for crop water demand.

3) VALUE OF FLOOD IRRIGATION

Flood irrigation is discussed under Section 8.4.1. The statement is made that by “converting flood irrigation to a more efficient system, it would be possible to improve overall irrigation efficiency by nearly 7%”. Notwithstanding this comment, flood irrigation has/may have other benefits (in some sub-basins) beyond providing water for crop production. Flood irrigation provides water for vegetation (trees, bushes, grasses, etc.) and wildlife, brings nutrients to vegetation (e.g. riparian vegetation) and contributes towards plant and animal biodiversity. These are all important values that need to be considered in order to have flourishing communities in a sustainable watershed. Any decision to change from flood irrigation to another type of irrigation should take into account these values. In addition, in some areas where flood irrigation is practiced, storing the spring freshet is not economically or environmentally feasible.

4) IRRIGATION EFFICIENCIES

For this study, irrigation efficiency is defined as the percentage of the water that is withdrawn from the source that is beneficially used by the crop. Irrigation efficiency reflects water losses due to distribution system losses (e.g. leaks),

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evaporation and poor irrigation practices (e.g. over-watering). (Final report, Page 3 and Pages 120 to 122.) Thus, the lower the irrigation efficiency, the greater the amount of water that

- a) never reaches the crop because of leaks and evaporation; and /or
- b) the crop cannot use the water (over watering).

There was significant discussion around the term *irrigation efficiencies* as it applies or could apply in practice in the Nicola watershed. Land management decisions are based on a variety of factors and objectives and using less water may not always be possible or desired. Since the terms of reference for this study required the Consultant to look at the impact of water conservation practices, the common method is to use standardized irrigation efficiency formulae for the agricultural sector.

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5) KEY TABLES IN THE REPORT

The reliability of the figures in the report tables depends on the accuracy of the assumptions.

Table 5.1 and 5.2 (pages 114 and 115 of the report, respectively). Given new information about the volumes of water used by the Spius Creek Fish Hatchery, the estimated annual water demand and use for the Spius sub-basin and for the institutional sector bear re-examination when there will be calculations done for the water balance for this sub-basin and the watershed as a whole.

Table 5.3 – It should be noted that the *actual use* column is an estimate only.

Table 5.4 and Table 5.5, footnote 3 (pages 120 and 121 of the report, respectively) – new wording: Some of the water withdrawn from the Moore sub-basin may be used in the Stump Lake sub-basin. Since irrigated fields cross sub-basin boundaries and the boundaries could not clearly be seen in sufficient detail on the maps that were produced, it was not possible to assess to a high degree of accuracy the diversion of water (irrigation) from the Moore to the Stump Lake sub-basin.

6) WHY SOME LANDOWNERS DO NOT USE ALL THE WATER THEY ARE LICENSED TO EXTRACT

One of the key findings of the study is that the volume of surface water licensed for agriculture use in all but the combined Middle Nicola and Clapperton sub-basins, is quite a bit higher than the estimated agricultural *water demand* or *water use* (Table 5.5, page 122 of the report). If some landowners with water licenses do not withdraw all of the water they are allowed, it could be because the pump capacity of their irrigation systems limits how much water can be withdrawn from the source within the time frame allowed by the license. Other reasons include: the water supply is not there, the water is not needed for the crop, there has been sufficient rain at the right time, and/or the river has changed course.

7) THEORETICAL VERSUS ESTIMATE

The meaning of the word ‘theoretical’ and ‘estimate’ differ. An estimate is an approximate calculation based on one or more assumptions. For example, Summit assumed that the number of wells in the Ministry of Environment’s database represented 50% of the actual number of operating wells. When they then calculated the demand for groundwater, they first multiplied the number of

wells in the database by 2. Then they multiplied the new well number by the average daily consumption per household, times the number of households in the area to arrive at the final figure. This final figure is an estimate of groundwater use.

Theoretical is defined as pertaining to or based on theory. In the well example above, there is no theory associated with how to determine the number of wells in an area. The calculation that was performed did not try to either prove or disprove the actual number of wells in the area. A theory is a system of assumptions, accepted principles and rules of procedure devised to analyse, predict or otherwise explain the nature or behavior of a specified set of phenomena. A theory implies that it has to be proved or disproved.

In this study, the objective was not to confirm or disprove a theory, but to calculate series of numbers based on certain assumptions and/or criteria.

8) SECTION 5.9.5 – INSTITUTIONS - PAGE 102

It was brought to Nicola WUMP's attention after the final report was completed that there was an error in the commentary under Groundwater. The Spius Creek Fish Hatchery utilizes significant quantities of both groundwater and surface water – use is 24 hours a day, seven days a week.

Water is withdrawn from Spius Creek under a license. Little water would be lost to evaporation or discharge to ground as retention time in the facility is probably an hour or less until it is discharged back into Spius Creek a few hundred metres downstream from the point of diversion.

Water is also withdrawn from medium to deep aquifer(s) through three production wells (pump levels approximately 120 to 160 ft. below ground surface). Generally, at least two wells are producing water for the facility on a 24 hour a day seven day a week basis – and for a significant part of the year, all three wells are used. The total amount of water withdrawn from both surface and groundwater is estimated to be 4.3 million litres per day.

9) SECTION 6.0, PAGE 123

It should be noted that the study did not examine licensed instream flows since that is part of a water supply analysis. Future revisions to instream flow guidelines will consider water supply.

The second paragraph of Section 6.1 states that “no flows are presently licensed for instream flows in three sub-basins”. While this is correct for the main channels of the creeks and other watercourses in these sub-basins, there are licenses on the side channels of some of these bodies of water.

10) THE LIMITS OF THE DEMAND STUDY – NO SUPPLY DATA

The scope of the Present and Future Water Demand Study excluded collecting information on water supply. The report therefore presents no supply data. The purpose of the study was to look at water demand only. Water supply will be done through a separate study. The reason for the separation was the cost of doing a combined study.

The fact that there is no water supply data in the report should not in any way discredit the findings on water demand. The findings from the Present and

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Future Water Demand Study fill one knowledge gap that was identified. The water balance, a key piece of information that remains to be determined, will flow once a watershed-wide water supply study has been completed.

4.6 Additional Water Storage Sites Study – Phase 1

The additional storage sites study was undertaken to answer the following question: If water needs to be stored in the Nicola watershed, which bodies of water should be investigated to determine if they have the capacity to meet water supply shortfalls? The study, as originally designed, had the following objectives:

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- 1) To provide data and information in order to determine where additional water storage would alleviate water demand shortfalls at critical times. (i.e., when low river flows require the cessation of drawing surface water for irrigation purposes in order to protect the fisheries resource.)
- 2) To gather information on the capital, maintenance and operating costs of new or upgraded water storage infrastructure in the Nicola watershed.
- 3) To provide recommendations re: upgrading and construction of new storage infrastructure through a cost-benefit analysis.
- 4) To provide a sufficient detail of quality information on water storage potential in the Nicola watershed for inclusion into the development of scenarios for water use management.

Nicola WUMP was not successful in obtaining sufficient funding to carry out the original terms of reference and the decision was made to do the study in phases. The goal of the study remained the same - to identify existing and potential storage sites for water along the Nicola River and its tributaries – but instead of leaving the methodology for each phase to the consultant, the terms of reference now outlined how the project would be carried out. This involved a GIS mapping exercise to produce maps for each of the ten sub-basins of the Nicola watershed showing swamp catchment areas, lake catchment areas, Agricultural Land Reserve and winter ungulate range area, pine stands, biogeoclimatic zones, privately held land, aspect, slope and elevation range. Once the maps were produced, an engineer was hired to work with the Multi-Stakeholder Advisory Committee and the Projects Manager to

- a) develop criteria for selecting sites with storage potential and/or increasing storage at current storage sites;
- b) determine the potential water storage capacity of the selected storage sites (paper exercise);
- c) identify approaches for further study.

The GIS mapping exercise identified 345 potential storage sites. The sites fell into two categories: lakes greater than 5 hectares and swamps in excess of 20 hectares. Then these sites were assessed against two additional criteria which reduced the list to 121 potential storage sites, of which 47 are swamps. The criteria were:

- storage capability of a minimum of 50 acre feet using arbitrary increases in dam height of 0.5, 1.0 and 1.5 metres; and
- water supply or catchment area to reservoir area ratio of 20:1.

Using this approach, the sub-basins that offer water storage potential appear to be Clapperton, Coldwater, Guichon, Quilchena, and Upper Nicola. Few sites were identified as suitable for further investigation in Mid-Nicola, Lower Nicola, Spius and Moore.

The table below summarizes the potential for water storage by sub-basin. This table is taken from the report entitled *Nicola Water Use Management Plan Additional Storage - Phase I*⁵.

Sub-Basin	# of Sites	Total Acre Feet Increase at 100 cm.	Range for Individual Sites	Comments
Clapperton	7	1,670	125 – 397	
Coldwater	22	3,935	43 – 652	
Guichon	28	7,538	97 – 1,657	Mamit Lake alone would be 1,657 acre feet
Quilchena	19	4,781	95 – 542	
Upper Nicola	36	18,014	82 – 5,298	Douglas Lake and Chapperon Lake would be 8,867 acre feet
Mid-Nicola	3	20,754	209 – 20,335	Nicola Lake alone would be 20,335 acre feet
Lower Nicola	1	115	115	
Spius	1	217	217	
Moore	4	1,057	158 – 404	

The above-mentioned report summarizes the work done by Thompson River Mapping and Pentilchuk Engineering, the approach that was used and recommendations for next steps. The full list of 345 potential storage sites is found in Appendix D and the short-listed sites in Appendix A. This report with the maps that were produced for each sub-basin form the deliverables under Phase 1 of this Study as of July 2007.

At its June 2007 meeting, the Multi-Stakeholder Advisory Committee listed a number of action steps in order to further reduce the list of potential storage sites. The action items are to be completed in the fall of 2007.

⁵ *Nicola Water Use Management Plan Additional Storage - Phase I* by Katherine G. Gizikoff, M.Sc. P.Ag. GGEM Consultants Ltd, with input from Carl Pentilchuk, Pentilchuk Engineering, July 2007.

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4.7 Governance – Phase 1

Partly as a result of discussions with senior staff at the Ministry of Environment about Nicola WUMP, interest from the Pacific Salmon Foundation⁶, and a small amount of funding having been secured to begin looking at governance, the decision was made to carry out some preliminary research into different models of governance.

The first part of the project consisted of an investigation of eleven aspects of governance as exemplified by different water management models. The scope of the research was limited to collecting information using the Internet. The water management organizations that were investigated in this manner were:

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Bonaparte Water User Group
Bow River Irrigation District
LaSalle Redboine Conservation district
Mackenzie Valley Land and Water Board
Manitoba Conservation District
Mount Werner Water District
Okanagan Basin Water Board
Oldman Watershed Council
Turtle Mountain Conservation District

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These nine water management bodies were compared as to the nature of the legal entity, selection and qualifications of board of directors, mandate and limits of authority, types of decisions made and how they made decisions, reporting requirements, sources of revenue, water user fee structure, staffing levels and job description of chief operating officer.

The research findings are found in the report entitled *A Study of Governance Models* (September 20, 2006) by Allison Guichon.

The project then moved to the next stage. The objectives of this stage were to

- 1) To create a better understanding of what is meant by governance by the Multi-Stakeholder Committee of Nicola WUMP;
- 2) To provide a description of a minimum of one type of option for the following components of governance:
 - operating principles
 - limits of authority (mandate) and types of decisions made
 - nature of legal entity
 - how should decisions be made
 - structure
 - user fees
 - legislation changes
 - principles for trading of water rights

⁶ The Pacific Salmon Foundation administers the Living Rivers Fund for the province of British Columbia. In 2006, the Pacific Salmon Foundation joined with the Fraser Basin Council and created the Fraser Basin Living Rivers Program. A portion of the Living Rivers Fund was allocated to this program. The 2006 business plan for the Fraser Basin Living Rivers Program identified governance and integrated planning as one of the strategies by which the Program's vision would be met. For this reason, the Pacific Salmon Foundation became very interested in how Nicola WUMP would address the issue of governance.

- staffing (may include a water bailiff option)
 - revenue collection – who and how will this be administered
- 3) By March 31, 2007, to produce a report with recommendations for feasible options for components of governance.

WMI Water Management Consultants Inc. (Kamloops, BC) was hired to work with the *Governance Multi-Stakeholder Advisory Committee* to meet the above stated objectives and carry out a number of tasks that were listed in the terms of reference. The intent of this phase of the project was to build on the Guichon report and further explore water management governance models that might be suitable/feasible for the Nicola watershed.

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The result of this phase of the project is a report entitled, *Governance – Part 1: Preliminary Assessment of Governance Options* (March 2007).

The main recommendations found in the report centred around a suggested way forward, i.e. next steps towards making a recommendation for a governance model for the Nicola water use management plan. The recommendations were as follows:

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- a) Prepare letters to the Ministry of Environment, TNRD, City of Merritt, Ministry of Agriculture and Lands to inform these agencies of the Nicola WUMP's intention to become more involved in local water resource and water use decisions. The formation of an inter-agency committee concerning partnering/exploring the way forward together should be considered.
- b) Expand Multi-Stakeholder Advisory Committee to be fully representative (especially First Nations input).
- c) In conjunction with the larger Multi-Stakeholder Committee, to choose the initial functions that should be fulfilled; to determine at what level the functions should be implemented; to set targets, timelines and resource/budget requirements.
- d) Maintain momentum by implementing some of the initial functions including the determination of what it takes to be part of the government decision-making/referral process. Funding availability will be an important component in achieving significant progress.
- e) Participate in the Ministry of Environment's water governance process (i.e. reviewing the imminent discussion document); and try to obtain pilot project status in the Nicola Valley.
- f) Further investigate how the legislative process may be utilized or changed in the future to support the ideals of Nicola WUMP.
- g) Ensure all levels of government are involved and integrated into the process.

The project, *Governance – Phase 1*, was completed in the spring of 2007. The Multi-Stakeholder Committee has yet to review and comment on the final report. This will occur in the fall of 2007.

4.8 The droplet

In response to a request from members of the Multi-Stakeholder Committee to provide periodic updates on progress with the planning process, the Communications Sub-committee came up with the idea of a newsletter and called it *the droplet*. The newsletter also has a secondary objective: to provide individuals who are new to Nicola WUMP or who have missed one or more Multi-Stakeholder Committee meetings with a quick update on how the planning process is unfolding. *The droplet* is published between meetings of the Multi-Stakeholder Committee. Articles include

a synopsis of the last Multi-Stakeholder meeting, developments since the last meeting, a brief progress report on any studies or projects underway, announcements of future events and/or other information that may be of interest.

Issues (#1 through #11) of *the droplet* are available on the web site and are found in Appendix A of this report.

5. Works in Progress

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5.1 Instream Fish Flow Study

In 2005, Fisheries and Oceans Canada applied for funding from the Southern Boundary Restoration and Enhancement Fund for a 3-year project with the following title: *Nicola Basin Streamflow Recovery and Refinement of In-Stream Flow Needs for Fish.*

The project has the following objectives:

- 1) To review historic and current WSC hydrometric data sets throughout the basin and document the range of variability within and between years – pre, post and proposed storage scenarios.
- 2) Use the range of variability approach (RVA – Richter, 1997) to identify flow events (timing, magnitude, duration, frequency and rate of change) which are critical to the production of coho and chinook salmon and steelhead trout. Develop specific life history periodicity charts on a stream by stream basis, and on a reach basis, if required.
- 3) Improve the level of hydrometric information (supply/demand) by establishing and maintaining semi-permanent data loggers (flow and temperature) and/or flow transect sites at key points along the stream continuum. Key points will relate to known critical spawning and rearing areas along the main stem and major tributaries (e.g. Coldwater River).
- 4) Utilize the new BC Instream Flow Guidelines to provide baseline fish flow recommendations relative to existing hydrometric stations.
- 5) Develop Nicola basin specific habitat suitability curves (depth and velocity preferences) for species and age classifications and relate to established spawning and rearing (parr) habitat transect sites.
- 6) Compare and contrast the various in-stream flow methods used to justify a set of reasonable flow recommendations suitable for low, average and good water years.

The first two years of the project have been completed. A report will be produced in year 3. The project is being managed out of the Kamloops office of the Fraser Basin Council in partnership with Fisheries and Oceans Canada. Periodic reports on the project's progress are provided to the Steering Committee.

5.2 Water Management Tools

In 2006, a presentation on the Okanagan Fish-Water Management Tool (OFWMT) was made to the Planning Team (now called the Steering Committee). The OFWMT is an Internet-accessible multi-user decision support model for the Okanagan basin. The decision-making framework is based on five ‘coupled’ state-of-the-science biophysical models (hydrology, socioeconomic water management rules, water temperature, kokanee and sockeye) that address lake and down-river considerations at a variety of sites. The model helps managers decide the weekly water releases at Okanagan Lake dam that meet the critical performance measures at a variety of lake and down-river sites.

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Several months after the presentation, Nicola WUMP was made aware of a funding opportunity (GEOCONNECTIONS initiative) for investigating a similar water management tool for the Nicola basin. Clint Alexander from ESSA Technologies⁷ had submitted a proposal to Nicola WUMP outlining a proposed course of action for developing a fish-water management tool for the Nicola watershed. The proposal also outlined several challenges associated with developing a water management tool in the Nicola basin and strategies for addressing these. The proposal included an estimated cost for the course of action, but before any more work on a water management tool could take place, funding would have to be secured.

Clint Alexander then undertook to prepare a letter of intent, the first step in accessing funding under the GEOCONNECTIONS initiative, and submitted it on behalf of Nicola WUMP and its partners. The GEOCONNECTIONS application process had a number of steps, one of which was a user needs workshop that had to be held prior to the submission of a preliminary proposal. The objective of the workshop was to review, discover and clarify information needs (wants and preferences) of Nicola basin water/fish managers in relation to the creation of a new decision support system. The final application also required that other criteria be met including matching contribution from partners and collaborators, especially government as sponsor/proponent.

The workshop took place on October 16, 2006. In addition to members from the Multi-Stakeholder Committee, there was staff from Fisheries and Oceans Canada and the Ministry of Environment, a councillor from the City of Merritt and staff from the Nicola Watershed Stewardship and Fisheries Authority.

⁷ ESSA Technologies worked with the Okanagan Basin Technical Working Group to develop the software for the computer model of the Okanagan Fish-Water Management Tool.

The User Requirements Workshop identified five broad categories of objectives:

- in-season flood control and water supply management;
- anadromous and resident fish population protection and restoration;
- agricultural water demand requirements;
- water demands for ecological functions (services);
- surplus water availability for new development, growth (longer term).

Before a full proposal could be submitted, two challenges needed to be addressed:

- 1) identifying clear, committed project leadership, including realistic commitments of agency staff time; and
- 2) clarifying total funding support.

In November and December 2006, Clint Alexander worked to address these challenges but in the end was unable to get either the commitment or the funding support. As a result, further work on a water management tool was suspended.

An application to the Fraser Salmon and Watersheds Program in the spring of 2007 resulted in \$20,000 being approved to continue working on a fish-water management tool. As other priorities took up the Steering Committee's and the Multi-Stakeholder Committee's time between April and June 2007, as of July, a work plan for the \$20,000 has yet to be developed and approved.

5.3 Surface and Groundwater Supply and Interaction Study

Key to moving forward with the development of a water use management plan is establishing the water balance in the watershed. Available data on surface water supply needs compilation and review. Information on groundwater is incomplete and fragmented. The impact on surface water volumes from groundwater extraction is not well known. Phase 1 (of the planning process) identified the issue that new extractions of groundwater may be impacting existing wells and surface water supplies. A better understanding of the groundwater resource and its interaction with surface water supply are critical to determining actual water availability.

In order to address the water supply knowledge gap, terms of reference for a water supply study were developed in early 2006 and some funding secured to begin work on answering the most important questions.

With the \$50,000 that was secured from the Fraser Salmon and Watersheds Program (Pacific Salmon Foundation/Living Rivers) a call for proposals went out in December 2006 to a number of consulting firms with experience in this area. The scope, objectives and tasks for the study were as follows and interested parties were asked to bid on Phases 1 and 2 only.

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Scope

This study will be done in three phases. The *first phase* will consist of reviewing existing water (surface and groundwater) supply data and studies, forecasting surface water supply, identifying knowledge gaps, developing criteria for selecting areas for further study and preparing a report summarizing the information. Phase 2 will flow from the recommendations in the Phase 1 report and focus on developing water supply and surface/groundwater interaction models and recommending a work plan for the next phase. Phase 3 will focus on providing greater accuracy for quantifying water supply and in the degree of surface and groundwater interactions, groundwater recharge rates; and confirm conceptual models.

The study area is the Nicola watershed and its ten sub-basins.

Study Objectives

- 1) To determine current water supply (surface and groundwater) and seasonal patterns of supply for the entire watershed and in each of the sub-basins.
- 2) To forecast future water supply and seasonal patterns stemming from climate change under a minimum of three scenarios.
- 3) To identify where and to what degree surface water and groundwater, including aquifers, interact in order to understand more fully the implications of water extraction.

TASKS

Phase 1 - Collection and Synthesis of Available Data and Information

1-0) Carry out a literature search as to studies completed and ongoing on this topic in the Nicola basin. Collect, review, compile, collate, tabulate and summarize available information on groundwater and surface water supply. At a minimum, the study should use groundwater and surficial geology mapping, air photos, reports and surface water flow data.

1-1) Identify other potential sources of information not yet compiled in literature including existing GIS mapping. To do so, meet, at a minimum, with the following:

- City of Merritt
- TNRD
- Pertinent Provincial and Federal Ministries
- Highland Valley Copper

1-2) Compile monthly water supply (groundwater and surface) data by sub-basin (weekly for August and September). (See Note 1.)

1-3) Describe surface water flows in each sub-basin from a historical perspective. Compare to recent trends. Comment on frequency, intensity, duration and season (months) of low flow levels. (See Note 1.)

1-4) Forecast surface water supply for each sub-basin using one climate change model⁸ as specified by the client. (See Note 1.)

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⁸ The Climate Change model to be used is called **Climate BC** and is the same one as was used for the PRESENT AND FUTURE WATER DEMAND STUDY.

- 1-5) Summarize existing groundwater and aquifer information by sub-basin (where possible) and include the following:
- groundwater type (confined and non-confined);
 - known and probable areas of groundwater/surface water interaction;
 - known characteristics such as location/elevation, current extraction and recharge rates, and critical time periods for surface water/groundwater exchange;
 - a rating system for aquifers that ranks identified aquifers according to their sensitivity to further water extraction based on their known or suspected interaction with surface water or current extraction rates;
 - any other known limitations to the potential availability of groundwater for use (such as water quality).
- (See Note 1.)

1-6) Analyze available information for knowledge gaps. Identify any key information items missing for each sub-basin, such as surface and groundwater interaction, that are required for water supply modeling.

1-7) Develop criteria with justification (e.g. location of new residential/recreational development) for selecting sites for further investigation in order to gather the missing information.

1-8) Recommend method by which water supply and surface and groundwater interaction can be presented or modeled.

1-9) Prepare an interim report.

PHASE 2 – DEVELOPING WORK PLAN FOR FURTHER INFORMATION GATHERING

2-1) Complete approved recommendations from TASK 9.

2-2) Using criteria developed under TASK 1-8, recommend sites for study in Phase 3.

2-3) Provide a work plan for implementing Phase 3 (Note 2). This work plan is to identify information needs, the areas of focus for further study, methodology of data collection that demonstrates how project objectives will be met, cost estimate, and time-line. Phase 3 will include a data collection component, potentially from but not limited to test pits, boreholes, monitoring wells, piezometers, pumping tests, tracer tests, geophysical surveys, environmental isotopes, and/or down hole investigations, etc.

Note 1: For Tasks 1-3, 1-4, 1-5 and 1-6, any data graphed for presentation purposes in the report should also appear in spreadsheet format as an appendix of the final report (hardcopy and electronic copy on disk). Any data mapped for presentation purposes should be developed with ArcView/ArcInfo GIS such that it can be integrated with other WUMP projects.

Note 2: Phase 3 is to provide greater accuracy for quantifying water supply and the degree of surface/groundwater interactions, groundwater recharge rates and confirm conceptual models for each sub-basin.

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Four firms responded with proposals that ranged in price from \$112,000 to \$350,000. Since there was insufficient funding to proceed with the study as outlined in the request for proposal, discussions took place with the Technical Advisory Group and the Multi-Stakeholder Advisory Committee for this study on how to proceed. In the end it was decided to try to find additional funding to begin work on Phase 1.

In June 2007, the Pacific Salmon Foundation indicated that additional funding would be forthcoming for the water supply study. It is anticipated that a water supply study will begin in September 2007.

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5.4 Water Management in the Guichon Pilot Project

This project began late in 2006 with the drafting of terms of reference. The scope, objectives and deliverables were as follows:

Scope

The goal of this project is to identify water management actions and tools to ensure a sustainable supply of water to meet seasonal needs of First Nations, agricultural users, residents, and fish in the Guichon drainage.

The project is proposed to be conducted in two phases. The first phase of the project will be to liaise with First Nations and stakeholders in the lower Guichon to compile a preliminary list of historic and current water management issues. This process will be followed by a workshop, facilitated by the professional, to summarize issues/concerns and develop potential resolution strategies. Phase 2 of the project will continue with the engineering consulting firm to investigate the pre-feasibility, including costs, of potential resolutions and to provide recommendations for moving forward on preferred resolutions. Phase 3 is not yet scoped, but may include on-ground investigations, feasibility assessments, and implementation. The final product, which may include an implementation plan for additional storage, an investigation into groundwater extraction options, an operating plan for the Mamit Dam, and/or conservation strategies for agricultural users, will be integrated with the relevant sections of the Nicola WUMP report and implementation plan in 2008.

Project Objectives

The objectives of the *Water Management in the Guichon* project are:

- to build trust and improve communications between groups and water users; and,
- to develop a water management action plan through consensus that will support current and future water needs of First Nations, the natural resources, agriculture, development and industry.

Deliverables/Methodology

The deliverables of the first phase for which funding has been received from the Fraser Salmon and Watersheds Program are:

- a preliminary list of historic and current issues compiled through consultation with the Lower Nicola Indian Band, the unincorporated community of Lower Nicola and other lower Guichon residents or water licensees;

- a workshop to summarize issues/concerns and develop potential resolution strategies; and
- an action plan for Phase 2.

Phase 1 of the Water Management in the Guichon project will include consultation to hear issues and concerns, as well as to find solutions. Consultation will consist of:

- liaison with the Lower Nicola Indian Band to initiate a listing of historical and current issues/concerns on water supply from a traditional, fisheries, agricultural, domestic, and development perspective;
- interview other agricultural water licensees in the lower Guichon drainage;
- meet with the Department of Fisheries and Oceans, and the Ministry of Environment;
- contact Highland Valley Copper, the industry extracting the largest volume of water from the sub-basin;
- meet with the Lower Nicola Water Works and Logan Lake Water Works to gather information on domestic and commercial water use; and,
- hold one public meeting to which the Lower Nicola residents will be invited to get their input with regard to domestic water supply.

Once the consultation has been completed and the information collated, a consultant/facilitator will be hired to lead the workshop to which First Nations, stakeholders, as well as all other residents in the Guichon sub-basin will be invited. The facilitator will lead the workshop participants through the issues and help them formulate some solutions by consensus. A report on the workshop will be prepared and will also include an action plan to move into Phase 2.

Funding in the amount of \$20,000 came from the Fraser Salmon and Watersheds Program for Phase 1, with another \$20,000 committed by Highland Valley Copper for Phase 2. As of July 2007, Phase 1 was nearing completion. However, due to unforeseen developments during the early stages of Phase 1, the project's timeline has had to be extended to the end of December 2007. An up-to-date progress report will be provided to the Multi-Stakeholder Committee in the fall when the planning process reconvenes.

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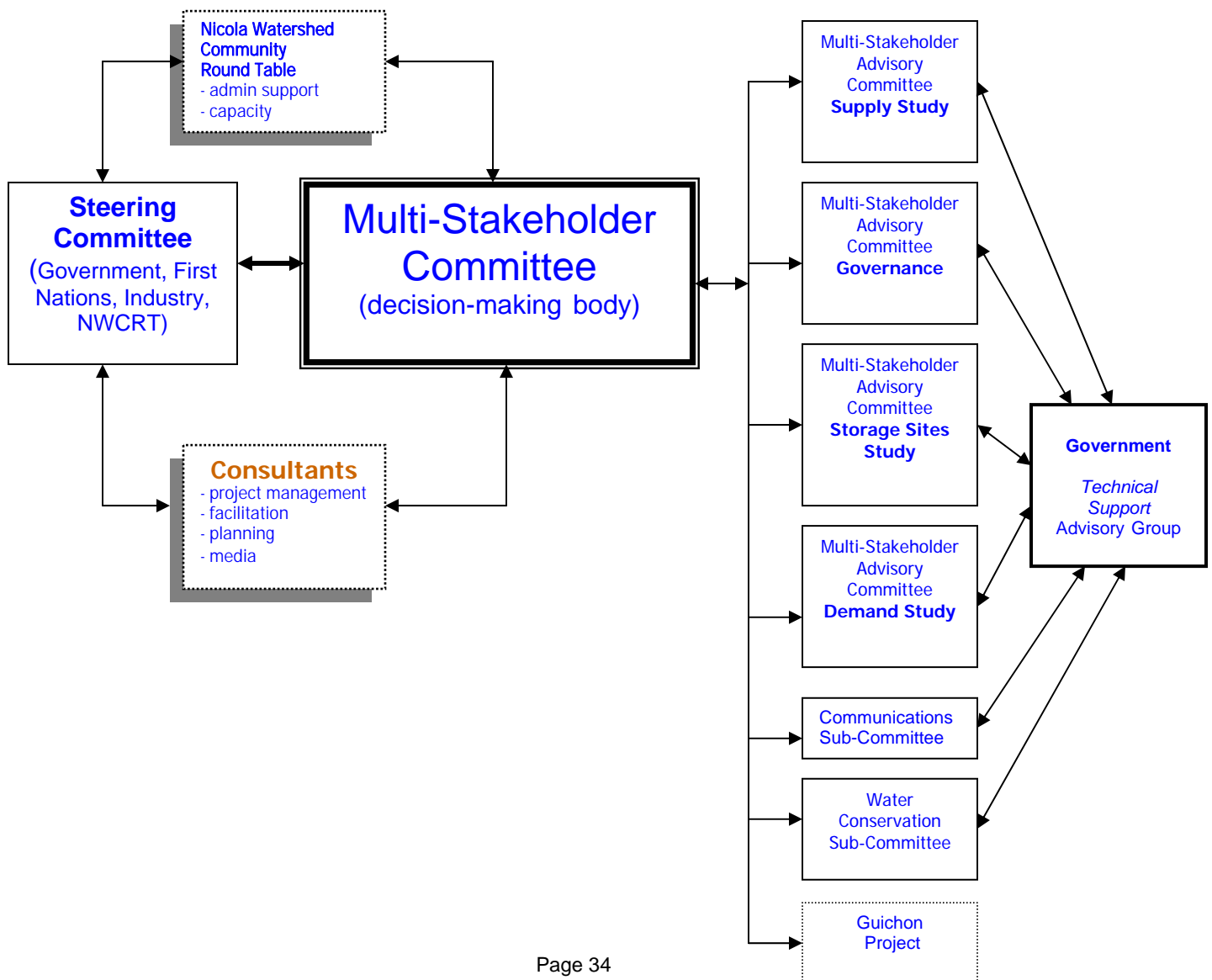
To avoid having to change a multitude of documents, this report continues to use the words to mean either one of the four stages of the planning process or one or more portions of studies.

6. Structure for the Planning Process

In February/March 2007, the Planning Team reviewed progress with the planning process. At the end of the review, the Planning Team concluded that some changes to the structure of the planning process would have a number of advantages, especially in trying to secure funding in order to complete the plan. The Planning Team took their idea to the Multi-Stakeholder Committee for feedback and direction. The new structure was presented at the March 2007 Multi-Stakeholder Committee and after discussion, adopted.

The main change to the structure was in the expansion of and a new name for the Planning Team, which became the Steering Committee. The function of chairing of meetings was made into a consulting position and, in order to address any potential conflicts of interest, the projects manager would no longer be a member of the Steering Committee. The chairing of meetings (Multi-Stakeholder Committee, Public and Steering Committee) became one of the support functions provided by the Nicola Watershed Community Round Table.

The new structure for the Nicola WUMP planning process is reproduced below.



7. Reports, Papers, Articles, Bulletins, Etc. on File

As part of the planning process leading to a water use management plan for the Nicola watershed, the Nicola Watershed Community Round Table is compiling a library of information. To date (July 2007), this library consists of numerous reports, papers, articles and other documents. Some are available in digitized format and of these, a number are available via the Nicola WUMP web site. As of July 2007, the Nicola Watershed Community Round Table has on file over 70 documents on water, water-related and Nicola WUMP relevant topics. These documents fall under one of the following categories:

2001 Census	Nicola Watershed
Agriculture - Agriculture Water Supply Issues	Nicola Watershed Strategic Plan
Coalbed Methane	Nicola WUMP
Conservation	Planning Process – LRMP
Ecological Footprint	Regulation
Environmental Assessment	Restoration – Restoration Planning
Fish – Fish Management and Funding Model - Fish and Sustainability - Fish and Water - Fish Flow Requirements - Fish Sustainability Planning - Projects Fisheries and Water Issues - Salmon Habitat - Stream Temperature – Thompson River Steelhead	Results-based Code Socio-Economic Statistics
Forest and Range Practices	Solid and Liquid Waste Management Species at Risk
Fraser Basin Business Plan – Living Rivers	Stewardship – Watershed Stewardship
Funding	Storage of Water
General	Surface and Groundwater Interaction
Global Warming	Sustainable Development
Governance	Water Demand
Groundwater – Regulation - Groundwater and Fish	Water Management Tool
HVC Landfill Project	Water Quality
Instream Fish Flows	Watershed Management
Living Rivers Funding	Water Supply issues
Low Flows	Water Use – Water Industry
Nicola Dam	Water Use Planning
Nicola Lake	World Trade Organization – Free Trade Agreement of the Americas

2001 Census data

Title	Name of Digitized File	Author	Date	TOPIC	Format Hard Copy (HC) Digitized (D)
2001 Census Profile of TNRD – 18 pages	Thompson-Nicola 2001 Profile	BC Stats	2001	2001 Census data	D

Agriculture - Agriculture Water Supply Issues

Title	Name of Digitized File	Author	Date	TOPIC	Format Hard Copy (HC) Digitized (D)
Analysis of Agricultural Water Supply Issues – National Summary – 33 pages	natsupply_c	Agriculture and Agri-Food Canada	May 2003	Agriculture water supply issues	Web site
Thompson Nicola Regional District Agricultural Overview – 20 pages	TNRD Agr. Overview	Thompson Nicola Regional District	1971-2001	Agriculture	D

Coalbed Methane

Title	Name of Digitized File	Author	Date	TOPIC	Format Hard Copy (HC) Digitized (D)
Coalbed Methane: A Citizen's Guide – 59 pages	Coalbed Methane	West Coast Environmental Law	May 2003	Coalbed Methane	D

Conservation

Title	Name of Digitized File	Author	Date	TOPIC	Format Hard Copy (HC) Digitized (D)
Water Conservation Strategy – City of Merritt – 46 pages		Urban Systems	May 2003	Water conservation	HC and web site
Conservation Ontario web site			Printed from web site on October 28, 2004	Conservation	HC http://conservation-ontario.on.ca/profile/profile.htm

Ecological Footprint

Title	Name of Digitized File	Author	Date	TOPIC	Format Hard Copy (HC) Digitized (D)
Ecological Footprints and Appropriated Carrying Capacity: Measuring the Natural Capital Requirements of the Human Economy – 28 pages		William E. Rees Mathis Wackernagel	unknown	Ecological footprint	HC (paper)

Environmental Assessment

Title	Name of Digitized File	Author	Date	TOPIC	Format Hard Copy (HC) Digitized (D)
A Brief Description of the British Columbia Environmental Assessment Process – 3 pages			n/a	Environmental assessment	HC
Ministry of Tourism, Sport and the Arts – Resort Review Process – 2 pages		Ministry of Tourism, Sport and the Arts	No date		HC
Summary Guide to the British Columbia Environmental Assessment Process – 46 pages			March 2003	Environmental assessment	HC

Fish – Fish Management and Funding Model - Fish and Sustainability - Fish and Water - Fish Flow Requirements - Fish Sustainability Planning - Projects Fisheries and Water Issues - Salmon Habitat - Stream Temperature – Thompson River Steelhead

Title	Name of Digitized File	Author	Date	TOPIC	Format Hard Copy (HC) Digitized (D)
Living Blueprint for BC Salmon Habitat – An Action Plan Produced by and Independent Panel	Blueprint for BC Salmon Habitat	B. Buchanan; G. Chislet D. Griggs; M. Healey, C. Hunt; A.Lill, D. Harver; L. Toussignant	1997-2000 (?)	Salmon Habitat	D
The State of Fish and Fish Habitat in the Okanagan and Similkameen Basins – 110 pages		Fisheries and Oceans Canada Okanagan Nation Alliance BC Ministry of Water Land and Air Protection	2005	Fish and Fish Habitat	HC (report)
Nicola River Watershed: Fisheries Resource Issues and the Involvement of DFO, MELP and First Nations – 35 pages		John Millar Matthew Child Nick Page (Coast River Environmental services Ltd.	1997	fisheries and water issues and initiatives	HC (report plus 2 maps)
Low Altitude Thermal Imaging of the Coldwater River – 32 pages	Thermal Imaging Report	Henderson Environmental Consulting	July 2001	Stream temperature	Web site
Coldwater River Watershed Recovery Plan – 47 pages excl. appendices	Coldwater Recovery	LGL Limited	November 2001	fish	HC and web site
Conflicts Between People and Fish for Water – 98 pages	frcc_conflicts_between_ people_and_fish_for-water	Dr. Marvin Roseneau Mark Angelo	September 2004	Fish and water	HC, D and web site
Review of Groundwater-Salmon Interactions in British Columbia – 19 pages	Groundwater Salmon print	Tanis Douglas	November 2006	Groundwater and Fish	HC, D and web site
A New Management and Funding Model for Fish, Wildlife and Park Recreation - 68 pages	RecreationFinalRptjan03	Recreation Stewardship Panel	November 29, 2002	Fish – management and funding tool	D
Thompson River Steelhead – A Path to Recovery – Workshops and Consultation Report – 36 pages		BC Wildlife Federation	April 15, 2006	Thompson Steelhead	HC
Watershed-Based Fish Sustainability Planning – A Guidebook for Participants – 85 pages		BC Ministry of Fisheries BC Ministry of Environment, Lands and Parks Fisheries and Oceans Canada	2001	Fish sustainability planning	HC

Sustainability issues to Fraser Salmon and the watersheds they depend upon – 13 pages	LivingRiversIssues	N/A	No date	Fish and Sustainability	D
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Forest and Range Practices

Title	Name of Digitized File	Author	Date	TOPIC	Format Hard Copy (HC) Digitized (D)
A Results-Based Forest & Range Practices Regime for BC – 67 pages	Final_Discussion_Paper	Province of BC	May 2002	Forest and Range Practices	D

Fraser Basin Business Plan – Living Rivers

Title	Name of Digitized File	Author	Date	TOPIC	Format Hard Copy (HC) Digitized (D)
Living Rivers Business Plan for the Fraser River Basin, 16 pages Oct 3, 2005 Meeting Summary	LRBPOct3 Mtg Sum	Fraser Basin Council Pacific Salmon Foundation	October 3, 2005	Fraser Basin Business Plan – Living Rivers	D

Funding

Title	Name of Digitized File	Author	Date	TOPIC	Format Hard Copy (HC) Digitized (D)
Eco Action Program		Environment Canada	unknown	Federal program	HC (promotional material)
Programs by region – 31 pages	Environment Canada Resources	Environment Canada	unknown	Funding Opportunities	D

General

Title	Name of Digitized File	Author	Date	TOPIC	Format Hard Copy (HC) Digitized (D)
Nicola River Corridor - Managing For Agriculture, Wildlife and Fish		Ducks Unlimited Environment Canada	unknown	Projects along the Nicola River	HC (8.5 X 11 fold-out brochure)
Water-Our Limiting Resource – Towards Sustainable Water Management in the Okanagan		unknown	unknown	List of names	HC (list of attendees at a workshop/conference)
Forum on Water – Water: Is There enough for Everybody – 71 pages	February 2004 Water Workshop	Nicola Watershed Community Round Table	February 2004	General	HC, D and web site

Global Warming

Title	Name of Digitized File	Author	Date	TOPIC	Format Hard Copy (HC) Digitized (D)
Melting Point – 8 pages		Chris Wood	2005	Global warming impacts	HC

Governance

Title	Name of Digitized File	Author	Date	TOPIC	Format Hard Copy (HC) Digitized (D)
A Participatory Approach to Water Management Irrigation Advisory Committees in Southern Ontario – 12 pages		R. Shortt, W.J. Caldwell, J. Ball, P. Agnew	Spring 2006	Governance	HC – article in Spring 2006 issue of Canadian water Resources Journal
A Study of Governance Models – 34 pages	NWUMP Consolidated Final Report - Governance	A. Guichon	September 2006	Governance	HC, D and web site
Financial Review of Water Service Agencies – Background Paper (Draft for Discussion) - 26 pages		Urban Systems	January 15, 2002	- Challenges facing water agencies - Financial Assistance Programs - Alternatives to Financial Assistance Water Conservation	HC
Governance – Part 1: Preliminary Assessment of Governance Options - 52 pages	NWUMP Consolidated Final Report - Governance	WMI Water Management International Inc.	March 2007	Governance	HC, D and web site
Watershed management, structural characteristics, information processing and cooperative strategies in conservation organizations – 7 pages		S. Low T. Rhandir	November-December 2005	Watershed management	HC

Groundwater – Regulation - Groundwater and Fish

Title	Name of Digitized File	Author	Date	TOPIC	Format Hard Copy (HC) Digitized (D)
Watermark - BC's New Groundwater Protection Regulation		Bob Brown; Mike Wei, Ministry of Environment	Winter 2005	Ground water - regulation	HC (article)
Streamline Watershed Management Bulletin – 32 pages			Spring 2007	Groundwater (article)	HC
BC's Groundwater Protection Regulation		Ministry of Environment		Groundwater - regulation	HC (pamphlet)
Buried Treasure – Groundwater Permitting and Pricing in Canada – 104 pages		Linda Nowlan; Geological Survey of Canada; West Coast Environmental Law; Sierra Legal Defence Fund	March 2005	Groundwater	HC
Groundwater Resources in British Columbia – 276 pages		Ministry of Environment, Lands and Parks Environment Canada	1994	Groundwater	HC
Groundwater Evaluation Guideline – 2 pages		Alberta Environment	December 5, 2002	Groundwater - regulation	HC

HVC Landfill Project

Title	Name of Digitized File	Author	Date	TOPIC	Format Hard Copy (HC) Digitized (D)
Letter from HVC to GVRD re: landfill project – 6 pages	Wolfs Letter to GVRD	Wolf Nickel, President and General Manger, Highland Valley Copper	February 9, 2005	HVC Landfill project	D

Instream Fish Flows

Title	Name of Digitized File	Author	Date	TOPIC	Format Hard Copy (HC) Digitized (D)
Water requirements for the Fisheries Resource if the Nicola River of BC – 147 pages	GT Kosakoski – 1982 Water Requirements for Nicola Fisheries	G. T. Kosakoski and Roy E. Hamilton	September 1982	Fish flow requirements	Web site
Nicola River Watershed – Water Use Management Plan Instream Flow Needs for Fish – 53 pages	Hatfield - 2006 - Nicola instream flows for fish	Todd Hatfield, Solander Ecological Research	October 30, 2006	Instream fish flows	HC, D and web site

Living Rivers Funding

Title	Name of Digitized File	Author	Date	TOPIC	Format Hard Copy (HC) Digitized (D)
Living Rivers in a Living Land - an initial exploration of the 'living rivers' Concept for BC	livingrivers2002		April 5, 2002	Living Rivers Funding	D

Low Flows

Title	Name of Digitized File	Author	Date	TOPIC	Format Hard Copy (HC) Digitized (D)
Summer 2003 Low Flows in the Southern Interior of British Columbia – 45 pages	2003 Summer Flows - Nicola	P. F. Doyle, Doyle Engineering	March 2004	Low Flows	HC, D

Nicola Dam

Title	Name of Digitized File	Author	Date	TOPIC	Format Hard Copy (HC) Digitized (D)
The Completion of the Nicola Lake Dam Project Technical Feasibility Study – 102 pages	2006-03-nic lak dam-tech feas study-mgmt sum-rep-FINAL DRAF.	Urban Systems	March 2006	Nicola Dam	HC, D and web site

Nicola Lake

Title	Name of Digitized File	Author	Date	TOPIC	Format Hard Copy (HC) Digitized (D)
Engineering Feasibility Study on Rebuilding Outlet of Nicola Lake – 84 pages	Engineering Feasibility Study on Rebuilding Outlet of Nicola Lake	L.A. Bergman	May 1983	Nicola Lake	Web site

Nicola Watershed

Title	Name of Digitized File	Author	Date	TOPIC	Format Hard Copy (HC) Digitized (D)
Nicola River Basin Management Strategy – Phase 1: Scoping Study – 45 pages	05-01-21 Scoping Study	Urban Systems	January 2005	Nicola watershed	HC, D and web site
Charting Our Water Future, Overview of Workshop Results – 26 pages	FinalReportwithackn	Gerry Tonn, Urban Systems	December 2004	Nicola watershed	HC, D and web site
Forum on Water – Water: Is There enough for Everybody – 71 pages	February 2004 Water Workshop	Nicola Watershed Community Round Table	February 2004	General	HC, D and web site

Nicola Watershed Strategic Plan

Title	Name of Digitized File	Author	Date	TOPIC	Format Hard Copy (HC) Digitized (D)
Nicola Basin Strategic Plan – Summary Document – 66 pages	MOE 1983 – Nicola Basin Strategy Plan	Ministry of Environment	July 1983	Nicola watershed strategic plan	HC, D and web site
Nicola Basin Strategic Plan – Technical Document – 327 pages	MOE 1983 – Nicola Basin Strategy Plan	Ministry of Environment	May1983	Nicola watershed strategic plan	D and web site

Nicola WUMP

Title	Name of Digitized File	Author	Date	TOPIC	Format Hard Copy (HC) Digitized (D)
Report on Phase 1 of the Process Leading to a Nicola Water Use Management Plan – 43 pages	REPORT ON PHASE finalep2305	Nicola Watershed Community Round Table	September 2005	Nicola WUMP	HC, D and web site

Planning Process – LRMP

Title	Name of Digitized File	Author	Date	TOPIC	Format Hard Copy (HC) Digitized (D)
LRMP – 3.0 Preliminary Organization 4.0 Information Assembly 5.0 Scenario Development 6.0 Scenario Evaluation Chapter 2: The LRMP Process – 14 pages		unknown	December 15, 1995	Planning process – LRMP	HC

Regulation

Title	Name of Digitized File	Author	Date	TOPIC	Format Hard Copy (HC) Digitized (D)
Water Management – User’s Guide for Works and Changes in and About a Stream – 24 pages		Province of BC	1995	Regulation	HC (booklet)

Restoration – Restoration Planning

Title	Name of Digitized File	Author	Date	TOPIC	Format Hard Copy (HC) Digitized (D)
Watershed Restoration Planning – Planning and Priority Setting for the Next Five Years – Phase 3 Watershed-Level Planning – 37 pages		WRP Provincial Coordination Team	May 15, 2000	Restoration planning	HC
Negotiating Restoration: Integrating Knowledges on the Alouette River, British Columbia – 26 pages		Jim Henry Vanderwal, University of British Columbia	April 1999	Restoration	HC, also available from the following web site: www.interchange.ubc.ca/plan/thesis/vanderwal/toc.htm

Results-based Code

Title	Name of Digitized File	Author	Date	TOPIC	Format Hard Copy (HC) Digitized (D)
Results Based Briefing: Issues to Consider in Responding to the Results-Based Code – 5 pages	resultsbasedcode	West Coast Environmental Law	2002	Results-based Code	D

Socio-Economic Statistics

Title	Name of Digitized File	Author	Date	TOPIC	Format Hard Copy (HC) Digitized (D)
Local Health Area 31 – Merritt Statistical Profile – 9 pages	Socio-economic profile	BC Stats - Province of BC	2001	Socio-economic statistics	D

Solid and Liquid Waste Management

Title	Name of Digitized File	Author	Date	TOPIC	Format Hard Copy (HC) Digitized (D)
The Water Files – 4-page newsletter		Urban Systems	April 2005 April 2006	water and wastewater industry	HC (newsletter)
The Highland Valley Centre for Sustainable Solid Waste Management – 2 page newsletter	Landfill Backgrounder	Sperling Hansen Associates	unknown	Solid waste Management	D

Species at Risk

Title	Name of Digitized File	Author	Date	TOPIC	Format Hard Copy (HC) Digitized (D)
Fall 2004 Consultations - Rockfish/Lingcod strategy - species at Risk Act Legal Listings - Species At Risk Salmon Recovery Strategies	DFO Community Consultations Report - Final	Norton-Arnold & Company	2004	Species at Risk	D

Stewardship – Watershed Stewardship

Title	Name of Digitized File	Author	Date	TOPIC	Format Hard Copy (HC) Digitized (D)
National Watershed Stewardship Report: Policy recommendations and suggested actions to expand and strengthen stewardship in Canada - 36 pages	National Watershed Stewardship Report Nov 2003	Langley Environmental Partners Society; Land stewardship Centre of Canada, Alberta; Conservation Ontario; Comité ZIP Baie des Chaleurs; Clean Annapolis River Project	November 2003	Watershed stewardship	D
Lake Stewardship Principles – 12 pages		TNRD	No date	stewardship	HC (booklet)
On the Living Edge – Your Handbook for Waterfront Living – 142 pages		S. Kipp and C. Callaway	2002	stewardship	HC

Storage of Water

Title	Name of Digitized File	Author	Date	TOPIC	Format Hard Copy (HC) Digitized (D)
Coldwater River Storage Feasibility Study – 54 pages	5110101_Final Report	Summit Environmental Consultants Ltd.	December 2002	Storage Sites	HC, D and web site

Surface and Groundwater Interaction

Title	Name of Digitized File	Author	Date	TOPIC	Format Hard Copy (HC) Digitized (D)
Surface Water-Ground Water Interactions Along the Lower Dungeness River and Vertical Hydraulic Conductivity of Streambed Sediments , Clallam County, Washington, September 1999-July 2001 – 60 pages		U.S. Department of the Interior US Geological Survey	2002	Surface and groundwater interaction	HC
Surface Water/Groundwater Interaction Study – draft report - 81 pages		BC Groundwater Consulting Services	March 12, 2006	Surface and groundwater interaction	HC

Sustainable Development

Title	Name of Digitized File	Author	Date	TOPIC	Format Hard Copy (HC) Digitized (D)
Framework for Measuring Sustainable Development in Catchment Systems – 12 pages		Jay J. Walmsley	Spring 2002	Sustainable development	HC

Water Demand

Title	Name of Digitized File	Author	Date	TOPIC	Format Hard Copy (HC) Digitized (D)
Nicola River Watershed Present and Future Water Demand – 223 pages	466102 Final Report June 1907	Summit Environmental Consultants Ltd.	June 2007	Water demand in the Nicola watershed	HC, D and web site

Water Management Tool

Title	Name of Digitized File	Author	Date	TOPIC	Format Hard Copy (HC) Digitized (D)
The Okanagan System Model: Quick Reference		Stacy Langsdale, UBC	January 2006	water management model	HC (PP slides)
An Overview of the Okanagan Watershed Fish-and-Water Management Tool (FWMT) Project	FWMT Overview	Dr. Kim Hyatt, Fisheries and Oceans Canada	July 23, 2004	Water Management Tool	D

Water Quality

Title	Name of Digitized File	Author	Date	TOPIC	Format Hard Copy (HC) Digitized (D)
Chemical and Biological Characteristics of the Nicola/Coldwater Watershed Including Nicola Lake – 63 pages	D. Holmes Chemical and Biological Characteristics of Nicola	R. W. Holmes	1979	Water quality	D and web site
The Water Quality of the Tributaries of Nicola Lake	D. Holmes – Water Quality of Nicola tributaries	D.W. Holmes	May 1988	Water quality	D and web site

Watershed Management

Title	Name of Digitized File	Author	Date	TOPIC	Format Hard Copy (HC) Digitized (D)
Watershed management, structural characteristics, information processing and cooperative strategies in conservation organizations – 7 pages		S. Low T. Rhandir	November-December 2005	Watershed management	HC

Water Supply Issues

Title	Name of Digitized File	Author	Date	TOPIC	Format Hard Copy (HC) Digitized (D)
Municipal Water Supply Issues in British Columbia – 32 pages		Crippen Consultants	September 1990	water supply issues	HC

Water Use – Water Industry

Title	Name of Digitized File	Author	Date	TOPIC	Format Hard Copy (HC) Digitized (D)
Process Water Supply – The Big Picture – 3 pages		Peter S. Cartwright	May 2005	Water use by industry	HC – article in Chemical Engineering Magazine
Water Industry Trends – Summary of Highlights from a Water Forum Conference – 10 pages		Bear Stearns	April 14, 2005	Global market for water	HC

Water Use Planning

Title	Name of Digitized File	Author	Date	TOPIC	Format Hard Copy (HC) Digitized (D)
Toward Sustainable Water Planning and Management in British Columbia – 46 pages		Dr. J.C. Day and J. A. Affum	November 1990	water planning	HC
Fresh₂Outlook Magazine			May 2003	water management planning	HC
Participatory Integrated Assessment of Water Management and Climate Change in the Okanagan Basin, British Columbia - approx 200 pages		Edited by S. Cohen and T. Neale	2006		HC of table of contents and Executive Summary. Full report can be downloaded from the following web site: http://www.ires.ubc.ca/aird/
Cowichan Basin Water Management Plan – excerpts from web site - Basin Forum and Partners - Vision, Goals, Objectives and Actions - The Water Management Plan - Supply and Demand Management Studies			Printed on March 3/07	Water Use planning	HC
Cowichan River Basin Water Use Plan – Request for Proposals – 18 pages		Cowichan Valley Regional District	October 21, 2004	Water Use Planning	HC
Cowichan River Basin Water Management Plan – Work Program Summary – 35 pages		Westland Resource Group Ltd.	January 2005	Water Use planning	HC
Water Use Plan Guidelines – 60 pages	none	Province of British Columbia	December 1998	Water use planning	HC

World Trade Organization – Free Trade Agreement of the Americas

Title	Name of Digitized File	Author	Date	TOPIC	Format Hard Copy (HC) Digitized (D)
Making the Links: A Citizen's Guide to the World Trade Organization and Free Trade Agreement of the Americas – 41 pages	WTO-FTAAdocument	Maud Barlow and Tony Clarke, Council of Canadians	2003 (?)	World Trade Organization & Free Trade Agreement of the Americas	D

APPENDIX A

Issues 1 to 11 of the droplet